CONTENTS

oil is everywhere

roofing paper ● heart valves ● asphalt ● crayons ● parachutes telephones ● dishwashing liquid ● transparent tape ● antiseptics ● purses deodorant ● panty hose ● air conditioners ● shower curtains shoes ● volleyballs ● electrician's tape ● floor wax ● lipstick synthetic clothing ● coal extraction & processing ● bubble gum running shoes ● car bodies ● tires ● house paint ● hair dryers pens ● ammonia ● eyeglasses ● contacts ● insect repellent fertilizers ● hair coloring ●movie film ● ice chests ● loudspeakers basketballs ● footballs, ● combs/brushes ● linoleum ● fishing rods ● rubber boots ● water pipes ● motorcycle helmets ● fishing lures ● petroleum jelly ● lip balm ● antihistamines ● golf balls dice ● insulation ● trash bags ● rubber cement ● cold cream umbrellas ● inks of all types ● paint brushes ● hearing aids compact discs ● mops ● bandages ● artificial turf ● cameras ● glue ● shoe polish ● caulking ● tape recorders ● stereos ● plywood adhesives ● toilet seats ● car batteries ● candles ● refrigerator seals ● carpet ● cortisone ● vaporizers ● solvents ● nail polish denture adhesives ● balloons ● boats ● dresses ● shirts (non-cotton) perfumes ● toothpaste ● plastic forks ● hair curlers, plastic cups ● electric blankets ● oil filters ● floor wax ● Ping-Pong paddles ● bras ● water skis ● upholstery ● chewing gum ● thermos bottles ● plastic chairs ● plastic wrap ● rubber bands ● computers ● gasoline ● diesel fuel ● kerosene heating oil ● motor oil ● jet fuel ● marine diesel and butane.*

* Over 500,000 products use oil or oil by-products as an ingredient in their production.

INTRODUCTION

Oil is everywhere. The food we eat, the clothes we wear, the tools and materials we use to build and repair our homes all rely on petroleum inputs. Most medical products and the delivery of medical care rely on oil. Of course, oil has afforded us an unmatched mobility as found in the personal automobile. Cars have given birth to vast road networks that have reshaped human settlement patterns. The billions of plastic products available today are made from oil. Oil is even a major component of some non-obvious products like denture adhesives, basketballs and lip balm. In short, oil is *systemic* -- a key, if invisible, component of our everyday lives.

Cheap oil has allowed us to achieve great economic benefit, enabling us to enjoy cheap food, travel and manufactured products. Indeed, while the US comprises five percent of the world's population, it consumes 25 percent of the world's oil. 95 percent of our transportation infrastructure relies on petroleum.

However, oil is also finite. Most of the oil the world now consumes consists of biological material deposited at the bottom of ancient shallow seas between 90 million and 150 million years ago. While nature can and eventually will produce more oil, it will do so only very slowly and on a time scale that must be measured in "geologic" terms – tens of millions of years. Therefore, for all practical human purposes, once a barrel of oil is consumed, it will never be replaced. That being the case, it is obvious that the supply of oil on the planet must some day run out. At that point there will still be large amounts of oil left under the surface of the earth, but it will be so difficult and costly to extract that it will not be worth the effort to try to do so. This is the point of "peak oil."

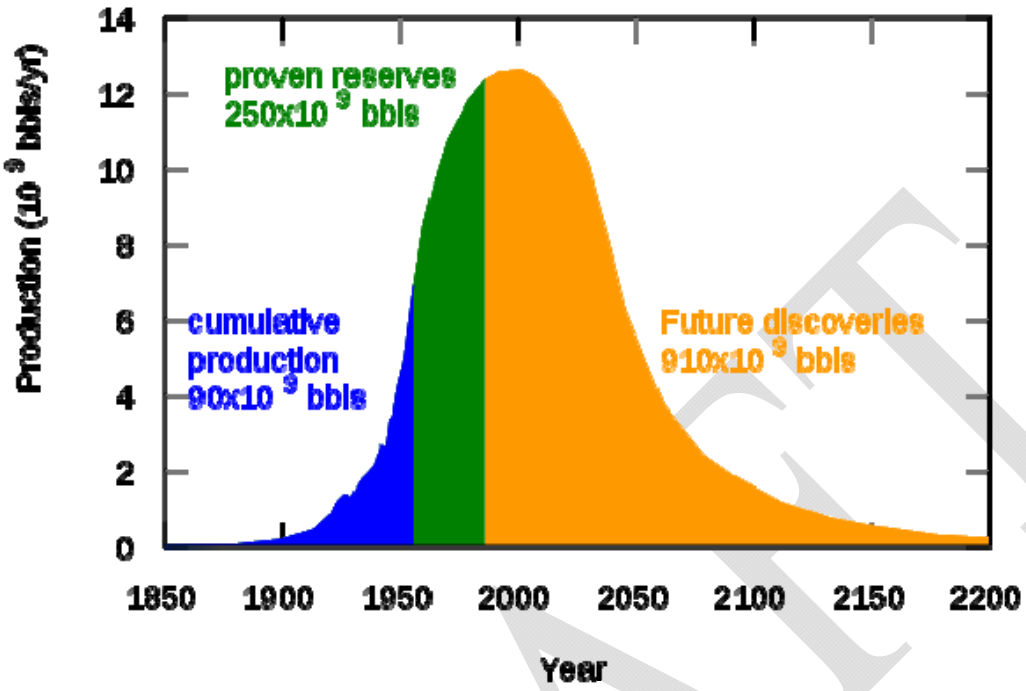
WHAT IS "PEAK OIL"?

The problem is not just that we will be unable to pump oil fast enough to meet a rapidly-growing global demand. The fundamental problem is that there must inevitably come a point in time when world oil production reaches some absolute maximum and then goes into decline. That point in time is "peak oil."

Coined decades ago by petroleum geologist M. King Hubbert, the term "peak oil" does not refer to the time when we "run out" of oil. Instead, the problem is that we will run out of *cheap oil*. Long before finite oil runs out, it will become increasingly difficult and costly to extract that it will no longer be possible to increase the rate of production and production will start to fall. That point – the point at which the *growth rate* in global oil production turns into a *decline rate* – is the point of "peak oil." When we reach that point, we will not have "run out" of oil, but we will have "run short."

In order to grasp the point that "running short" is not the same as "running out," it is necessary to understand that the "sipping soda through a straw" model of oil production is incorrect. That model assumes that it would be possible to suck up the world's oil at a uniform high rate until suddenly, one day, the oil is all gone, just as it would be possible to sip up all the soda in a glass at a uniformly high rate until the bottom of the glass is reached. The extraction of natural resources generally does not work like that.

In reality, what happens is that the best, easiest-to-find and produce oil is produced first. The oil that is inferior, harder to find and/or more difficult to extract is produced later. The result is something of a bell-shaped curve, in which production rises over time to some kind of peak and then goes into decline. During the decline phase, production can go on for a very long time, though at ever-decreasing levels. Hubbert projected that world oil production would peak around 2000, but continue at ever-declining rates for another 200 years thereafter. Hubbert's projection turns out to have been off by a few years, but he was remarkably close.



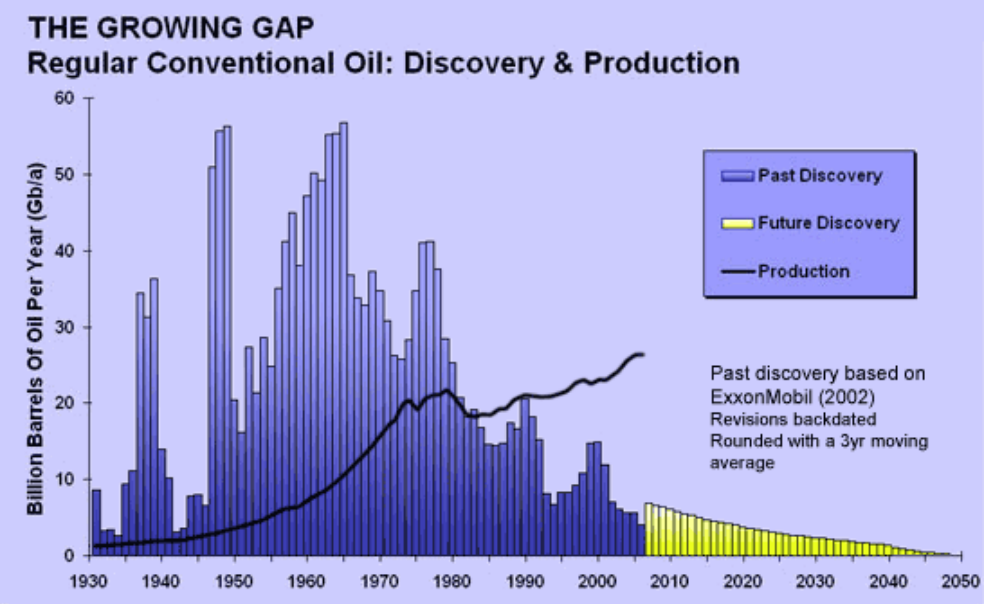
The "Hubbert Curve." Source: Wikimedia Commons

When this Task Force first began its work in March 2008, there was a sense that the peak might still be some years away. However, it is now clear that peak may have arrived while we were at work. It is likely that the world will never again produce or be able to produce as much oil in a single year as it did in 2008. Production reached a plateau in 2005 and barely budged above that the plateau in 2008, despite a record oil price of $147 a barrel recorded in July. In July 2008, the price of a gallon of unleaded gasoline rose to over $4.00 a gallon in Bloomington and as high as $5.00 a gallon in other parts of the county.

Subsequently, as we all know, the market price of oil – and the price of unleaded -- plummeted. This was not because of an increase in production, but because of a huge drop in *demand*. Indeed, oil production is actually down significantly. The Organization of Petroleum Exporting Countries (OPEC) in particular has reduced its output in an attempt to place a floor under the price. In the meantime, exploration for new oil fields and the development of previously-identified but hitherto unexploited fields has been put on hold.

As the economy begins to recover from its worst nosedive since the Great Depression, demand for oil will once again ramp up, but it could be difficult to achieve the production level of 2008, much less to move beyond it.

Further evidence that peak oil has been either reached or is very near is that we are not discovering new sources of oil. Indeed, the rate of production has been outrunning the rate of new discoveries by an ever-growing margin for almost a quarter of a century:



Source: www.aspo-ireland.org

However, it's not just the Bloomington Peak Oil Task Force who thinks we've reached peak. Experts agree. Recently, analysts at the financial services company Raymond James announced that:

> Non-OPEC oil production apparently peaked in the first quarter of 2007, and given precipitous falls in oil output from Russia to Mexico, there's not much hope of a recovery. OPEC production – and thus global out put – peaked a little later, in the first quarter of 2008…. The contention rests on a simple argument: OPEC oil production actually fell even as oil prices were above $100 a barrel, a sign of the 'tyranny of geology' that limits the easy production of ever more crude. Those declines had to have come for involuntary reasons such as the inherent geological

limits of oil fields…. We believe that the oil market has already crossed over to the downward sloping side of Hubbert's Peak.[1]

Other observers believe that peak oil might not yet be here just yet, but is right around the corner.

- The president of the International Association for the Study of Peak Oil and Gas, Prof. Kjell Aleklett of the University of Uppsala in Sweden, stated that "oil production will probably peak between 2011 and 2012…. Perhaps if demand grows more moderately than expected, the peak might be delayed until 2018 or so."[2]

- Eric Streitberg, chairman of the Australian Petroleum Production and Exploration Association. Speaking at his association's 2009 annual convention, he stated that "peak oil is just three years away."[3]

- Another expert opinion comes from Charlie Maxwell, "the life-long oil industry analyst viewed by *Barron's* magazine as their energy guru." Maxwell believes that, because of the current recession, peak oil has been postponed by a couple of years, from 2013 to 2015.[4]

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[1] Keith Johnson, "Peak Oil: Global Production's Peaked, Analyst Says," *Wall Street Journal Blog*, May 4, 2009, http://blogs.wsj.com/environmentalcapital/2009/05/04/peak-oil-global-oil-productions-peaked-analyst-says.

[2] Tom Nicholls, "The Peak is Nigh" [interview with Kjell Aleklett], *Petroleum Economist*, Apr. 2008, p. 40, http://www.fysast.uu.se/ges/files/April%202008%20Issue%20-%20The%20peak%20is%20nigh.pdf.

[3] Andrew Collins and Andrew Curtin, "Peak Oil, ETS and Jobs on the Agenda at APPEA 09 Oil and Gas Conference," Feb. 6, 2009, http://www.abc.net.au/rural/resource/stories/s2587478.htm

[4] When recently asked what had surprised him most about the "oil roller coaster we've been on," Maxwell replied:

> I would have to say that what struck me most, as a surprise, is the virulence in the downtrend in the world economy. That's a negative for the peak oil story, but only a temporary negative. By crushing demand, we are in effect gaining two more years, maybe three, in which we in the consuming world have added to our time before the peak, and could take good advantage of, since the peak is right upon us – I have it still at 2015 for all liquids…. A lot of people had said that the year 2015 is too far out for the peak. But I built a big margin in there because I thought we might have two recessions. I didn't dream that we would have one really big one. So I've got 2015 out there. But if you said to me last July, when do you really believe the peak is going to come, I would have said 2013. I started years earlier by estimating 2015 and I happily held to that view as I saw the recession begin to develop because I could see that we would probably push it off a little bit. For your purposes, I've got 2008 for the peak of non-OPEC – not really a peak, it's a plateau, but we're falling off it now. And then 2011 for the peak of the top 50 listed companies, the ones that dominate the stock market, so the stock market investors will say the oil industry has peaked because their stocks have peaked. And then I've got 2012 for the peak of black crude oil and the 2015 for the all-liquids peak, which I take to be ultimate peak oil. And that would include gas-to-liquids, coal-to-liquids, NGL's [natural gas liquids]. And it would include both synthetic and natural crudes. Steve Andrews, "Interview with Charlie Maxwell (Part 1 of 2)," *The Energy Bulletin*, June 22, 2009 (http://www.energybulletin.net/node/49303).

The phenomenon of peak oil is even recognized by the U.S. government. The U.S. Government Accountability Office (GAO) reports that energy markets will become more volatile, making supply disruptions more likely. The GAO advises that "[t]he consequences of a peak and permanent decline in oil production could be even more prolonged and severe than those of past oil supply shocks."[5] A U.S. Department of Energy-sponsored study, widely known as the "Hirsch Report," makes it clear that peak oil presents the world with an unprecedented risk management problem:

> Waiting until world oil production peaks before taking crash program action would leave the world with a significant liquid fuel deficit for more than two decades. Initiating a mitigation crash program 10 years before world oil peaking helps considerably but still leaves a liquid fuels shortfall roughly a decade after the time that oil would have peaked. Initiating a mitigation crash program 20 years before peaking appears to offer the possibility of avoiding a world liquid fuels shortfall for the forecast period.
>
> The obvious conclusion…is that with adequate, timely mitigation, the economic costs tot the world can be minimized. If mitigation were to be too little, too late, world supply/demand balance will be achieved through massive demand destruction (shortages), which would translate to significant economic hardship.
>
> There will be no quick fixes… Effective mitigation means taking decisive action well before the problem is obvious. [6]

When the Hirsch Report was written in 2005, the authors were reluctant to state precisely when oil production might peak, as the range of estimates was still too broad. They cited a number of authorities who disagreed about the probable date of peaking, putting it anywhere from as early as 2006 to as late as 2025 or later. By June 2008, however, lead author Robert Hirsch had concluded that "Today the situation is worse [than it was in 2005] and the reason for this is that it is now obvious that world oil production is already on a plateau. It has reached a high level, and has leveled off. The point at which oil production will decline is probably not far away. If the world [had] started to implement

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[5] *Crude Oil: Uncertainty about Future Oil Supply Make it Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production* , GAO-07-283. February 2007.

[6] Hirsch, R. L., Bezdek, R., Wendling, R. *Peaking of World Oil Production: Impacts, Mitigation & Risk Management. U.S. Department of Energy*. National Energy Technology Laboratory. February 2005 (hereinafter, the "Hirsch Report").

solutions 20 years before the peak oil problem, we would have stood a very good chance of beating the problem and could have avoided significant negative consequences for our economy. As it turns out, we now don't have 20 years; we don't even have 10." [7]

The Task Force endorses this view. After close examination, the Task Force agreed that the date of peak will turn out to be somewhere between 2008 and 2015 – most likely, 2008. If the Task Force is correct, we do not have any "lead time" to plan; instead, we must immediately acknowledge peak and begin to adapt to it.[8]

Rate of Oil Depletion

So what happens after production peaks? After peak is reached, production obviously declines exponentially thereafter. The rate of decline is widely estimated to be about 3 percent per year.[9] The *Association for the Study of Peak Oil and Gas* estimates that by 2030, production could be down to 50-60 million barrels per day from a possible high of 90-94 million barrels per day in ___.[10] The rate at which the world has been burning through oil is sobering. Although oil production began as long ago as 1859, as of 2005:

- 97% of all the oil that had ever been produced worldwide had been produced since 1940.
- 88% of the oil that had ever been produced had been produced since 1960.
- 57% of all the oil that had ever been produced had been produced since 1980.

[7] Interview with Robert Hirsch, June 2008.
http://knowledge.allianz.com/en/globalissues/safety_security/energy_security/hirsch_peak_oil_production.html

[8] Indeed the difference between the two – 2008 and 2015 -- dates is not of much practical significance. Even if the date of peaking turns out to be as late as 2015, it will be very difficult to prepare for it. For all practical purposes, peak oil is already here.

[9] The Oil Depletion Protocol, http://www.oildepletionprotocol.org/

[10] Note to Gary: citation?

> 37% of all the oil that had ever been produced had been produced since 1990.[11]

Given the enormous rate at which the world has been burning its way through its oil endowment in the past few decades, two things are highly probable:

- Geological constraints alone are enough to prevent continued production at the current near-peak rates much beyond 2015.
- Despite continuing significant declines as time goes on, production rates will remain sufficiently high that most of the remaining in the world will be consumed over the course of the next several decades.

What's more, the U.S. currently imports approximately two-thirds of its oil. Our ability to do so depends on the continued willingness and ability of a relatively small number of oil-producing nations with surpluses to continue to export. However, production within many of those countries will probably be going into decline within one or two decades.
It's time to change the way we do business: it's time to start re-thinking our individual and community habits to radically reduce our reliance on oil.

Non-Solutions

As the discourse on "peak oil" only grows, so too do possible "solutions." Many solutions pivot on the idea that we will be able to continue "business as usual" without any effort to conserve or become more efficient. For the following reasons, the Task Force feels that some of the most popular proposals lack merit.

Arctic National Wildlife Refuge

The ban on offshore drilling in the Arctic National Wildlife Refuge (ANWR) has re-entered public discussion and some advocate for opening up this ecologically-fragile area for drilling. However, even if a substantial amount of oil is found in this area, it will take many

[11] Richard Gilbert and Anthony Perl, *Transport Revolutions: Moving People and Freight Without Oil* (London, Earthscan, 2008), p. 120.

years to bring it into production. By the time it becomes available, it is likely that world production will already be in steep decline.

What's more, it is highly unlikely that ANWR could produce any where near the amount of oil necessary to meet current U.S. demand. According to a U.S. Geological Survey estimate, the amount of technically-recoverable oil in ANWR is somewhere between 5.7 and 16 billion barrels.[12] Those sound like huge numbers, but they pale in comparison to consumption rates. The U.S. has been using oil at the rate of approximately 7 billion barrels per year. Therefore, if ANWR actually does contain as much as 16 billion barrels of technically recoverable oil, the U.S. would go through every drop of it in a little over two years if it had to rely on that source alone.[13]

It is interesting to note that the purpose of the first oil well in Pennsylvania was to find a replacement for whale oil for indoor lighting. Whale oil burned with a clean, bright flame, but by 1846, the U.S. whaling fleet had

[12] The probability that it is at least 5.7 billion barrels is 95%. The probability that it could be as high as 16 billion barrels is only 5%. The mean estimate is 10.4 billion barrels.

[13] U.S. Geological Survey, *Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis* (Fact Sheet 0028-01: Online Report), http://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm

In reality, oil from ANWR could not be produced fast enough to permit it to be depleted in such a short time. According to a recent estimate by the United States Energy Information Administration, it is reasonable to assume that, if the ban on drilling in ANWR were lifted in 2009, actual production there would not begin until 2018. Between 2018 and 2030, ANWR would be able to produce somewhere between 1.9 and 4.3 billion barrels, with a mean estimate of 2.6 billion barrels. The Energy Information Administration (EIA) estimates that, at its peak, around 2028, ANWR production would be somewhere between 510,000 and 1,450,000 barrels per day. That represents between 2.7% and 7.6% of estimated U.S. consumption at the current rate. According to the EIA, this might have the effect of reducing the price of oil by somewhere between $0.41 and $1.44 per barrel.

reached "peak whales" and was going to the ends of the earth in search of its prey. Above is a cartoon from Vanity Fair, published in 1861 showing happy whales celebrating the discovery of oil wells in Pennsylvania. Source: Vanity Fair, April 20, 1861, p. 186.

By the time ANWR oil came into production, it is likely that world production will already be in steep decline. The addition of production from ANWR would not be sufficient to increase world petroleum output. It would simply reduce the rate of decline slightly for a few years until ANWR, too, become depleted. Moreover, if a global free market in oil prevails, there is not even a guarantee that oil from ANWR would go to American consumers. It will go instead to the highest bidders, who could well be from Asia or elsewhere in the world.

Oil Shale

Production of oil from shale has also been proposed as a solution. "Oil shale" is neither oil nor shale. It is a rock containing kerogen, a waxy substance that might best be described as a precursor to oil. Like petroleum, it consists of organic matter laid down millions years ago. Unlike petroleum, the source rock was never buried deep enough (7,500 to 15,000 feet) to be subject to the intense heat needed to "cook" the kerogen into petroleum. To turn the kerogen into oil, humans must do what nature has not – apply substantial amounts of heat to do the cooking. This makes the conversion of kerogen into oil an energy-intensive and costly process. Thus, while it always seems as though the production of oil from oil shale might become profitable if only the price of oil would rise a few more dollars a barrel, when the price of oil does go up, the rising cost of energy itself continues to make the production of oil from shale economically unfeasible. This phenomenon has been dubbed the "Law of Receding Horizons."

> In 1980, I asked an economist who was an expert on the cost of producing oil shales, what the world price of oil would need to be in order to make oil shale commercial. He turned the question around by replying that oil shale would always cost at least $10 per barrel over the world price of oil…. So forget about oil shale.
>
> – Robert A. Hefner, The GET, 2009

It is unlikely that the Law of Receding Horizons will ever be repealed so as to permit the profitable extraction of oil from "oil shale." Even if it is, we should not expect production to ramp up quickly, or the amount produced to amount to more than a fraction of our requirements. According to a 2007 U.S. General Accounting Office report, "The Green River Basin is believed to have the potential to produce 3 million to 5 million barrels per day for hundreds of years. Given the current state of the technology and associated challenges, however, it is possible that 10 years from now, the oil shale resource could be producing 0.5 million to 1.0 million barrels per day."[14] That would be 2.6% to 5% of U.S. consumption at current rates. Such a rate of production ten years from now would not result in an increase in U.S. oil production, but rather would simply reduce the rate of decline. And it is quite possible that no oil will be produced in commercial quantities from U.S. oil shale, ever.

Biofuels

Some believe that it will be possible to make up for the decline in oil production by resorting to the large scale production of biofuels – petroleum substitutes made from plants. The story of biofuel production in the U.S. has, up to this point, largely been the story of corn-based ethanol. By 2005, the U.S. consumed 3.9 billion gallons of ethanol (compared to 136.9 billion gallons of gasoline).[15] By 2008, ethanol production was predicted to reach some 9 billion gallons. This growth in production was achieved in large part dues to lavish federal subsidies, which in 2007 amounted to 76% of all federal subsidy money going to renewable energy.[16] The utility of corn ethanol production has been widely

Source: US Climate Change Technology Program,www.climatetechnology.gov/vision2005/goal2.htm

[14] GAO, *Crude Oil: Uncertainty about Future Oil Supply Makes It Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production*, Feb. 2007 (http://www.gao.gov/new.items/d07283.pdf), p. 55.

[15] Energy Information Administration, *Biofuels in the U.S. Transportation Sector*, Feb. 2007 with errata as of 10/15/07, http://www.eia.doe.gov/oiaf/analysispaper/biomass.html.

[16] Jeff St. John, *Corn Ethanol's Subsidy Glut*, Jan. 9, 2009, http://www.greentechmedia.com/articles/read/corn-ethanols-subsidy-glut-5489/

questioned because of doubts about how much it produces in the way of additional energy. According to David Pimentel of Cornell University, "To produce a liter of 99.5% ethanol uses 43% more fossil energy than the energy produced as ethanol."[17] If that statement is even remotely accurate, then the U.S. corn ethanol program must be seen as a farm subsidy program, not an alternative energy program.

Production of ethanol from sugar cane, a major industry in Brazil (where production is also subsidized and where half of the cane crop is devoted to ethanol production), seems to have more to recommend it. According to one estimate, the amount of energy produced is about 9 times the amount of fossil fuel energy input.[18] However, Pimentel and Tad Patzek place the energy return on Brazilian cane sugar much lower, at 2.28:1 rather than 9:1; for U.S. cane sugar, they estimate the rate of return at 1.48:1.[19]

One of the major problems associated with the production of ethanol from corn is that it drives up the price of corn. On the one hand, that is probably the main purpose of the U.S. corn ethanol program. However, that has made corn grown for food purposes more expensive as well, and has thus driven up the price of food for consumers. The ethanol subsidy program, in combination with heavy spring rains and flooding in the Midwest, was blamed for a 119% increase in the price of corn between 2007 and 2008.[20]

Because diverting food crops to fuel production seems like a risky or questionable strategy, some hopes are placed on "cellulosic" ethanol – fuel produced crop residues or grassland biomass. However, Patzek warns that the removal of any substantial amount of biomass

[17] David Pimentel, "Renewable and Solar Energy Technologies: Energy and Environmental Issues," in *Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks*, David Pimentel, ed. (New York: Springer, 2008), p. 10.

[18] Robert M. Boddey *et al.*, "Bio-Ethanol Production in Brazil," in Pimentel, ed., *Biofuels, Solar and Wind…*, pp. 321-356.

[19] David Pimentel and Tad W. Patzek, "Ethanol Production: Energy and Economic Issues Related to U.S. and Brazilian Sugarcane," in Pimentel, ed., *Biofuels, Solar and Wind*…, p. 361.

[20] David Goldman, *Food Price Spike: Is Ethanol to Blame*? June 27, 2008, http://money.cnn.com/2008/06/27/news/economy/ethanol_food_prices/index.htm.

from the land for use as biofuel feedstock is unsustainable -- it would rapidly wear out the soils because the biomass would no longer replenish the nutrients in the soils in nutrient cycle.

NOT JUST PEAK OIL: PEAK ENERGY

Oil is not the only hydrocarbon fuel whose production peak will pose difficulties. Coal and natural gas will also probably peak within a couple of decades. Because we expect more and more people to switch to electricity to power their cars and heat their homes, the peaking of both coal and natural gas will also inform the way we go about our individual and collective lives. In Indiana, most of our electricity is powered by coal. The Task Force took a very close look at coal and determined that world coal production will peak in 2030 and that world natural gas will also peak in 2030. Both of these issues are discussed in detail in *Appendices I and II*.

THE BLOOMINGTON PEAK OIL TASK FORCE

The Bloomington City Council and Mayor acknowledged peak oil in 2006 with the passage of *Resolution 06-07: Recognizing the Peak of World Oil Production*. In late 2007, the City strengthened its commitment to mitigate the effects of peak by establishing the Bloomington Peak Oil Task Force. As spelled out in *Resolution 07-16: Establishing a Bloomington Peak Oil Task Force*, the charge of the group was to assess Bloomington and the surrounding community's vulnerability to changing energy markets and to develop researched and prudent strategies. The *Resolution* called for the Task Force to document its findings in a report for approval by the Mayor and City Council.

Since March 2008, the seven members of the Task Force have met bi-weekly to work through vulnerabilities and solutions. Early on, the Task Force decided to parse its work into the following subjects: The Economic Context, Land Use, Transportation, Housing, Sustenance and Municipal Services. Each Task Force member assumed responsibility for each subject-matter area. The Task Force approached each of these subject areas with a three-pronged analysis. First, the group collected data and background data. Second, it assessed the community's vulnerability to a decline in cheap oil in each of these subject areas. Lastly, it worked to develop prudent mitigation strategies.

GUIDING PRINCIPLES

In drafting recommendations for this report, the Task Force was guided by the following principles:

- **SUSTAINABLE**. Recommendations should be sustainable. That is, they should foster environmental integrity, equity and economic health.

- **ACTIONABLE**. Recommendations should be actionable. Toward this end, the Task Force has organized its goals and strategies into those which should be implemented and/or realized in the short term and those which are long-term goals. Most often, the Task Force's recommendations call for the City and other community stakeholders to start to implement change immediately, understanding that it may take years to fully implement a recommendation.

- **CONSERVATION-FOCUSED**. Recommendations should pivot on conservation. While the Task Force's recommendations call for great efficiencies in some areas and, occasionally, new energy sources in others, most of the recommendations found herein hinge on reducing oil consumption. The Task Force maintains that a lot of the oil we use is wasted, mostly out of habit. We do not need to use all the oil we do to have happy, prosperous and fulfilling lives. As most of the oil we consume is frivolous, initial steps at conservation should be quite easy.

ADOPTION OF THE OIL DEPLETION PROTOCOL & CALL FOR 5% REDUCTION IN OIL CONSUMPTION

Many other communities have either adopted oil reduction or oil independence goals. Toward this end, many have adopted the Oil Depletion Protocol, a proposed international agreement under which nations would reduce their oil consumption at rates at which known oil reserves are being depleted – approximately 3 percent.[21] However, to prepare for peak in a robust way, the Task Force calls for a reduction in consumption that not just keeps pace with depletion, but exceeds it.

The Task Force recommends that the community start now to reduce its reliance on petroleum, by reducing petroleum consumption by **5 percent per year**. This would realize a 50 percent decrease in oil consumption in just 14 years. While it may sound like an ambitious goal, by cooperating and re-thinking the way we do things, this is a very achievable goal. Not only will reducing petroleum consumption make our community healthier and more sustainable, but it will save us all money.

[21] The Oil Depletion Protocol, http://www.oildepletionprotocol.org/

VISION

The recommendations in this Report are intended to envision a *resilent* and *prosperous* community while we collectively descend the peak of energy production. In so doing, the Task Force is engaging operational definitions that are a little different from conventional understandings. We define these key terms in the following ways:

ENERGY DESCENT: The transition from a high fossil fuel use economy to a more frugal one. Our decline in energy use should mirror the increase in fossil fuels since the Industrial Revolution.[22]

RESILIENCE: The ability of an ecosystem -- from an individual person to a whole community -- to hold together and maintain its ability to function in the face of change and shocks from the outside. Resilient systems can roll with external changes and adapt as needed. Local resilience promises:

- If one part is destroyed, the shock will not ripple through the whole system;
- There is wide diversity of character and solutions developed creatively in response to local circumstances;
- It can meet its needs despite the substantial absence of travel and transport; and
- The other big infrastructures and bureaucracies of the oil-addicted economy are replaced by fit-for-purpose local alternatives at reduced cost.

PROSPERITY: Our ability to flourish as individuals and as a community within ecological limits of a finite planet. Importantly, this term is not necessarily aligned with monetary wealth,

Certainly, preparing for peak oil presents our community with unprecedented challenges. However, it also presents us with unprecedented opportunity. The Task Force makes no claim that our recommendations provide all the answers; indeed, we expect that the community will have numerous, innovative ideas to add. However, we do think that the recommendations we propose here provide a good start.

[22] "What Exactly IS Energy Descent?" *Transition Culture*, http://transitionculture.org/2006/05/02/what-exactly-is-energy-descent/

While the recommendations that follow are primarily aimed at "powering down" our energy consumption, the recommendations also promise non-energy benefits such as reduced environmental impacts, greater savings for residents, improved quality of life and greater interaction and cooperation among and between community members. Peak oil presents us with an opportunity to make a great community even better.

THE ECONOMIC CONTEXT

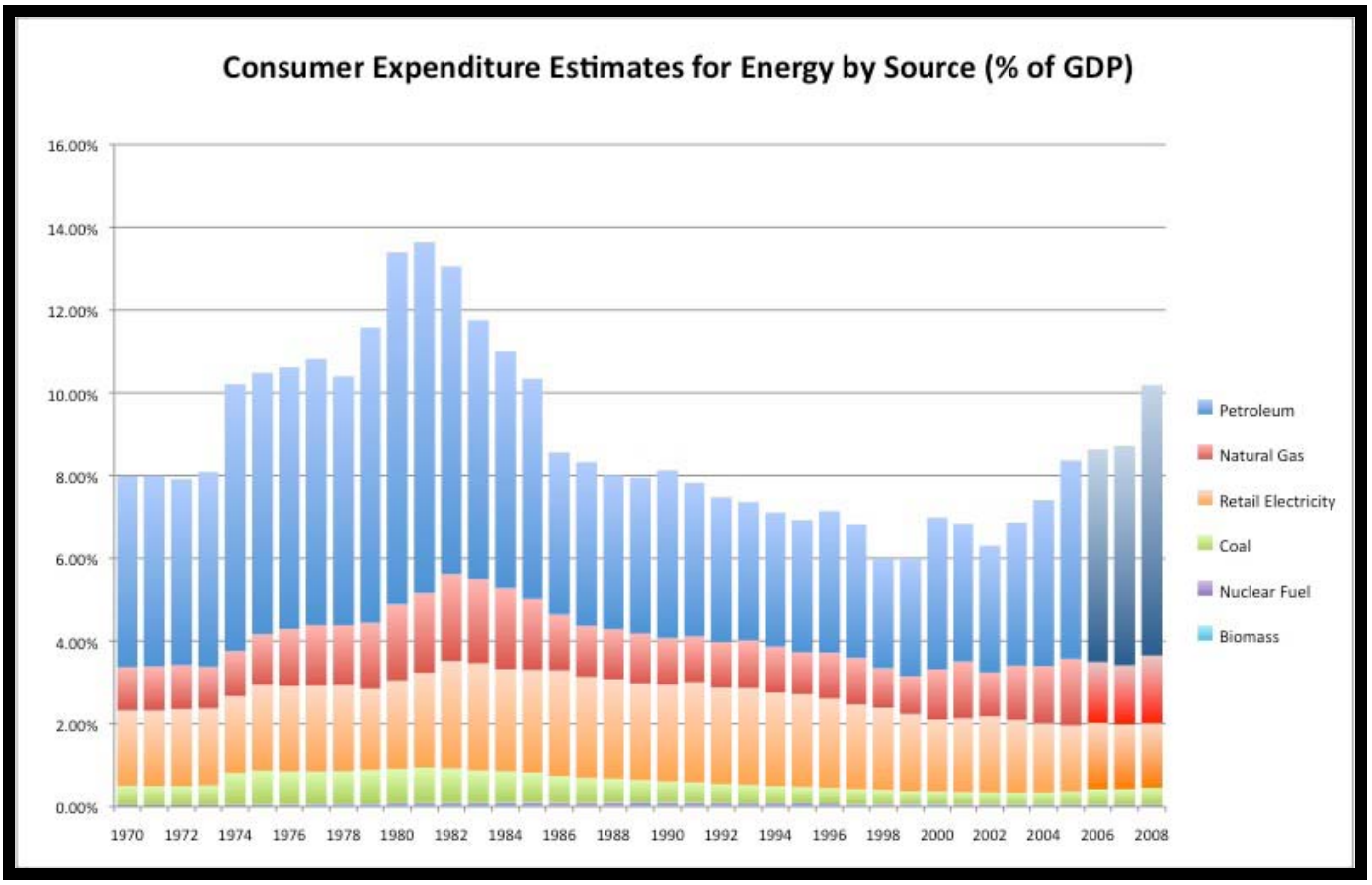
The enormous expansion of the human population and the economies of the United States and many other nations in the past 100 years have been accomplished by, and allowed by, a commensurate expansion in the use of fossil (old) fuels, meaning coal, oil, and natural gas. To many energy analysts the expansion of cheap fuel energy has been the principal enabler of economic expansion, far more important than business acumen, economic policy, or ideology.

– Charles A.S. Hall, Robert Powers and William Schoenberg[1]

As this report is being written, the most serious global recession since World War II has been under way for some time. While the severity and duration of the recession may be due to factors that are not directly connected to the peak oil phenomenon, some observers attribute the economic crisis to the rapid escalation of oil prices over the last decade -- an escalation that reached an unprecedented high in the summer of 2008.

As is commonly understood, the current crisis was largely triggered by the collapse of the sub-prime mortgage market. However, what is less understood is the link between oil and the housing market. It is very possible that the trend of ever-increasing energy costs from 2004-2008 caused the housing bubble to burst. Indeed, this run-up occasioned energy prices to occupy a percentage of the Gross Domestic Product not seen since 1985:

[1] Charles A.S. Hall et al.. "Peak Oil, EROI, Investments and the Economy in an Uncertain Future," in Pimentel, ed., Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks, David Pimentel, ed. (New York: Springer, 2008). p. 110.



Source: Charles A.S. Hall, "Economic Implications of Changing EROI Ratios," presentation to the Association for the Study of Peak Oil and Gas, Barcelona, Spain, October 2008.

This thesis is explored most thoroughly by economist Jeff Rubin. Rubin asserts that oil price increases were behind four of the last five global recessions, including the present one. He writes:

> From January 2004 to January 2006, the rise in oil prices from $35 to $68 per barrel drove energy inflation, as measured in the US consumer price index, from less than 1 percent measured year over to year to as high as 35 percent. Together with an associated increase in food prices … soaring energy costs drove the overall consumer price inflation rate from below 2 percent to almost 6 percent during the summer of 2008, reaching its highest mark since the 1991 oil shock. You don't have to be a Nobel Prize-winning economist to figure out what happened to interest rates over that period. As soaring oil prices stoked inflation's flame, the federal funds rate began a relentless climb from a record low of 1 percent to over 5 percent by 2007. And rates stayed by and large at that level for another year until the economy rolled over into recession. But just as interest rates were starting to catch up with inflation, a mountain of subprime mortgages came due for refinancing. Not only was the interest-free teaser period about to end, but the interest rates that subprime

mortgage holders would now have to start paying are almost double the rates when they first got the mortgages. The rest is history.[2]

Inflation and Volatility

It will be difficult to predict the effect of peak oil on prices. As Rubin suggests, the natural effect of petroleum shortages will likely occasion inflation. The primary cause of inflation in such an environment will be an increase in the price of oil. This will result in corresponding

Source: Clayton Guiltner, blog entry, Apr. 22, 2008

And, as discussed in the *Transportation* chapter, a significant increase in the cost of fuel will stress the budgets of households reliant on personal vehicles and will have an especially regressive effect on the community's lowest wage earners. Similarly, the cost of products will likely rise for at least two reasons. First, many products are reliant on oil as a key input, such as plastics, aspirin and clothing, to name a few. Secondly, as Bloomington imports much of its products, as the cost of transporting goods to the community increases, so too will product prices escalate.

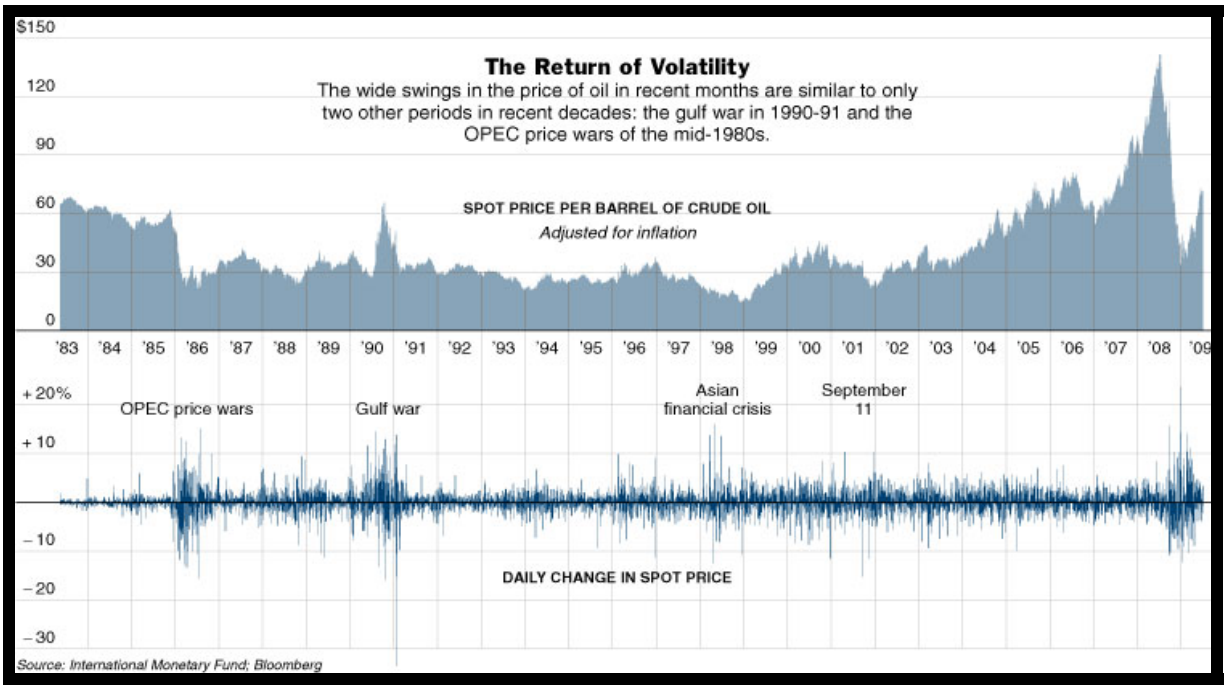
A period of inflation, accompanied by slow or negative economic growth, would represent a return to the so-called "stagflation" of the 1970s and early 1980s. There were two major periods of inflation during this time. The first, during 1973-74, arose from the "first oil shock" caused by the OPEC oil embargo that resulted from the 1973 Arab-Israeli War. It saw the rate of inflation increase from an annual rate of 3.63 percent in January 1973 to a high of 11.80 percent in January 1975. Inflation declined somewhat thereafter, falling to a low of 4.86 percent in December 1976 before beginning to rise again. It shot up in a major way following the "second oil shock" resulting from political events in Iran in 1978-79. In

[2] Jeff Rubin, *Why Your World is About to Get a Whole Lot Smaller: Oil and the End of Globalization* (New York: Random House, 2009), p. 190.

November 1978, Iranian oil workers reduced output from 6 million barrels per day to 1.5 million barrels per day. The inflation rate in the United States rose from 8.89 percent in November 1978 to 14.76 percent in March 1980. It remained as high as 10.14 percent in October 1981. Meanwhile, Gross Domestic Product actually declined in 1973 and 1974, and again in 1982.

However, inflation is just one part of the picture. As prices increase, demand decreases triggering lower prices. Lower prices tend to encourage greater demand. And so goes the wild oscillations in gas prices. The fallout of the summer of 2008 is testament to this volatility: On July 11, 2008, the price of oil hit $147.29/barrel. Faced with record prices at the gasoline pump, motorists rapidly began to alter their behavior, cutting back on discretionary driving or resorting to public transportation. New gas guzzlers sat forlornly on auto dealers' lots. Further figuring into demand destruction was the mortgage crisis that hit just a few weeks after the record oil price peak and triggering a global economic meltdown. Oil took a nosedive down to about $33/barrel in December 2008. Indeed, oil demand dropped by nearly 1.5 million barrels a day since July 2008.[3] One year after the historic price record, oil was inching its way above $70/barrel.

[3] Jad Mouawad, "One Year After Oil's Price Peak: Volatility," *New York Times*, July 10, 2009, Green Inc. http://greeninc.blogs.nytimes.com/2009/07/10/one-year-after-oils-price-peak-volatility/?scp=1&sq=one%20year%20after%20oil's%20price%20peak&st=cse



Daily changes in the spot price of crude oil, 1983-2009. *Source: International Monetary Fund, Bloomberg as cited in the New York Times*, July 10, 2009.[4]

Some observers might see the rapid fall of oil prices in the latter half of 2008, "proof" that the "theory of peak oil" has been falsified, but we believe they are wrong. While it is hard to know how long the current recession will last, at some point the gloom will lift and when it does, oil consumption will once again begin to accelerate. Then rising demand could collide with falling production, triggering another rapid run-up in oil prices – and possibly bringing about another recession soon after the current one ends. At that point, if not before, the world will probably begin to sit up and take notice that the Age of Oil is actually beginning to come to its inevitable end. By the end of the present century, if not before, most of the energy that is now being produced to fuel our vehicles and charge our electrical grid will have to come from renewable resources.

The increasing likelihood of ever-more volatile oil prices is widely recognized. The United States Government Accounting Office (GAO) reports that energy markets will become increasingly volatile, making supply disruptions more likely.[5]

[4] *Ibid*.

VULNERABILITIES

1. Systemic Reliance

As pointed out in the Introduction, crude oil is the lifeblood of our culture and society. From transportation to food to ubiquitous plastic products, everything hinges on oil. Thanks to this dependency, few of us have control over basic necessities of life. As a community, we are very exposed to a decline in cheap oil.

2. A Finite Earth Cannot Support Infinite Growth

This is a point seems simple enough to grasp, but one that tends to get lost in our well-intended efforts to produce and consume more in the name of collective well being (GDP). This point is also one long championed by ecological economists, specifically Herman Daly. Daly writes about his struggle to communicate the idea of ecological constraint to the World Bank, while Daly worked there in the late 1980s and early 1990s. He writes:

> That was when I realized that economists have not grasped a simple fact that to scientists is obvious: the size of the Earth as a whole is fixed. Neither the surface nor the mass of the planet is growing or shrinking. The same is true for energy budgets: the amount absorbed by the Earth is equal to the amount it radiates. The overall size of the system – the amount of water, land, air, minerals and other resources present on the planet we live on – is fixed. The most important change on earth in recent times has been the enormous growth of the economy, which has taken over an ever greater share of the planet's resources. In my lifetime, world population has tripled, while the numbers of livestock, cars, houses and refrigerators have increased by vastly more. In fact, our economy is now reaching the point where it is outstripping Earth's ability to sustain it. Resources are running out and waste sinks are becoming full. The remaining natural world can no longer support the existing economy, much less one that continues to expand. [6]

Clearly, the energy budget of the Earth is fixed. For more than 200 years we have been increasingly able to exceed that budget by drawing down non-renewable fossil fuel

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[5] "Crude Oil: Uncertainty about Future Oil Supply Makes I Important to Develop a Strategy for Addressing the Peak and Decline of Oil Production," GAO-07-283, February 2007, http://www.gao.gov/new.items/d07283.pdf

[6] Herman Daly, *Special Report: Economics Blind Spot is a Disaster for the Planet*, 15 Oct. 2008, http://www.newscientist.com/article/mg20026786.300-special-report-economics-blind-spot-is-a-disaster-for-the-planet.html?page=2

resources created by ancient sunlight tens or hundreds of millions of years ago. However, this sort of consumption cannot go on for *another* 200 years.

Since 1929, GDP has grown by 3.4 percent per year.[7] As discussed above, petroleum occupies a substantial percentage of GDP. Even if we replace that petroleum reliance with a form of renewable energy, it would be a considerable challenge to sustain an economy the size of the one we have now. Assuming that GDP increases by 3 percent per year, the nature of exponential growth suggests that by the year 2100 the economy would be *14 times* as large as the one we have now. And if 3 percent annual growth required the consumption of 2 percent more primary energy per year to achieve, then by 2100 our economy would require almost *6 times* as much energy as it does now. It is highly unlikely that such a scenario is achievable.

What if a 2 percent growth rate is extended out to a period of a thousand years? In that case, annual energy consumption would have to be at a level 398,264,652 times as high as it was a thousand years earlier. This is an obvious absurdity, and it is clear that simply will not be possible to supply enough energy to increase energy consumption by a factor of almost four hundred million using only the resources available on and to a finite planet.

> "[The Age of Exuberance] was over, and its standards were already obsolete. Because of cultural lag, their obsolescence would be only belatedly recognized. Meanwhile, prices would inevitably rise. Politicians and pundits, working from the old paradigm, would continue invoking merely fiscal explanations for this inflation, neglecting its ecological basis."
> – William R. Catton, Jr., *Overshoot*, 1980, p. 47.

The argument is not fundamentally changed even if we assume that we manage to increase the energy efficiency of the economy so that we cut the amount of additional energy required per unit of GDP growth in half. Suppose that, in order to support annual GDP growth of 3 percent, primary energy consumption only needed to increase 1 percent instead of 2 per cent. In that case, we would need to consume

[7] Bureau of Economic Analysis, *Comprehensive Revision of the National Income and Product Accounts: 1929 Through First Quarter 2009* (July 2009).

1.1 times as much energy per year in ten years as we do today, 2.7 times as much in a hundred years, and 20,959 times in a thousand years. While 20,959 is a lot less than 398,264,652, it is almost as absurd to imagine that we could increase our consumption (and production) of energy by a factor of 20,959 in a thousand years as it is to imagine that we could increase it by a factor of 398,264,652. In order for economic growth to continue in perpetuity, it would have to be the case that growth and energy consumption be absolutely decoupled. It is unlikely that growth and energy consumption could ever be completely unhinged from each other. However, in recent decades, economic growth and energy consumption have been *relatively* decoupled, which means that the amount of additional energy required per unit of growth has decreased.

Better not Bigger

The economic problems caused by peaking oil, coal and natural gas production will eventually begin to call into question, in a much more obvious way than previously, conventional notions of "growth." It is commonly assumed that an increase in the production and consumption of goods is associated with a higher quality of life. Peak will call into the idea that quality of life and economic health are necessarily tied to *more*. Most usually, a "growth economy" is measured by increasing the Gross Domestic Product (GDP). As has long been observed, GDP is an incomplete picture of quality of life as it does not account for income distribution, social factors such as health, and ecological factors -- not least of which is energy scarcity. However, as is discussed throughout this report, it is fully possible to nurture a prosperous and dynamic economy that does not pivot wholly on consumption. In other words, instead of the old notion that "bigger is better," peak will require us to focus more closely on "better, not bigger."[8]

To be sure, the City of Bloomington has already taken forward-thinking steps to foster thoughtful economic vitality. The City's Department of Economic and Sustainable

[8] To borrow from Eben Fodor who borrowed from Edward Abbey. See, Eben Fodor, *Better, Not Bigger: How to Take Control of Urban Growth and Improve Your Community* (Gabriola Island, BC: New Society Publishers, 1999).

Development states that, "[l]ocal government must take the lead in envisioning and creating a thriving community, identified by the health of its environment, the vitality of its economy and the equity among its citizens."[9] Working from this basic tenet, a post-peak local economy is necessarily much more local. This re-localization offers the promise of a new kind of prosperity.

In a post-peak community, it makes sense to work toward a steady-state economy. Importantly, steady state does not mean stagnation or plateau, instead it means that the amount of resource throughput and waste disposal remain relatively constant. The key features of such an economy are: (1) sustainable scale, in which economic activities fit within the capacity provided by ecosystems; (2) fair distribution of wealth; and (3) efficient allocation of resources.[10] Toward this end, we echo the resolution of the Bloomington Environmental Commission that a steady-state Bloomington means:

> A sustainable economy (that is, an economy with a relatively stable, mildly fluctuating product of population and per capita consumption) is a viable alternative to a growing economy and has become a more appropriate goal for the U.S. and other large, wealthy economies. A long-run sustainable economy requires its establishment at a size small enough to avoid the breaching of ecological and economic capacity (especially during supply shocks such as droughts and energy shortages), to promote the efficient use of energy, materials and water, and enable an accelerated shift toward the use of renewable energy resources.[11]

[9] City of Bloomington, Department of Economic and Sustainable Development, Business and Sustainability site: http://bloomington.in.gov/sections/viewSection.php?section_id=6

[10] Center for the Advancement of the Steady State Economy, http://www.steadystate.org/CASSEBasics.html

[11] *Position of the City of Bloomington Environmental Commission on Economic Growth in the United States*, adopted on May 22, 2008 following two years of discussion. http://bloomington.in.gov/media/media/application/pdf/3465.pdf.

From the Global Problems to Homegrown Solutions

We can no longer import our lives in the form of food, fuel and fundamentalism. Life is homegrown, always has been. So is culture. And so too are the solutions to global problems.
-- Paul Hawken, Bioneers Conference 2006

The Bloomington economy is clearly woven into the fabric of both the national and global economies. The food we eat, the clothes we wear, the tools we use to fix our homes and tend our gardens are almost exclusively imported from distant States, sometimes even distant countries. Getting these basic goods to our community exacts a heavy transportation cost. While a protracted examination of the local Bloomington/Monroe County economy is beyond the scope of this *Report*, as the price of oil continues to become more volatile, we can anticipate certain local economic patterns and opportunities.

Higher Production and Distribution Costs

Most local businesses rely on shipping in products for retail sale or raw materials for product manufacturing. As the cost of fuel becomes more expensive, these businesses will be hard hit. They may shift to new products or may have to lay off employees to compensate for the higher cost of doing business.

Less Discretionary Income

Businesses will also experience loss if residents are unable to afford their products. Insofar as the current economic recession will endure and insofar as peak oil, in the absence of intervention, it is likely to make economic conditions even worse and cash-strapped households will have less discretionary income to spend on goods and services other than necessities. Businesses such as restaurants and entertainment venues which rely on the discretionary spending of local residents will be squeezed. Bloomington businesses that sell in a national or global market will face the same recessionary headwinds as businesses in other communities, and also will have to contend with higher shipping costs.[12]

[12] On the other hand, our community's position as a college-driven metro will likely buffer some of the economic effects of peak oil. Traditionally, Monroe County has had one of the lowest unemployment rates in Indiana. In part, this is due to the presence of Indiana University (IU). IU of one of the City's largest

Fuel Rationing

As we collectively slide down the peak oil bellcurve, fuel for cars will become more scarce and more expensive. As in other times of fuel scarcity, it is likely that fuel will be rationed as it was in the in the early 1940s and during the 1970s energy crisis. Rationing will be either market-driven, taking the form of higher prices or government-driven. A combination of both forms of rationing is plausible.

Gasoline rationing was considered during the Second Oil Shock of 1978-1979. Ration coupons were actually printed, but never issued. Source: Wikimedia Commons

Despite the inconvenience, gasoline and diesel fuel rationing could have the benefit of permitting the allocation of fuel to priority users such as emergency first responders, urban transit systems, farmers, and truckers in adequate quantities and/or at below-market prices, so that they could continue to operate despite budgetary constraints. At the same time, however, rationing would mean that others who still have the money to pay for fuel would not necessarily be able to buy as much as they want, whenever they want, and might have to curtail their consumption. While local government does not have any jurisdiction rationing, we should anticipate it.

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employers. If past is prologue, during the Great Depression, the limestone industry and the Showers Furniture Company were crippled. At the same time, IU payroll remained relatively stable, but employees took big salary cuts.

Population Growth and Shifting Demographics

The population of Bloomington might grow and/or change as a result of peak oil. As is discussed in the *Transportation* chapter, Monroe County is a net importer of workers – almost 19 percent of the workforce comes to Monroe County from surrounding counties to work. These commuters might move to Bloomington in order to avoid or reduce the cost of daily commuting. On the flip side, people who currently live in Bloomington but work elsewhere (about 7 percent) might move away for the same reason, but more people live outside the city and work in Bloomington than live in Bloomington and work somewhere else.

Economic hardship could cause an increase in enrollment at Indiana University if residents lose their jobs and elect to return to school. Hardship might also mean declining enrollments at IU if parents and students are unable to afford tuition. If enrollment declines, the number of students living in the city might decline, resulting in a change in the mix of temporary to permanent residents in the City. Businesses catering particularly to the student population could be adversely affected.

Changes in population size and mix could have unanticipated effects on housing demand. Housing demand might be reduced if economic adversity causes a reduction in the number of individual households, as people formerly living apart (such as adult children living apart from their parents) move in together in an attempt to save money.

MITIGATION GOALS & STRATEGIES

Following are some general steps we can collectively take to mitigate the economic effects of peak oil while fostering a healthy and prosperous post-peak local economy.
All of these steps are classified as "short-term" simply because we need to take these steps very soon to mitigate the effects of peak oil. However, once instituted, the presumption is that these initiatives will only become stronger in the long term.

SHORT-TERM STRATEGIES (1-5 years)

1. Promote Economic Relocalization.

Rising petroleum prices will result in increasing costs for importing goods into the community from outside and for exporting goods from the community elsewhere. We should start to work now toward relocalization. Relocalization aims to build communities based on the local production of food, energy and goods. That Bloomington *must* and *will* undergo a significant relocalization at some point is assumed in other sections of this report, particularly the chapter on *Sustenance*. Because of this tendency, we think that Bloomington businesses which are able to replace distant suppliers with local and regional suppliers, and distant markets with local and regional markets, might ultimately tend to do better than businesses that are unable to manage such a transition.[13]

Economic Incentives
To accelerate the pace of relocalization the City should leverage economic development incentives, such as a Business Incentive Loan Fund and tax abatements to further

[13] It should be noted, however, that extreme price volatility might hamper efforts at relocalization as individuals or businesses encouraged to produce for the Bloomington market because of high transportation costs could suddenly find themselves priced out of that market very quickly if transportation costs plummet. Moreover, if government rationing or fuel allocation policies are introduced that give priority to freight transportation the cost of importing goods into Bloomington from elsewhere could remain low much longer than if no such priority exists.

encourage the "relocalization" of goods and services, especially those essential to daily life.[14]

Buy Local

Local government can help foster and expedite a "relocalization" by actively promoting and incentivizing local businesses. The City of Bloomington has taken great strides to foster local purchasing by partnering with local stakeholders to launch a community-wide *I Buy Bloomington* publicity campaign to be launched in the fall 2009. Such efforts to publicize the economic and pragmatic benefits of local purchasing are essential. We hope that such outreach strengthens existing local businesses and encourages new ones to form.

Encourage a Local Exchange System

In thinking through ways to incentivize more people to buy local, the Task Force did examine the possibility of reinstituting a local currency. Local currency complements U.S.-issued money but is a medium of exchange that could only be spent in Bloomington might tend to encourage local production. Local currencies have been used in other communities with mixed success. A previous attempt to introduce a local currency (BloomingHOURS[15]) in Bloomington was unsuccessful. For a local currency to be successful in Bloomington, it would be important for government to back the system. For example, if the Utilities Department and Bloomington Transit accepted local currency, such support would substantially help strengthen such an alternative system.

As local currencies tend to have mixed results, it would be prudent for the community to explore the idea of a Local Exchange Trading System (LETS) as a complement to conventional U.S. currency. LETS systems are local, non-profit exchange networks in which goods and services can be traded without the need for printed currency. LETS networks use interest-free local credit so direct swaps do not need to be made. For instance, a member may earn credit by doing childcare or computer work for one person and spend it

[14] See, City of Bloomington's Business Incentives , http://bloomington.in.gov/sections/viewSection.php?section_id=418.

[15] BloomingHOURS was introduced in August 1999; however, within a year the currency had gone out of circulation and merchants were left with a stockpile of currency that was falling out of favor with residents.

later on carpentry with another person in the same network. This helps a wide cross section of the community – individuals, small businesses, local services and non-profits – save money and resources and extend their purchasing power.[16]

Local Government Should Collaborate With *Transition Bloomington*

Relocalization promises resilience and is gaining increasing momentum thanks to the growing "Transition Town Movement." The Transition Town Movement seeks to equip communities for the twin challenges of climate change and peak oil. The Movement aims to prepare cities and towns for a shift from oil dependence to local resilience.[17] Central to the Transition Town Movement is the idea that life without oil could be happier and more rewarding than a current oil-dependent society. [18] Indeed, a recent *New York Times* article on the Transition Town Movement exclaimed, "The End is Near! (Yay!)"[19] while a popularizer of the Transition Movement, Rob Hopkins, has written that transition meets the threat of peak oil with a spirit of "elation, rather than the guilt, anger and horror" behind most environmental activism. "Change is inevitable, but this change could be fantastic."[20]

The key tenet of the Transition movement is that communities, especially in western, industrialized countries, lack "resilience" defined as the ability to respond with adaptability to disturbance. The Transition Movement is predicated on four key assumptions:

1) That life with dramatically lower energy consumption is inevitable, and that it's better to plan for it than to be taken by surprise;

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[16] See further, *LETS Program: A Sustainable Local Economy*, Relocalize.net http://www.relocalize.net/node/2194

[17] Rob Hopkins, *The Transition Handbook: From Oil Dependency to Local Resilience* (Totnes, Devon: Green Books Ltd., 2008), p. 54.

[18] Rob Hopkins and Lipman, P., *Who We Are and What We Do*, version 1.0 (01 February 2009).

[19] Jon Mooallem, The End is Near! (Yay!), *New York Times*, April 19, 2009, http://www.nytimes.com/2009/04/19/magazine/19town-t.html?_r=1&scp=1&sq=the%20end%20is%20near&st=cse

[20] *Ibid*.

2) That our settlements and communities presently lack the resilience to enable them to weather the severe energy shocks that will accompany peak oil;

3) That we have to act collectively, and we have to act now;

4) That by unleashing the collective genius of those around us to creatively and proactively design our energy descent, we can build ways of living that are more connected, more enriching and recognize the biological limits of our planet.[21]

A local Transition group has recently formed in our own community – *Transition Bloomington*.[22] The local government should partner with *Transition Bloomington* to work toward a cooperative post-carbon future.

2. Economic Development Leaders Should Closely Examine Sector Dependency on Oil

Leaders from the Bloomington Economic Development Corporation, The City of Bloomington's Economic and Sustainable Development Office and the Greater Bloomington Chamber of Commerce met with members of the Bloomington Peak Oil Task Force to discuss the relationship between peak oil and the local economy. It is clear that leaders are working hard to improve the quality of life for Bloomington residents. However, it is also clear that these leading economic development entities have not looked specifically at the local economic vulnerabilities posed by peak oil. As the specific economic effects of peak are both difficult to predict and beyond the scope of this *Report,* we recommend that local economic development entities engage in an analysis of the extent to which our community's biggest employers are dependent on petroleum for their business. As is discussed in the *Sustenance* chapter, we know that the healthcare industry is intimately tied to oil. What about IU? What of the other industries the community aims to strengthen: biotechnology, technology, life sciences and the arts? Local government and its community partners should work to identify the ways in which peak oil will affect:

- Production and distribution cost;
- Consumer demand; and
- Suppliers of raw materials and semi-processed goods.

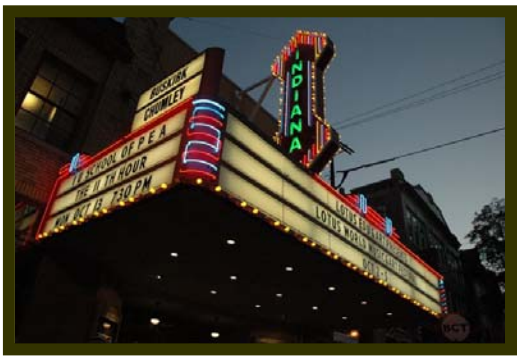
[21] *Ibid*. at 172

[22] http://transitionus.ning.com/group/transitionbloomington

Government and its partners should explore what alternatives might help to mitigate the effects of peak oil.

3. Prepare the Tourism Industry for Peak Oil

Bloomington is working hard to position itself as a premiere cultural, arts, entertainment and recreational destination for residents and visitors. In an environment where fuel is costly, it is likely that local destinations will likely become more popular and that the local tourism industry stands to benefit substantially from this "relocalization" of travel. However, to adequately prepare for peak oil, the City should work with its partners in the tourism industry to consider the industry's current oil requirements and to develop indicators for monitoring consumption.[23]



Furthermore, while more people may decide to keep travel local, tourists will be still be faced with the cost constraints presented by high fuel costs. This makes the public transit, bicycle and pedestrian recommendations outlined in the *Transportation* chapter even more critical.

4. Commit to a Steady State Economy

As mentioned previously, a "steady state economy" does not mean a stagnating economy. Instead, a steady state economy is a sustainable economy wherein production and consumption remain relatively stable while quality of life and well being are vastly improved through strategic changes in the prominence of economic sectors and techniques, such as renewable vs. non-renewable energy.[24] While the idea of "steady state" may sound a bit scary, especially in a time of great economy hardship for many community

[23] This is suggested by Susanne Becken, "Developing Indicators for Managing Tourism in the Face of Peak Oil," *Tourism Management*, 29, no. 4 (2007): 695-705.
[24] As stated in the Position of *the City of Bloomington Environmental Commission on Economic Growth in the United States* (May 2008).

members, the idea comports with the City's commitment to a sustainable economy and with the notion of relocalized economic activity.

5. Develop and deploy alternative forms of energy.

With global peak energy perhaps as little as a couple of decades away, the world and the nation will need to embark on a crash program to deal with it. Because peak energy will occur as a result of the peaking, over a period of two or more decades, of various non-renewable sources of energy, and as all of the non-renewable resources are finite, attempting to solve the problem of peak energy by substituting some forms of non-renewable energy that are still relatively abundant for other forms that have gone into decline (such as a substitution of natural gas for petroleum) is a temporary but not a permanent solution. While a detailed examination of possible forms of alternative energy are beyond the scope of this *Report*, local government should work with public, private entities and other stakeholders to encourage and strongly incentivize [25] alternative forms of energy.

6. Vigorously Promote Green Jobs

As one of its key economic development strategies, the City of Bloomington has expressed its intent to position Bloomington as a "green capital of the Midwest."[26]

While it is difficult to predict exactly what the post-peak employment environment will look like, we do know that we will experience a "greening" of employment as the economy becomes necessarily more local and sustainable.

Source: www.globalwarming.house.gov

[25] The City's zoning law, The Unified Development Ordinance, contains incentives for developers to integrate alternative energy into their projects. However, to date, these incentives are seldom engaged.
[26] City of Bloomington, Indiana, Strategic Plan 2009-2010, p. 8. *See*, http://bloomington.in.gov/strategicplan

Local government should partner with the public and private sectors to aggressively develop and incentive green-sector jobs.

The change in the employment profile presented by peak oil represents both a vulnerability and a mitigation opportunity. It is, unfortunately, somewhat difficult to predict what this mix might be, and even more difficult to predict the timing of any shift from one job mix to another. On the vulnerability side, as previously noted, economic difficulties facing consumers could cause the supply of jobs in restaurants, entertainment, personal services and "luxury" retail to shrink. This would be particularly problematic for the many Indiana University students who use such jobs to help pay their way through college. Thus, it is more than conceivable that a post- peak economy could make it more financially difficult for students to attend Indiana University. A substantial decline in enrollments would adversely affect the City's largest employer. Additionally, for employees in low-paying jobs, the costs of commuting a long distance may come to outweigh the economic benefits of employment. Unemployment in low-paying jobs could increase for this reason as well as the elimination of jobs.

In general, jobs in fields that are petroleum-intensive will be somewhat in jeopardy. For example, the demand for long-haul truck drivers could fall as more of the nation's freights shifts from the roads to the more energy-efficient railroads. As jet fuel becomes increasingly expensive, more airlines could be driven to the wall, resulting in mass employee layoffs.

On the other hand, there is probably considerable potential for new employment in "green jobs," which has been one of the hottest sectors of the economy in recent years. Some green jobs aren't likely to make much of an impact in Bloomington. For example, despite the rapid increase in the production of energy from wind, there will probably be little call for wind turbine installers in this area, simply because the winds here are too weak and intermittent to provide a reliable supply of power.

According to the BlueGreen Alliance and the Natural Resources Defense Council, in a post-peak environment, Indiana will need the following types of skilled trade:

- **Carpenters** to make buildings more energy efficient.
- **Electricians** for expanding mass transit solutions.
- **Operations managers** to manufacture energy-efficient automobiles.
- **Machinists** to craft essential components of wind power.
- **Welders** for solar power manufacturing.
- **Industrial Truck Drivers** to transport supplies and fuels for the cellulosic biofuels sector.[27]

To this list, we would add "farmers" and "agricultural workers." In the long run, should shortages of fuel cause a breakdown in mechanized agriculture, a significant amount of additional labor could be required for food production. A June 2009 report by Pew Charitable Trusts asserted that green jobs in the U.S. grew at a faster rate than did jobs overall, and probably fell in 2008 at a rate lower than that of jobs overall.[28] Furthermore, a recent report from the Political Economy Research Institute, *Green Prosperity: How Clean-Energy Policies Can Fight Poverty and Raise Standards in the United States*[29], finds that investments in a clean energy economy can significantly drive down the unemployment rate and provide job opportunities across all skill and educational levels. Through increased employment and lower energy bills and transportation costs, the standard of living for low-income people would rise.

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[27] *Job Opportunities in a Green Economy: Indiana Can Gain from Fighting Global Warming*, http://www.nrdc.org/globalWarming/jobs/indiana.pdf; *See also*, Pollin and Wicks-Lim, *Job Opportunities for the Green Economy: State-by-State Picture of Occupations that Gain from Green Investment*, http://www.bluegreenalliance.org/admin/publications/files/0005.4.pdf .

[28] The Pew Charitable Trusts, *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf.

[29] Pollin, Wicks-Lim and Garrett-Peltier, *Green Prosperity* (June 2009) http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/green_prosperity/Green_Prosperity.pdf

To be sure, green-collar jobs require some new skills and some new thinking about "old" skills. The economic development community should identify specific skills called for to meet the demands of our local economy. These jobs are necessarily local: just as we probably can't ship a house off to China to install solar panels, similarly it is costly to transport the components of panels to Bloomington and Monroe County.[30] Just as these jobs are inherently local, so too, such job must provide workers a living wage and we must work toward creating a green-collar environment that provides for a mix of entry and professional-level work.

[30] With a nod to the example provided by Green for All, Green-Collar Jobs Overview, http://www.greenforall.org/resources/green-collar-jobs-overview

THE BUILT ENVIRONMENT

Consumption of energy is tightly linked to the physical form of the human built environment. For decades, the layout of our community has literally been fueled by the availability of cheap oil. Cheap oil has meant that we have been able to live in energy-inefficient houses separated great distances from the rest of life's necessities.

Throughout their lives, people travel to and from their residences, to their places of work, to shopping, to schools, to the market and to the doctor. How we get from here to there – our mode of transportation -- greatly influences just how much energy it takes to travel from one place to another. In the U.S., the ubiquity of the personal automobile has re-shaped our everyday lives such that we can live a considerable distance from work, the grocery store, the hardware store and other necessities of life.

Just as this distal separation of home and the rest of life shape energy use, so too does the physical form and function of the structures of our homes, stores and offices. Townhomes, where many dwellings share common interior walls are particularly efficient from a heating perspective. Multi-story structures also tend to be more energy efficient than single-story structures. The nature of systems installed in structures influences their energy use: incandescent lighting vs. florescent or LED; toilet and waste systems; heating and air conditioning. All of these things contribute to the energy efficiency of a structure.

Importantly, there is no hard and fast relationship between energy consumption and quality of life. Higher per-capita energy consumption does not guarantee a higher quality of life nor does lowering per-capita energy consumption mean a lowered standard of living. Per capita, the U.S. uses twice as much petroleum energy

as any other industrial democracy. While direct qualitative comparisons of living standards are extremely difficult, it's probably safe to say that the quality of life experience for a French, German, Japanese or Norwegian citizen is *not* half that of the average American, even though citizens of those countries consume half as much oil as Americans do.

A decline in cheap oil means that built environment must take a shape that reduces reliance on individual automobile transport and reduces other forms of energy consumption. In other words, the built environment must become resilient: bike paths and virtually car-free streets will lead from solar homes with passive insulation to grocery stores, recreation areas, employment, parks, community gardens or free public transit to reach places to far to walk or bike. Manufacture and processing of food and other essentials of daily life will be predominantly local. School children will walk or ride their bikes to school. Parents will line up to pick up kids on bike or foot, rather than waiting in idling cars. [1] Certainly, this relocalization of resources will require a substantial transformation of the built environment and lifestyles; however, it also affords us an opportunity to enhance our quality of life – both as individuals and as a community.

[1] This borrows from Peter Newman, et al, *Responding to Peak Oil and Climate Change*, (Washington, DC: Island Press, 2009), p. 55

Land Use

The Human Scale

The development of our communities has historically been constrained by travel considerations. Indeed, cities arose as a reaction to the agricultural surplus. Because there were far more consumers than producers, it was simply more energy efficient for food producers to travel to food consumers than for food consumers to travel to the producers. Thus the town arose from the need for a central marketplace as well as a place where agricultural production, which occurred unevenly throughout the calendar year, could be safely stored and distributed for consumption which occurred regularly throughout the year.

Additionally, food producers needed mechanisms whereby they could convert their surplus into goods and services. So arose in the city not only the raw marketplaces where food could be exchanged for money and then that money for items such as agricultural implements, housing materials, clothes, and other goods but also a financial machine offering stabilizing institutions such as commodity futures exchanges, banking services, and other mechanisms affording an economic system delivering compound growth. That is what has traditionally been understood as the "Human Scale." Namely, a physical scale of development wherein the majority of a community can go about their daily activities and can satisfy their daily needs without incurring large costs of transportation.

The scale was, and is not, fixed. It is determined by available transportation technologies and the economics of those technologies. Traditionally, that has meant that the Human Scale was dominated by realities of foot travel.

The Automotive Age

Walkability defined the human scale for much of the agriculture age until the advent of an iconic 20th-century development: the personal automobile. The end of the WWII saw pent-up demand for the personal automobile and technological advances in the internal combustion engine. Paired with improvements in mass production, the personal automobile became much more commonplace: everyone owned a car. As the personal auto became the norm, the Human Scale was radically redefined.

> *The cities will be part of the country; I shall live 30 miles from my office in one direction, under a pine tree; my secretary will live 30 miles away from it too, in the other direction, under another pine tree. We shall both have our own car.*
>
> *We shall use up tires, wear out road surfaces and gears, consume oil and gasoline. All of which will necessitate a great deal of work ... enough for all.*
>
> -- Le Corbusier, *The Radiant City* (1967)

The transportation economics that the automobile enabled also enabled an entirely transformed method of land speculation and arbitrage. Because the automobile so effectively shrank distances it was now possible to separate nodes of daily activity by vast distances. Large tracts of rural land could be purchased cheaply and then transformed into residential subdivisions. Americans could live in one place, work in another, while shopping, schooling, and conducting all of the other aspects of daily life in equally distant places.[1]

Conventional land use planning separated land uses to create homogeneous -- some would say "lifeless" -- residential developments. [Levittown, PA in 1950's]

Source: http://planning.city.cleveland.oh.us/cwp/landuse.htm

[1] Real-estate interests reacted quickly and predictably, introducing the legal concept of zoning for purpose wherein legal restrictions on what activities were allowed on certain parcels and which were prohibited were introduced. Originally sold to the public on the basis that they were a way to ensure that no slaughterhouse, refinery, factory, or prisons would, or could, be built in their residential neighborhoods, zoning became a powerful tool by which developers could guarantee infrastructure investments in their parcels while simultaneously vastly increasing the demand for land, thereby driving up its price.

Spatial & Economic Dispersion

The result was the unprecedented spatial expansion of the typical community -- a vast increase of the Human Scale. As suburbs exploded around city cores they drained those cores of residents and the inner-city became little more than employment centers (for those lucky cities) or depressed quarters for those unable, financially, to escape them. Meanwhile the suburbs developed a new and heretofore unique arrangement where zoning forced land use into specialized pods such as residential, employment, or retail and those pods, separated by large distances, connected to each other via highways and arterial roads. The city's dense and redundant web of street grids gave way to the suburbs sparse set of connectors, each a single point of failure whose capacity diminished with every additional vehicle mile added or induced.

The automobile-enabled a suburban diaspora whose effects were and are felt most acutely by lower-income earners. Without access to low-cost transportation, such as pedestrian travel or public transit, lower-income workers were forced to either take on the expense of automotive ownership (approximately $5,000 a year for an average automobile[2]) or forego the employment opportunities of the suburbs, which left little else. Because lower-income workers are more likely to own older and more worn vehicles, the effects of fuel prices are particularly significant for them. If they must make a twenty mile round-trip commute from their place of residence to their place of employment and their vehicle gets the twenty mile per average fuel consumption of an older vehicle then amortizing the price of a gallon of gasoline becomes a significant fraction of their work day. At $5,000 a year for vehicle ownership, a typical 2,000-an-hour a year laborer must earn $2.50 an hour just to cover the cost or his or her vehicle. $2.50 an hour is 35 percent of the new minimum wage of $7.25 an hour.[3]

[2] According to the American Automobile Association.

[3] The new minimum wage was effective July 24, 2009.

When it comes to land use, identifying our community's vulnerabilities to a decline in cheap oil requires us to look at portions of the community built out before inexpensive fuel became readily available. For areas of the community developed prior to World War II, much of the infrastructure remains at a pedestrian Human Scale: streets are narrow, sidewalks are walkable and the distances to amenities and employment can be relatively short. Unfortunately, this is not true in a larger context.

The McCalla Elementary School on E. 9th was decommissioned as part of school consolidation in 1967

Other macro-level changes in the community have stripped the older neighborhoods of their inherent self-reliance. The school consolidation craze of the 1960s onwards has largely rendered the concept of the neighborhood school moot. In 1967, prior to consolidation, there were 23 elementary schools in Monroe County (.039 per capita [total population]/.38 per capita [total elementary student school population]).[4] Today there are 16 elementary schools (.013 per capita[total population]/.25 per capita [total elementary school population])[5] and only 9% of elementary students travel to school by foot.[6] Note to Greg: Which population base do you want to use? Likewise the neighborhood grocery has given over to the supermarket and everything from hardware staples to pharmacies has decamped from even the older neighborhoods to the shopping centers and strip malls on the community's periphery.

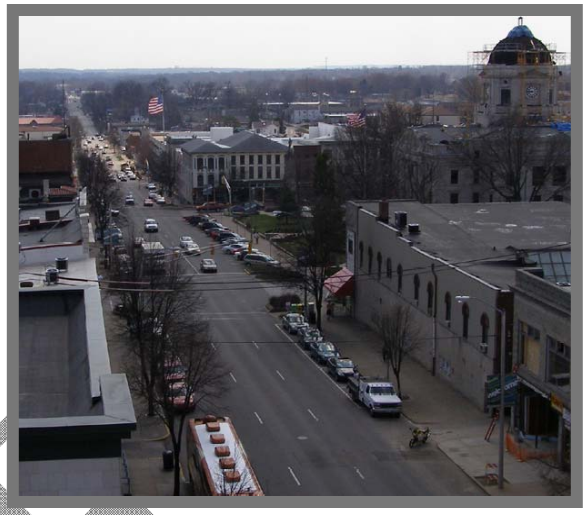
[4] Based on 1960 US Census data.

[5] Based on 2000 US Census data. Total elementary school population in 1967 estimated to be 6,028; total elementary school population between both MCCSC and R-BB is 6,518.

[6] This figure only reflects elementary students within the Monroe County School Corporation; it does not include students in the more rural Richland-Beanblossom School Corporation. Furthermore, the number reflects students who live within "non-transported boundaries" (1.5 miles) of the school. In 2008-2009, approximately 5,138 elementary students were enrolled in MCCSC; 493 of these students lived within non-transported boundaries of the school. It is assumed that some students walk and bike, but that parents drive some of these students to school.

Relocalization

If the emergence of the personal automobile transformed the built environment into the shape we know today, then what effect will a decline in personal automobile use have on the built environment? In a word: relocalization. Instead of disbursed settlement patterns and concentrated pockets of commerce, neighborhoods will once again become areas of community wherein most residents are able to meet their everyday needs by walking, biking or taking public transit. As one observer puts it, "[t]he End of Suburbia could become the End of the Commute rather than the death of a neighborhood."[7] However, relocalizing the community will require us to re-think our built environment.



Downtown Bloomington

[7] Pat Murphy, *Plan C: Community Survival Strategies for Peak Oil and Climate Change* (Gabriola Island, BC: New Society Publishers, 2008), p. 251.

Review of the Current Situation: Paving the Way

Road Infrastructure and its influence on development

The SR 37/SR 46 "Exchange" constructed in anticipation of building a new terrain highway through much of Southern Indiana's farmland and greenspace in the interest of increased commodity transport by truck.

Two prominent features have considerably influenced the development of Bloomington's built environment for the past two decades. The first was, in keeping with the school of thought of the time, the bypassing of State Road 37 around Bloomington's west side. An aphorism attributed to industrial designer Norman Bel Geddes, who designed General Motor's *Futurama* exibit for the 1931 World's Fair, stated "the highway should not impress upon the city, nor should the city impress upon the highway." Meaning that the traditional practice of running connecting pikes and roads through the centers of the communities they connected was no longer appropriate in the automotive age. Because, in the automotive age, most highway traffic would not be expected to be destined for the communities through which the highway ran. It was expected to be *bypass* traffic which, if routed through the community, would only add to congestion and not commerce. So best to allow it to pass by the communities connected by the road.

Bloomington was not immune from this bypass logic. State Road 37 used to come through Bloomington by way of Cascades Park. The park was built as a Depression-era makework project but one of considerable civic utility. The City leaders at the time believed that the experience of entering (or leaving) Bloomington would be greatly enhanced if the road wound through a park – as it still does. But by the 1960s Bel Geddes' sentiment had deeply pervaded the highway engineering mindset and, when calls were made to help deal with the "congestion" on State Road 37 it was natural to look at bypassing the City as one part of a comprehensive solution. By the early 1970s the road had been divided, four-laned, and now took a route not through the City, but far off to its west side, through an almost

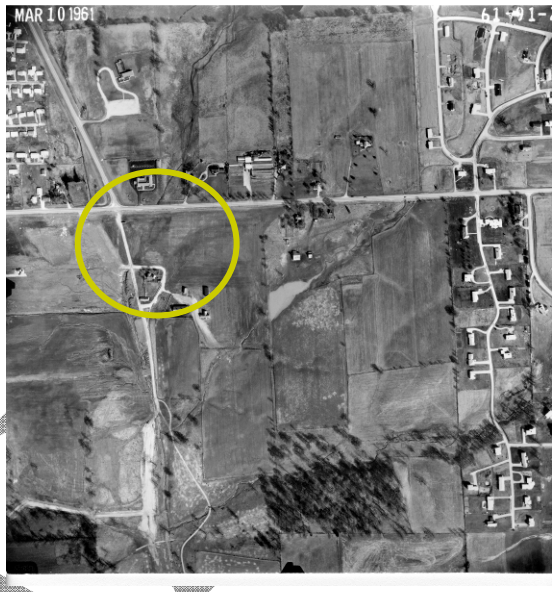
entirely rural landscape.

Simultaneously, the State of Indiana wished to increase opportunities for tourism and economic development around the recently-completed Lake Monroe. Large numbers of day-trippers from the communities to Bloomington's north, especially Indianapolis, were expected to use the lake for summertime recreation and preparations for traffic management were made. These preparations included the provision of a second bypass around the City, connecting State Road 37 at the City's north to a new highway down to the lake outside the eastern edge of the City. Unfortunately, neither bypass remained rural for very long. The first to sprout was the "College Mall" area, established on formerly agricultural land and connected to the City both by the new eastern bypass as well as by a widened Third Street. Immediately, the College Mall began to draw economic activity away from the City's downtown beginning a long, but not particularly sharp, decline (largely because of the presence of Indiana University's urban campus) of the downtown.

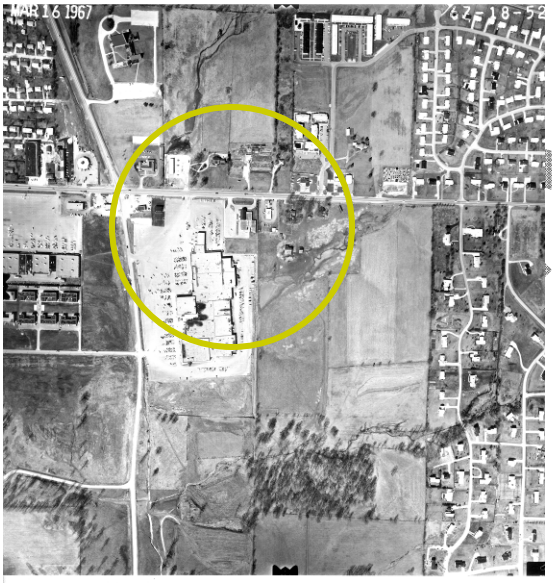
The Machine in the Garden

The First Sprout: College Mall

College Mall Area – 1949



College Mall Area – 1961



College Mall -- 1967

College Mall -- 1972

In the late 1980s, commercial activity, including land acquisition, funded through a mix of private and public funds, began along the western, State Road 37, bypass as well as the area

between Second Street/Bloomfield Road and Third Street/Whitehall Pike was developed into a major retail destination for residents of both Bloomington and the surrounding counties. The result, as our *Activity Nodes* map (Map A) shows, is the development of the community into one consisting of three primary areas of activity. One is centered around Bloomington's downtown core (central node), biased towards the university's western edge.

> *Anybody who travels back and forth across the Atlantic has to be impressed with the differences between European cities and ours, which make it appear as if World War Two actually took place in Detroit and Washington rather than Berlin and Rotterdam.*
>
> James Howard Kunstler, *Home From Nowhere* (1996)

Another is centered on the College Mall area (eastern node) while the third is centered at the nexus of State Road 37 and Third Street/Whitehall Pike (western node). Significant secondary and tertiary developments are also present at both the eastern and western nodes, such as the Ivy Tech/Cook Campus development farther west and both the new retail centers north of Third Street at College Mall and the significant residential developments (including Renwick) along Sare Road.

Developments within those three nodes have come at the expense of Bloomington's neighborhoods, particularly the newer neighborhoods. In general, the newer the neighborhood the less access it has to activity node essential amenities, such as grocery stores, retail shopping, pharmacies, schools, etc. and the more dependent it is on the automobile to reach those basic services. Put differently, the newer a neighborhood the more likely it is to be vulnerable to fuel prices and fuel disruptions. This is both because newer neighborhoods tend to be developed farther from the City core or either of the western or eastern activity nodes and because newer neighborhoods are developed almost exclusively for residential use, although some of the very newest developments are beginning to include retail and employment functions within them again.

About the *Activity Nodes* Project

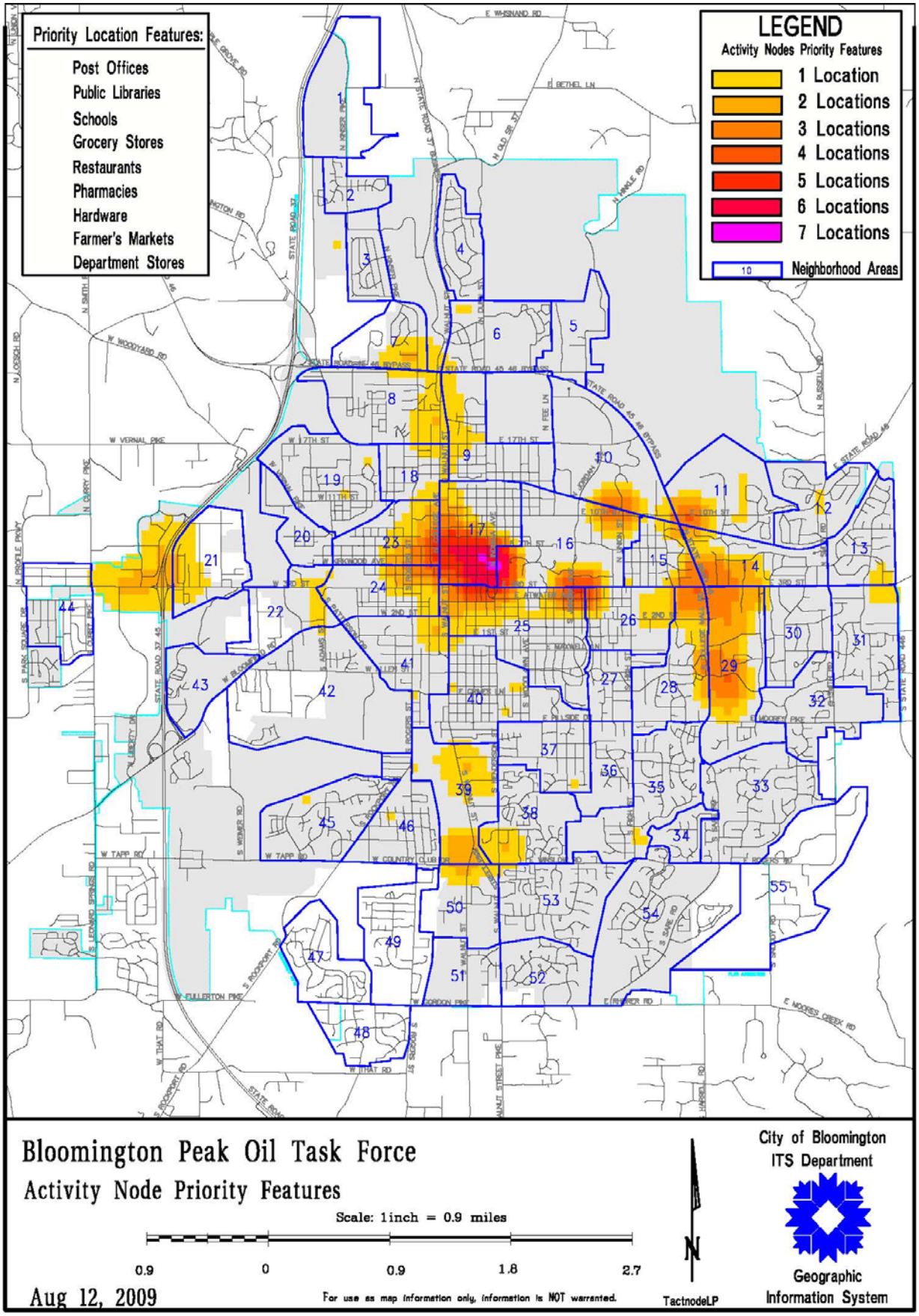
In an effort to understand where critical services are located vis-à-vis where people live, the Task Force mapped the location of key services – services that are critical to the everyday lives of residents: grocery stores, schools, pharmacies, post offices, public libraries, restaurants, hardware stores, department stores and farmers' markets. The proximity of these features to pockets of residential density will be key in a post-peak environment. While the current picture of activity nodes points to three distinct nodes (Map A), an ideal configuration would place people closer to the nodes or the nodes closer to the people (Map B). It is clear from mapping the necessities of everyday life that those necessities cluster around major thoroughfares and do not necessarily track population density (Map C).

Importantly, the idea of such nodal pockets is anticipated in the City's *2002 Growth Policies Plan*. The GPP outlines the idea of a "Neighborhood Activity Center" (NAC). A NAC is a "mixed commercial node that serves as the central focus of *each* neighborhood (emphasis added)."[8] The GPP directs that NACs should be easily accessible by pedestrians and minimize auto traffic while providing "small-scale retail and business services within the context of neighborhoods while maintaining compatibility within the existing fabric of development."[9] However, the GPP identified just a handful of NACs, only a few of which map onto the critical nodes identified by the Task Force.[10]

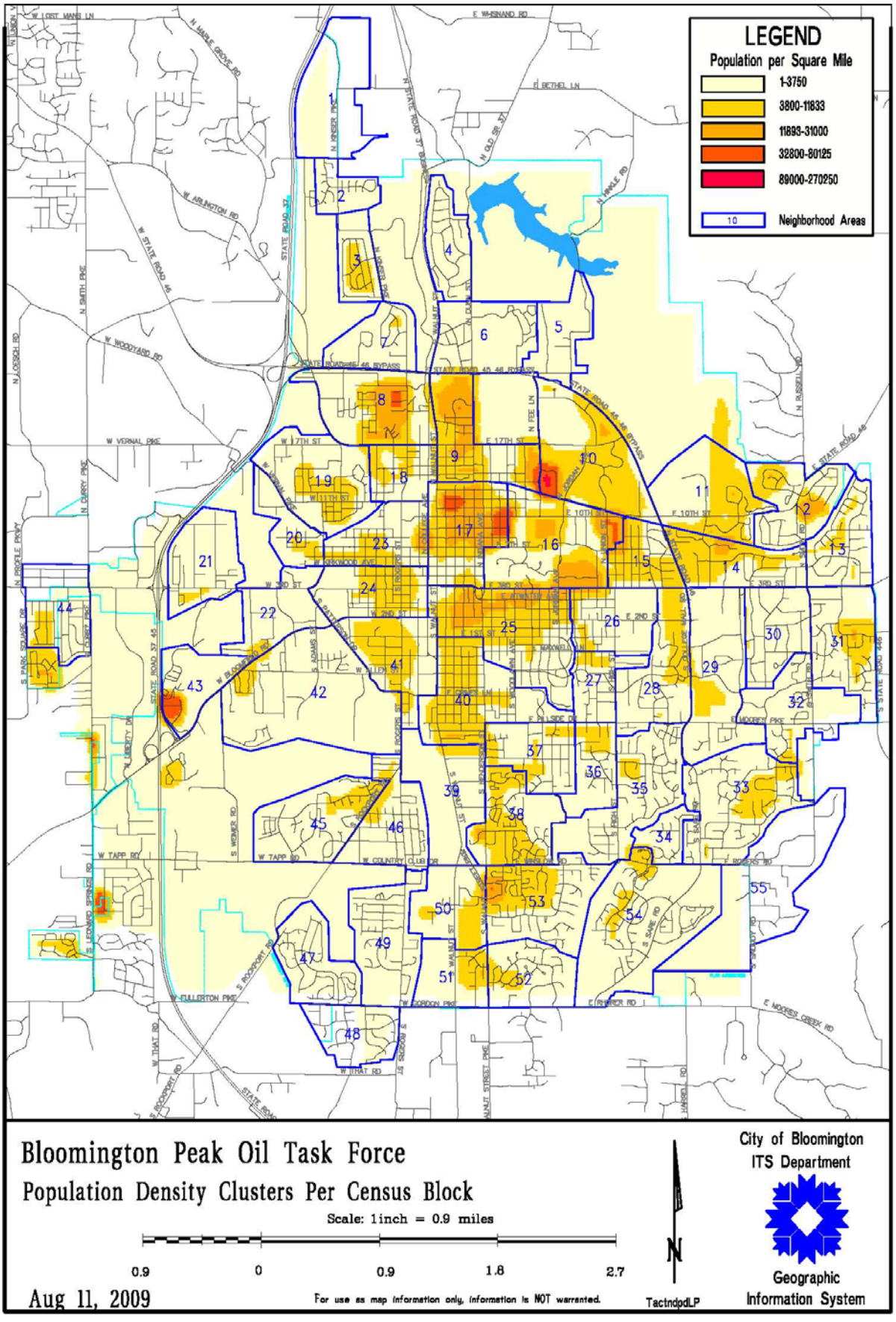
[8] GPP, p. 33

[9] *Ibid*.

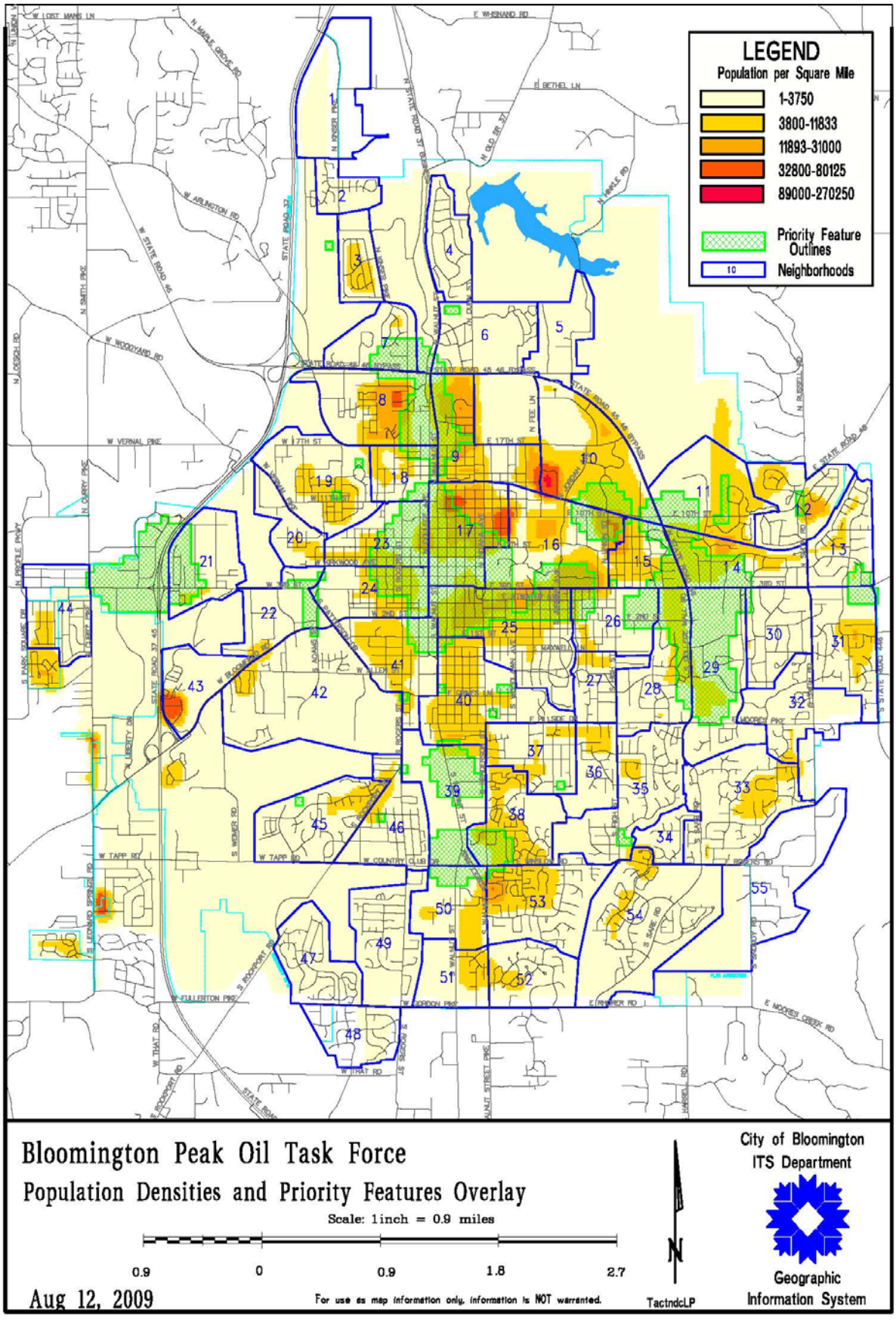
[10] https://bloomington.in.gov/media/media/application/pdf/2181.pdf



MAP A: ***Activity Nodes Map***



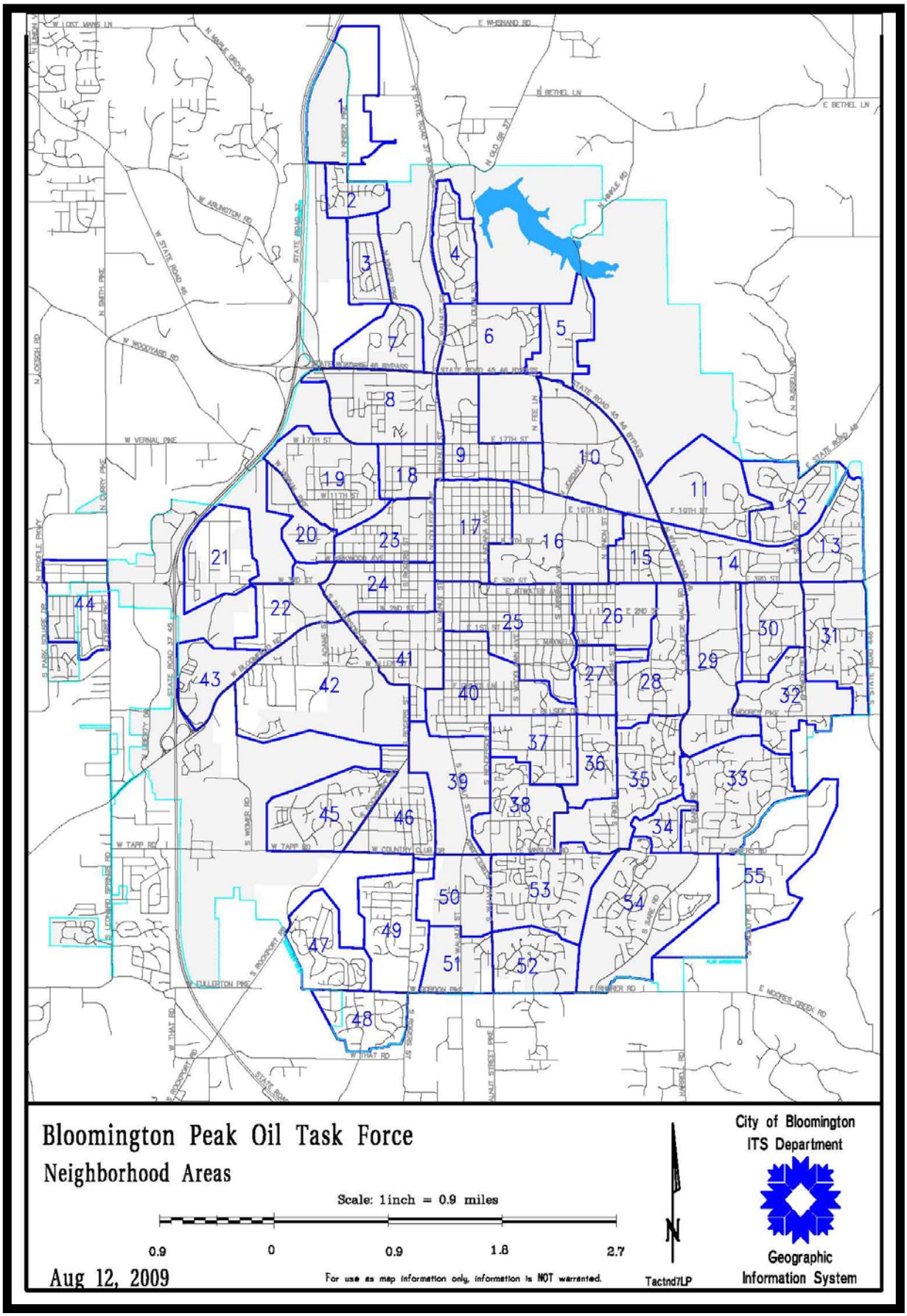
MAP B: *Population Density*



MAP C: Activity Nodes with *Population Density Overlay*

Natural Neighborhoods

One key step in re-setting the human scale is to make the City more polycentric – to bring the basic amenities of daily living within walking distance of the most residences. In effort to think through where multiple centers might fall, the Task Force outlined key neighborhood geographic areas; some are defined by already-existing neighborhood associations while others are bounded by natural and/or built constraints. The result is City matrix of 55 "Natural Neighborhoods." Collectively, these neighborhoods work as a basemap for the Task Force on top of which it overlays all other maps that follow in this *Report*: activity nodes, walkability, population density and proximity to bus stops.



MAP D: *55 Natural Bloomington Neighborhoods*

VULNERABILITIES

1. When it comes to land use, the physical separation of where we live from where we carry out the exigencies of everyday life – work, food, school, healthcare, community – is by the biggest threat posed by a ready availability of cheap oil.

As fuel prices rise and/or fuel disruptions occur with greater frequency, neighborhoods without access to amenities will become unlivable and will be abandoned unless efforts are made to transform them into self-sufficient communities either by adding missing amenities or by developing alternative transportation options. However, fuel issues and other costs associated with transportation will bring a heavy impetus to develop underdeveloped land within the City core, such as parking lots, vacant lots and lots occupied by single-story buildings. As those areas as transformed they will add to the residential inventory of the City. And because of their proximity to necessary amenities, these areas will draw residents from the City's suburban and exurban fringes. [11]

> *[I]t is beginning to dawn on many that the 21st Century will not see the same easy access to low-cost oil that fueled the unprecedented technological advances of the last century. We are either at or very near the era when the demand for oil will outstrip the ability of the earth to supply the needs of the global society.*
>
> Nygren, Massie, Kern. "Army Strategy For The End Of Cheap Oil." United States Military Academy, West Point, NY. 2006.

[11] This will have the effect of driving down property values in those areas, making investment in them problematic at best and nonsensical at worst. In which case the City may find itself, as Youngstown, Ohio does today, in a position of having to abandon those areas to municipal services and shrinking the municipal boundary.*Youngstown 2010*. http://www.youngstown2010.com/

MITIGATION GOALS & STRATEGIES

SHORT-TERM (1-5 years)

1. Include the Concept of Peak Oil as Policy Guidance in the Growth Policies Plan

The GPP was drafted in a climate where new urbanism was the predominant planning trend, sustainability was barely emerging and peak oil was not on the planning radar. However, now even the American Planning Association has recognized the need to plan for peak.[12] As the GPP will be due for an update in 2012, the City should include planning for peak in this guiding land use document.

2. Increase the Number of Activity Centers in the GPP

In the interest of both updating the GPP and preparing for a post-peak future, it is recommended that the City greatly increase the number of Activity Centers to bring people nearer essential services and essential services within walkable distance of all 55 neighborhoods (Map D) . Small, self-contained neighborhoods with a clearly-defined center populated by essential services and no further than a quarter mile from the edge is a prudent way to plan for a post-peak and sustainable future.

Most of the neighborhood community activity nodes identified in the GPP are sited on the periphery of the community and either do not feature essential services as defined by the Task Force's Activity Nodes map or are not sited in area of dense population. [13] Importantly, the GPP points out that, "[i]t should be noted that while several NACs have been identified on the land use map, more could be designated in the future as further study is done an appropriate locations have been identified." [14]

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[12] . "Responding to Peak Oil and Energy Uncertainty" was a session featured at the American Planning Association's 100th Annual Conference, May 2008.

[13] While the GPP also designates areas as "Community Activity Centers" and "Regional Activity Centers," these areas are assumed to be accessed by users who may drive personal automobiles to the centers; therefore, "walkability" is not prioritized.

[14] *Ibid*, 33.

3. Include Plans for Peak Oil in the Unified Development Ordinance

As discussed previously, the GPP is the City's guiding land-use policy document. The Unified Development Ordinance (UDO) implements the GPP. In contrast to the GPP, the UDO was drafted as peak oil was entering City consciousness. Indeed, many, if not most, of the changes recommended here were already under-way in the very recent past as a result of responses to rising fuel prices as well as suburban flight and urban redevelopment. We have direct experience that tells us that not only are such changes the right way to go but that they are nearly certain.

The picture above was featured in a March 2008 article in The Atlantic entitled, "The Next Slum?" The article opened by asserting that, "Fundamental changes in American life may turn today's McMansions into tomorrow's tenements."[1] Similar structures can easily be found in Bloomington subdivisions. Suzanne Dechillo, The New York Times/Redux

Much of what Bloomington and Monroe County recognize as their traditional and historic neighborhoods -- based on form and not use -- would be actually illegal to build today in many areas. The City of Bloomington has already revised its zoning rules to place more emphasis on form, but it can, and should, do more. Specifically, the City should amend the UDO to address the following:

- **Revise setback requirements.**
  A setback is the minimum required distance between a structure and the lot line so the lot on which the structure is located. The majority of the City's zoning districts outline minimum setback requirements; only the Courthouse and Downtown Overlays do not require a building front setback from the road. All of the Monroe County zoning districts require substantive front setbacks. Any setback and buffering requirements on residential and commercial building should be reviewed and, if necessary, eliminated from the UDO and the County's planning documents. "Street forward" building design should be encouraged while front lot parking should be discouraged.

- **Remove disincentives to micro-agriculture and sustenance**

- **Remove single-use type designations and encourage mixed-use**

- **Encourage form-based (effect-based), as opposed to use-based, development.**
  Use-based development is essentially post WW II suburban development where permitted land uses (residential, retail, employment) are the defining characteristic of the zoning code. This encourages, indeed mandates, separation of use and automotive dependence. Instead, encourage:

  - An even stronger commitment to compact, mixed-use urban form;
  - Increased residential densities in the urban core;
  - Narrower streets;
  - Sustainable development;
  - Environmental integrity; and
  - Economic and cultural vibrancy

4. Add an Activity Nodes Overlay to the UDO

In the interest of ultimately making all neighborhoods within walking distance of essential services and transportation, the City should start with a Nodal Development Overlay as a pilot. Standards for such an overlay should be structured to foster the essential characteristics of pedestrian-friendly, Human Scale development:

- Design elements that support pedestrian environments and encourage transit use, walking and bicycling;
- Transit access within walking distance (generally ¼ mile) of anywhere within the node;
- Mixed uses and a core commercial are such that essential services are within walking distance;
- Public spaces, such as parks, public and private open space and public facilities within walking distance;
- A mix of housing types and residential densities that achieve an overall net density of *at least* 12 units per acre.

MEDIUM-TERM (5-15 years)

1. Transition the City's Zoning Ordinance to a Form-Based Code

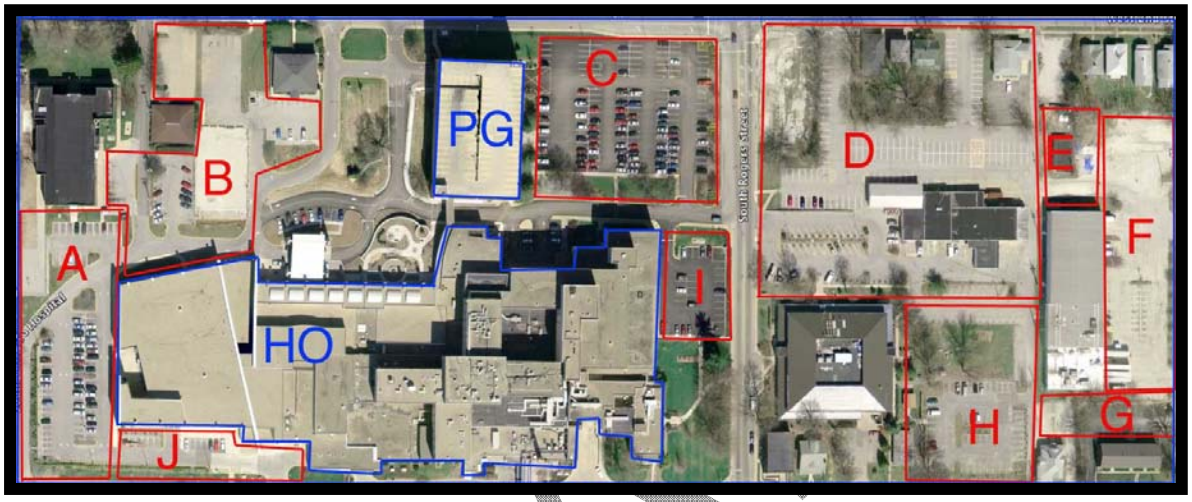
Conventional zoning failed to recognize the benefits of mixing housing with complementary shopping and employment opportunities. ["What's Ahead for Cleveland," 1941]

The City's current zoning document is something of a hybrid – while it contains some provisions focusing on the form of the built environment, much of it is predicated on allowed or prohibited uses. Within the next five to 15 years, the City should replace its zoning ordinance with a form-based code. Unlike use-based codes, a form-based code is a multidisciplinary approach that connects the design of circulation and public space networks to building design. Asserting greater control over form would allow the City to exercise more control in fostering pedestrian-friendly mixed use developments throughout the City and for the post-peak benefit of all residents.

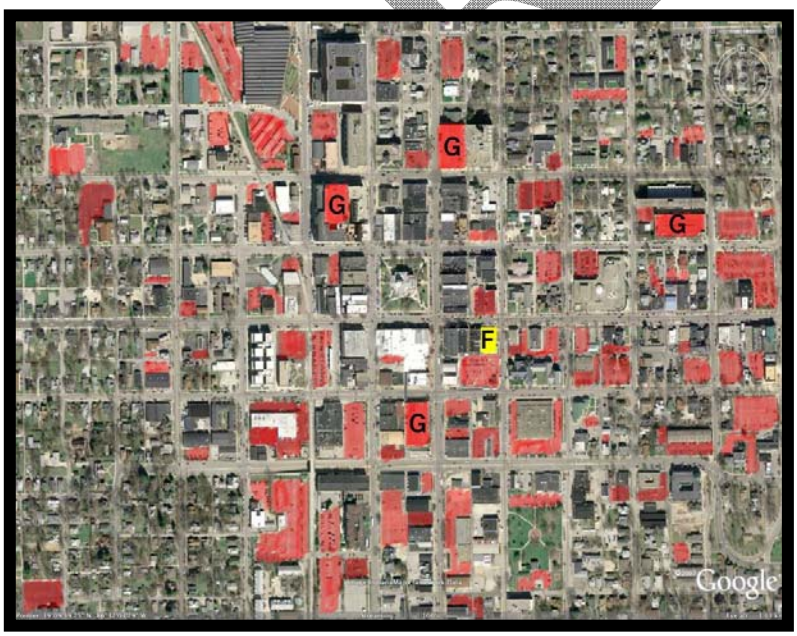
2. Advocate for a Change in the Structure of Property Taxes

Perhaps the largest determinant of the form of our towns and cities can be traced to the availability of tax incentives and other forms of public subsidies. Although tax reform is not within the power of local government, local government leaders should work with State legislators to allow the flexibility needed to accomplish reforms necessary for a post-peak environment. Specifically, Indiana is supposed to assess property values according to "market valuation," meaning that the assessed value of property as used to determine property taxes should match as closely as possible the actual market value of the property. However, the valuation becomes distorted in the City when a large portion of a lot is reserved for automotive parking (because the assessed value of the lot tends to weigh heavily towards the value of the buildings on the lot and not the lot itself).

This has led to a situation in which roughly half of all the land in the downtown core of Bloomington, the most heavily developed part of the county, is used for no higher use than the storage of itinerant automobiles (i.e. parking). If that land could be put to productive use for retail, employment, or residential uses that would be the equivalent of "making" new land. It would also shrink geographic distances reducing the Human Scale and further enabling traditional transportation modes such as walking or bicycling.



An example of the profligate use of land for no higher use than surface parking is that of the Bloomington Hospital complex, which comprises a total of approximate 27 acres in downtown Bloomington (above). Of those 27 acres, nearly 12 are reserved for automotive parking, predominantly single-level surface parking (*See* photo above). If the surface parking were only converted to multi-level parking garage structures it would "reclaim" nearly 10 of those 12 acres for building sites without a net loss of a single parking space. 12 acres is twice the footprint of the current hospital building. The Bloomington Hospital is located just outside of the City's downtown core.



Parking garages are prominent features in the Bloomington downtown. At left, garages are denoted with a "G."

3. Revisit the use of Tax Increment Financing, particularly as it relates to often-competing and competitive uses between the City and the County.

Tax Increment Financing (TIF), in which property taxes captured in a defined geographic area are used almost exclusively for improvements within the area (as opposed to accruing to a municipal or county general fund), was originally proffered as a tool to spur the redevelopment of urban brownfields. [15] TIF came to Indiana in 1987 and in the years since, has exploded as local governments, in light of declining State and federal support, have sought it out as an alternative financing model for infrastructure and economic development.

> North Park: an arterial scar of land some 400-plus acres, owned by a developer who the State of Indiana paid to build the arterial highway in the first place. An open green-space, peppered with abandoned limestone quarries and decreed by the County Redevelopment Commission as organically blighted, incapable of normal economic development without an influx of massive amounts of public subsidy.

Unfortunately, this has taken the use of TIF beyond its original spirit of urban renewal and into a local government financing method of first resort. This has resulted in 70% of TIF monies in Indiana being devoted to automotive-dependent suburban retail (malls, etc.), not urban brownfield redevelopment.[16] TIF has substantially turbocharged sprawl.

BEFORE: *1998 North Park Area pre-TIF designation: Mostly greenspace*

AFTER: *North Park Today: denuded and bifurcated by a new road*

[15] Johnson and Man, eds., *Tax Increment Financing and Economic Development: Uses, Structures, and Impact* (SUNY Press, 2001).
[16] *Ibid.*

Both the City of Bloomington and Monroe County have Redevelopment Commissions whose power and duty is to establish TIF districts and designations as well as to control how property taxes collected within those districts are expended within the district. The Monroe County Redevelopment Commission has now established three TIF districts, all established over greenfield areas and housing activities such as medical office park, institutional activities, warehousing, and suburban retail. The City has established seven TIF districts covering the immediate downtown, Whitehall Plaza as well as the RCA/Thomson brownfield.

The City and County Redevelopment Commissions are in competition to drive development to their respective TIF areas. This is largely a zero-sum game as a firm induced to build on a county suburban greenfield is a firm not available to redevelop an urban brownfield, such as the RCA/Thomson site. In the County there are few brownfields but still many remaining greenfields which the County, naturally, would like to see developed in order to grow the tax base.

The situation often arises where the County wishes to convert a greenfield into some sort of retail, industrial or employment use while urban brownfields remain undeveloped within the City. Co-operation between the two Redevelopment Commissions along with concessions between the City and County to help presume in the direction of urban redevelopment as opposed to suburban greenfield development would go a long way towards slowing or even reversing the outbuilding of suburban infrastructure. A regional (at least county-wide, if not multi-county) redevelopment commission would be able to consider all parcels within the region as a whole, not just a particular political subdivision, and be able to make more considered decisions based on a regional mosaic of parcels. This would yield redevelopment decisions that are in better interest of the region and that comport with the intent of "redevelopment."

4. Implement Regional Planning: Toward a *Unified Comprehensive Land Use and Transportation Plan*

As we revise the use of the existing built environment, we must simultaneously plan for the shape of the future built environment. In a post-peak era, we should be aiming for development patterns that lead to higher population density in areas designated as activity nodes, and that foster mixed use, walking, biking and transit use. (*See Transportation* chapter). Right now, transportation planning is largely separate from land use planning and land use planning is a largely self-contained effort: IU, Monroe County and the City of Bloomington all draft and implement their plans independent of each other. Without regional planning, there is no comprehensive picture as to which areas will be selected for development and which will be preserved and no regional vision for low-energy intensive, coordinated development to occur. However, such cooperation is precisely what is called for in the City's *Growth Policies Plan* – the City's guiding land-use document. [17] Although highly controversial, a structure for Monroe County similar to Marion County's "UNIGOV" (combined municipal and county governments) may be the most effective way to implement regional planning.

5. Explore School De-consolidation

From roughly the 1960s onward, the nation has embarked on a program of school consolidation wherein a number of traditionally neighborhood schools are consolidated in a single larger facility. Ostensibly this should produce cost savings from economies of scale while also providing access to facilities and other aspects of pedagogic infrastructure that would otherwise not be available to students of smaller and more geographically distributed schools.

The promised cost-savings accruing from consolidation are a source of controversy. Consolidation does not appear to have resulted in significant cost efficiencies, with the

[17] The Plan directs the City to "[s]tudy the feasibility of creating a consolidated planning department for the City and County as a method of improving planning and development management," GPP, Implementation Measure ACC-3, p. 22.

exception of consolidations of several small school districts into one larger district. Consolidation of large districts, on the other hand, has not produced the expected results. But transportation costs associated with consolidation are known. The Monroe County School Corporation currently expends about 10% of its total budget running its schoolbus systems (and outsourcing some of that to private contractors). This 10% figure is nominal for "baseline" gasoline and diesel prices in the $2-$3/gallon range. As fuel costs rise, the percentage of the school district's revenue that must be diverted from education to transportation will increase. An investigation into cost savings, if any, realized by consolidation within the two major school corporations (Richland-Beanblossom and Monroe County Community Schools) should be conducted and those results contrasted against greater fuel and other transportation costs associated with de-consolidation.

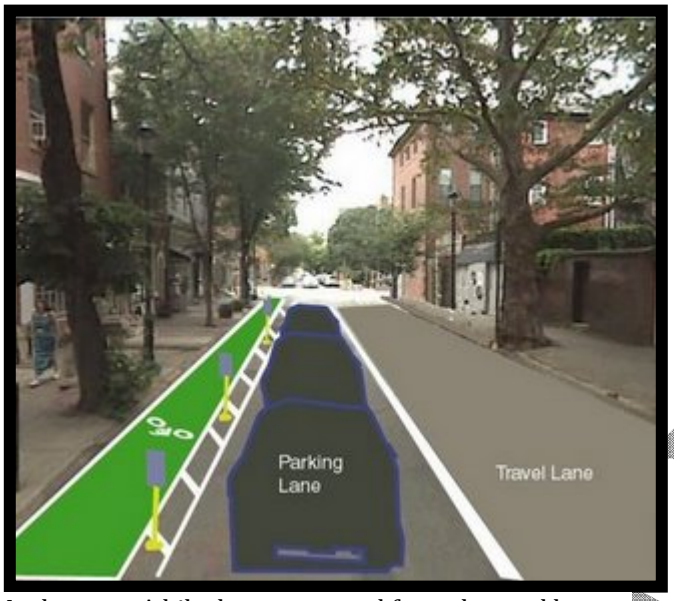
6. Target Public Routes to Help Shape Neighborhood Development

Transit routes considerably affect development patterns. As mentioned earlier, late 19th and 20th century suburbanization occurred alongside streetcar lines and led to the developments such as the Van Swearingen brother's developments in Cleveland as well as the Paoli subdivision of outer Philadelphia, a product of investments made in commuter facilities by the Pennsylvania Railroad.

Likewise the City should work with Bloomington Transit to exercise the quality and form of residential and commercial development by targeting bus routes and schedules both to channel development in a scale-appropriate manner as well as to foster and develop identities of individual neighborhoods served along lines named for the neighborhoods (or with stops so named). Importantly, routes should only be expanded once Transit realizes a greater fuel per-passenger fuel efficiency than its current 30 miles per passenger gallon. Presumably, better advertising, higher public awareness, and higher fuel price pressures public transit ridership will inevitably increase, leading to much higher per-rider fuel statistics. A discussion of public transit is more fully treated in the following chapter, *Transportation*.

7. Build in Transportation Physical Separation Buffers

Road systems should be optimized for multi-modal transportation options, including bicycling and pedestrian uses. Natural and artificial buffers between transportation modes should be incorporated into road design wherever feasible. Examples of such buffers include parallel parking provisions along roadsides allowing vehicles to act as safety buffers between pedestrian users of sidewalks and automotive users of the roadway. Automotive buffers, in the form of parked vehicles can also be used to form and designate segregated bicycle lanes.



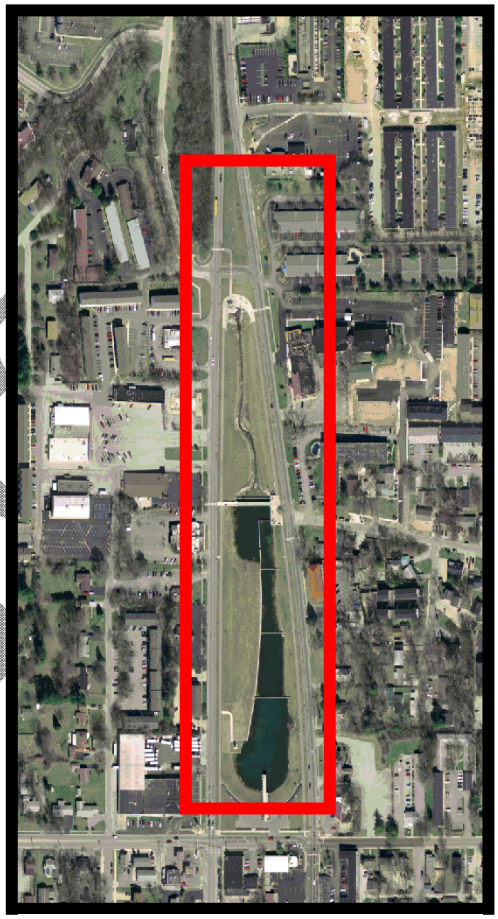
Manhattan – A bike lane separated from the road by way of a 6' buffer of parked cars.

Currently Bloomington designates bicycle lanes with on-road graphics but there are no physical provisions for traffic separation. On some of the wider roads, such as College and Walnut and Third Street east of Bryan, a narrow concrete walkway built out in the road and against which automobiles park would provide a dedicated and protected set of bicycle lanes between the walkway and the associated road shoulder or sidewalk.

8. Discourage Arterial Streets Where Possible

Contemporary practice has been to emphasize the arterial roadway for connectivity between activity nodes. Arterials, because of their size (particularly width) serve as barriers within a community, segregating parts of the community from other parts. They also represent single points of failure where a serious accident or congestion choke can halt travel on a large scale. Where possible arterial roadway construction should be avoided in favor of a network of smaller, redundant, roads.

Where an arterial-style road is necessary, the roadway should be constructed in a boulevard style with a significant pedestrian-friendly median (similar to what exists between College and Walnut where they are separated by Miller-Showers Park, at right). In this way, the amount of continuous roadway that must be tangentially crossed by a pedestrian can be minimized.



Miller-Showers Park , a narrow strip of land purchased by the City in 1929 for $1 separates two of the City's heavily-used arterials.

9. Narrow Roads Where Possible

A post-peak approach to road building should invert today's dominant paradigm -- the paradigm of fewer but wider roads.[18] Instead, an active program of road narrowing coupled with road multiplication should provide guidance.

Paradoxically, narrower roads are better suited for multi-modal use as they act to naturally constrain vehicle speeds while not providing an uncrossable-barrier for pedestrian traffic. Overall system capacity can be maintained by building more roads, similar to the Jeffersonian grid pattern that dominates the core of Bloomington. Likewise, alleyways should be encouraged within residential communities as a way of reliving the main road for bicycle and pedestrian traffic.

LONG-TERM (15+ years)

1. Within 15 years, the City should complete its exploration of transitioning all 55 natural neighborhoods (or some variation thereof) to activity nodes that provide for essential services and transit within walking distance.

[18] For example, one can find many highway and street widening projects in the Metropolitan Planning Organization's, Transportation Improvement Program.

TRANSPORTATION

Of all sectors of the U.S. economy, transportation is the most petroleum-dependent and the most vulnerable to disruption resulting from declining world petroleum supplies. 97 percent of transportation energy is reliant on fossil fuel. Of that figure, fully 95 percent comes from petroleum.[1]

For decades, low world petroleum prices prevailed, informing our habits of living and travel. In the years following WWII, car production and road construction soared. Automobile production increased from 2 million in 1946 to 8 million in 1955. Increased car ownership triggered more road building. In 1947, Congress authorized the construction of 37,000 miles of highways and an additional 42,000 in 1956.[2] Since the 1949, fuel consumption for transportation has increased almost four-fold.[3] Thus, emerged an infrastructure and a culture highly reliant on oil to meet the needs of our everyday lives.

Indeed, the low petroleum prices that prevailed for decades not only fostered personal car ownership and a road network that allowed us to live substantial distances from where we worked, shopped, etc, but low oil prices and inexpensive transportation costs supported long-distance trade within, among and between nations. As a result, cities like Bloomington have become dependent on other regions for almost every good and service needed in daily life, from food, clothing, water, transportation fuel, shelter, medicines and communication, to big screen televisions and solar collectors and wind turbines. One would be hard pressed to find any food, product, or service for sale in Monroe County, that doesn't involve *any* transportation beyond the boundaries of Monroe County. Even locally produced and sold food usually requires the use of seeds, machines, tools, fertilizer,

[1] Natural gas comprises approximately 2 percent and renewable energy comprises 3 percent of energy used in the transportation sector. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2008*.

[2] George Tindall, *America: A Narrative History*, 2nd ed. (New York: W.W. Norton, 1988), p. 1284.

[3] In 1949-2008, the energy consumption for transportation increased from 7,880 trillion Btus to 27,842. EIA, *Annual Energy Review 2008*, p 40.

irrigation systems, fuel, containers, hoop houses, etc. that have been produced elsewhere and had to be transported to Monroe County over long distances.

Because of our reliance on the automobile and because of the transport dependencies outlined above, a disruption in the supply of petroleum could disrupt most everyday aspects of life in Bloomington and Monroe County. However, there is much we can do reduce our vulnerability to a decline in cheap oil.

The level of vulnerability of our community results from how easy or hard it is for people, businesses, and both public and private institutions to respond to increasing fuel prices by reducing their petroleum fuel purchases **without** suffering severe negative consequences for their income-generating capacity and ability to meet basic human needs of shelter, food, water, health care, and transportation. Vulnerability is influenced by:

- The quality and costs of transportation alternatives available to people in Bloomington and Monroe County (walking, biking, public transit, rail, ride shares, group taxis, etc.);
- How much we are able to reduce fuel demands pro-actively by reducing travel demands ahead of, or in step with, higher prices and/or reduced availability of fuels;
- Our ability to buffer sudden shortages in supply (where fuel is unavailable at any reasonable price); and
- The availability and cost of alternative fuels, alternative fuel vehicles, and fuel-efficient vehicles.

REVIEW OF THE CURRENT SITUATION: VMTS & EQUITY

Automobile Dependency

A key index of oil dependency is car ownership. On average, in the United States, there are 755 motor vehicles per 1,000 people (highest in the world until recently).[4] Like the rest of the nation, residents of Bloomington and Monroe County are highly-reliant upon their personal vehicles. In Monroe County, there are approximately 672 vehicles per 1,000 people.[5] (*See* Appendix III).

Vehicle Miles Travelled: Around the Earth 112 Times a Day

Another indicator of our dependency is just how much we drive those cars. How much we drive is commonly measured by vehicle-miles traveled (VMT). VMT is the total number of miles driven by all residential vehicles within a certain time period in a geographic area. VMT is influenced by population, the number of vehicles per household, the number of car trips per day and the distances traveled.

In 2003, Monroe County residents drove an estimated 2.8 million miles *per day*. This distance is the equivalent of:

- Driving one car from the US east coast to the west coast 933 times in one day.
- Driving one car around the Earth on its equator 112 times in one day.
- Driving one car from the Earth to the Moon 12 times in one day.

These 2.8 million miles we drive translates into 22.8 miles per capita, per day for Monroe County residents. While Monroe County VMT is lower that many other communities in

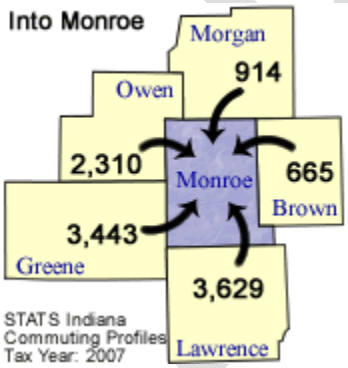
[4] Organization for Economic Co-operation and Development. *See*, William Pentland, "The World's Top Car-Owning Countries," *Forbes*, July 30, 2008.
[5] Based on 2000 U.S. Census figures.

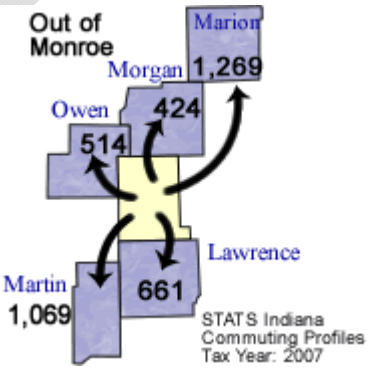
Indiana, the figures is still substantially higher than other comparable college communities such as Washtenaw County, MI (Ann Arbor) whose 11 VMT make it roughly half that of Monroe County.

According to the 2000 U.S. Census, approximately 67% of Bloomington workers commuted to work in single-occupancy vehicles, 14.5% walked to work, 9.2 carpooled, 2.8% used public transportation and 2.7 percent used bicycles.[6] These figures still indicate a very heavy dependence on automobile transportation.

Commuting Into and Out of Monroe County

Monroe County is a net "importer" of workers. In 2007, a total of 84,468 people (both residents and commuters) worked in Monroe County, out of which 15,859 commuted into Monroe County from neighboring counties. With that, 18.8 percent of all jobs in Monroe County were filled by commuters -- almost 19 percent of the workforce. Predominantly these commuters reside in Owen, Green and Lawrence Counties. 5,952 residents of Monroe County work in other counties, the largest numbers driving to Martin, Lawrence and Marion County (Indianapolis).[7]





[6] 2000 U.S. Census.

[7] STATS Indiana, *STATS Indiana Annual Commuting Trends Profile Based on Indiana IT-40 Returns for Tax Year 2007* http://www.stats.indiana.edu/commtframe.html

Oil & Equity: The Impact of Fuel Costs on Households Budgets

The community's most economically vulnerable are the most exposed to a decline in cheap oil. Subtracting out the large student population, the poverty rate of Monroe County hovers somewhere around 26 percent. For comparison, the poverty rate for the nation is 12.5 percent and Indiana's rate figures in at 12.3 percent.[8]

In order to get a sense of what increased fuel prices mean for different income brackets, it is instructive to look at average fuel efficiencies and fuel expenditures as percentages of different income levels. Assuming that Monroe County residents drive approximately 22.8 miles per person per day at an average efficiency of 20.3 miles per gallon (MPG)[9], the following illustrates the per capita costs of ever-increasing fuel prices.

Impact on Income: Increasing Fuel Prices at Average MPG & Average VMT

Price per Gallon	**$2.00**	**$3.00**	**$4.00**	**$5.00**	**$10**
Costs per mile @ *20.3 average MPG*	$0.10	$0.15	$0.20	$0.25	$0.49
Costs per capita per day @ *22.8 miles per capita per day*	$2.25	$3.42	$4.56	$5.70	$11.17
Costs per person per year	$819.90	$1,248.30	$1,664.40	$2,080.50	$4,077.78
Fuel expenses as % yearly per capita income **$27,935**[10]	2.94%	4.47%	5.96%	7.45%	14.60%
Fuel expenses as % yearly per capita income **$15,000**	5.47%	8.32%	11.10%	13.87%	27.19%

[8] Identifying a poverty rate from residents in Monroe County is challenging, due to our significant student population. The US Census puts the rate at 41.6 percent – a somewhat inflated rate. Even selecting out the college students and reducing the figure by 15 percent, we are still left with a poverty rate of about 26 percent. As communicated by Todd Lare, Executive Director of the South Central Community Action Program as quoted in the local newspaper. Dann Denny, "40% of City in Poverty: US Census Bureau says Poverty Increased Nearly 7% From 2006 to 2007," Herald-Times On-line, September 13, 2008.

[9] This is based on the U.S. EPA's computer model – MOBILE 6.2 -- for estimating emissions from highway vehicles. http://www.epa.gov/oms/climate/420f05004.htm.

[10] Monroe County 2006 personal per capita income.

Fuel expenses as % yearly per capita income **$6,000** [11]	13.67%	20.81%	27.74%	34.68%	67.96%

The above table serves as a starting point to conduct a benchmark analysis**.** The goal of the analysis is to determine how much fuel use would have to be cut by reducing VMT, or how much fuel efficiency would have to increase with rising gas prices, to keep the percentage of fuel expenses to income the same as in the table above at a gas price of $2.00 per gallon. As illustrated above, at $2.00 gallons and 22.8 VMT, fuel constitutes roughly the following proportion of per capita income: 2.9 percent of $27,035/annum; 5.47 of $15,000/annum, and 13.7 percent of $6,000/annum. The results are as follows:

- **$5/gallon**. At an average gas mileage of 20.3 MPG, and a gas price of $5 per gallon, average miles driven per day would have to go down from 22.8 to 10 miles per capita per day for the percentage of fuel expenditures to income to stay the same as they were at $2.00 per gallon. That is a reduction in fuel use by 50.7 percent.

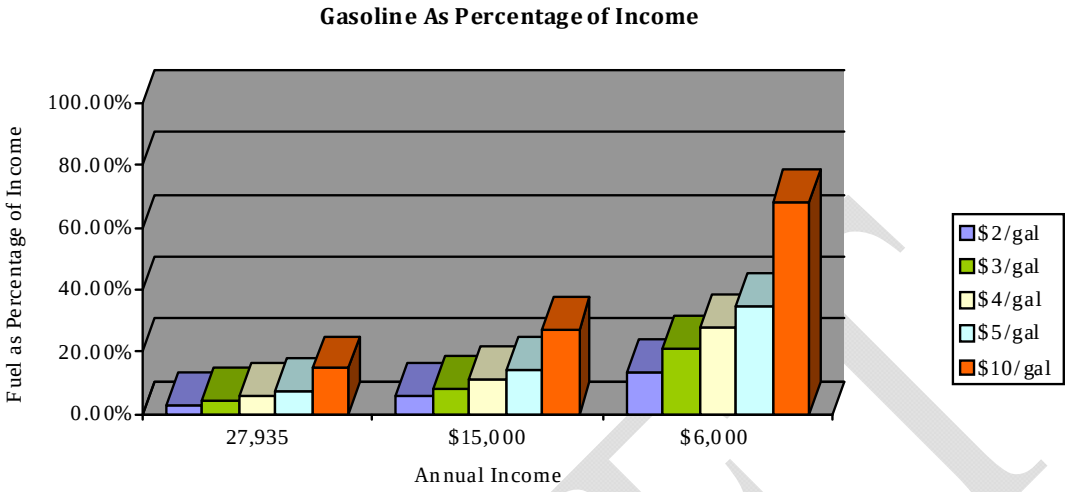
- **$10/gallon.** With an average gas mileage of 20.3 miles per gallon, and a gas price of $10 per gallon, average miles per day would have to go down from 22.8 to 4.5 miles per capita per day, for the percentage of fuel expenditures to income to stay the same as they are at $2.00 per gallon. That is a reduction in fuel use by 78 percent.

- **Maintaining Average VMT & Increased Economies**. Assuming residents do not cut back on driving and continue to average 22.8 miles per capita per day, at a price of $5 per gallon, fuel economy would have to increase to 50 miles per gallon on average for the percentage of fuel expenditures to income to stay the same as they are at $2.00 per gallon and an average fuel efficiency of 20.3 miles per gallon. At a fuel price of $10 per gallon, fuel economy would have to double again, to 100 miles per gallon, for fuel expenditures to stay at the same percentages of income as they are at $2.00 per gallon. Increasing the fuel economy for the whole vehicle fleet from 20.3 miles per gallon to 50 miles per gallon is -- at the current state of technology, and based on the fact that it takes time to phase out and replace the existing vehicle stock -- close to utopian within the next 5-10 years.

Therefore, the most likely scenario is that people in the lower income brackets will have to respond with drastic cuts in vehicle miles travelled, since they cannot increase substantially the percentage of fuel expenditures as part of their income. People in higher

[11] Poverty level for household of three.

income brackets of course may not cut down on trips as drastically, and take the edge off high fuel costs by buying more fuel-efficient new cars.



As illustrated above, low-income workers will suffer disproportionately from an increase in fuel prices.

VULNERABILITIES: TRAVEL-AS-USUAL

1. **Around the World 112 times a day. We rely on quick, easy, on-demand transport to take us considerable distances everyday.**

2. **Increasing fuel prices disproportionately burdens lower-income residents.**

3. **Commuters in and out of Monroe County are more exposed to increasing fuel prices.**

   Again, Monroe County imports almost 19 percent of its workers and exports approximately 7 percent of its residents to work in other counties, such as Marion County (Indianapolis). This import/export model will likely be re-organized in light of peak oil as people are challenged to cover gasoline costs.

REVIEW OF CURRENT SITUATION: WALKING AND BIKING

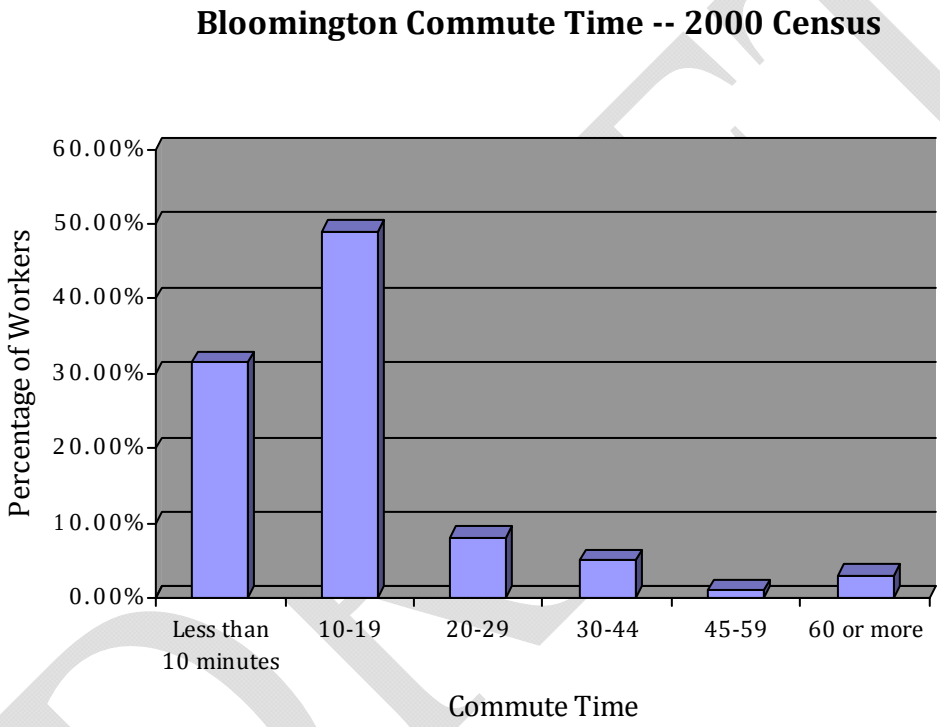
The City of Bloomington has worked hard to develop a network of safe, convenient and attractive bicycle and pedestrian facilities with guidance provided by the *Bloomington Bicycle and Pedestrian Transportation and Greenways System Plan*.[12] These facilities are for all ages and mobilities. Indeed, the City is one of less than 100 communities across the country to be recognized as a "Bicycle Friendly Community" by the League of American Bicyclists for "longstanding commitments to providing safe accommodation and facilities for bicyclists, and for their efforts to encourage bicycle travel for transportation and recreation." Similarly, Monroe County has developed an alternative transportation plan whose aim is "making alternative transportation a way of life for many Monroe County residents." Furthermore, in January 2009, the Bloomington/Monroe County Metropolitan Planning Organization adopted a *Complete Streets Policy*. The guidelines outlined in the policy ensure that roadways safely accommodate all users of a corridor, including pedestrians, bicyclists, users of mass transit, motorists, among others. While the City's efforts to minimize the use of cars have been sturdy and steady, we need to re-examine local efforts to improve the bicycle and pedestrian infrastructure in light of peak oil. This means accelerating many of these projects.

Whether the effects of peak oil can be mitigated by shifting from driving to walking and/or biking largely hinges, perhaps the most significant of which is distance. If the typical Bloomington resident can be said to have an average 19-minute commute to work, how feasible is it for him/her to bike to work? What about biking or walking to other necessary destinations of life, such as the grocery store, school, the doctor's office, etc.

[12] *Bloomington Bicycle and Pedestrian Transportation and Greenways System Plan* (March 2008), http://bloomington.in.gov/media/media/application/pdf/57.pdf

The Distance Factor

The greater the distances people travel in their cars to get to work and other destinations, the more vulnerable those residents are to a decline in cheap oil. To wit: A car driving at an average speed of 20 miles per hour can travel about 3.3 miles in 10 minutes. By comparison, it would take an average walker, walking at a pace of three miles per hour over an hour to cover the same distance. Similarly, it would take a non-athlete biker rider about 22 minutes to cover the same distance. The following graph shows average work commute times for Bloomington residents in 1990 and 2000.



In 2000, about 32% of all commutes by Bloomington residents took less than ten minutes, and about 50% took 10-19 minutes. Using the average speeds for walking and biking above, a driver who drives within the City and needs less than 10 minutes to get to work might be able to substitute walking or biking, although walking would require a considerable adjustment in time management. A nine minute car ride could be substituted by a roughly 45 minute walk or a 20 minute (or less) bike ride.

To put this into perspective, New Urbanist planners assume ¼ mile to be a comfortable walking distance to grocery stores and other necessities of life. This translates into a five

minute walk. If a commuter current enjoys a 5 mile 16-minute commute by car, s/he would have to build in both time and fitness: walking the same distance would take over an hour and a half, while biking it to work would be about a 35-minute bike ride.

In other words, if around 67% of Bloomington residents currently drive alone to work and the average commute time for most of these drivers is 19 minutes, then a shift to other modes of transportation would require a change in habits. For Monroe County residents commuting into Bloomington, walking is almost certainly prohibitive and biking is a challenge. The greater the distance, the lower the likelihood that people will turn to bicycles or walking as ways to get to work, or anywhere else.

Source: The Associated Press

Land Use Patterns

As discussed in the previous chapter, settlement patterns of the past have really been shaped by cheap fuel and with little regard to non-car transportation. Most new housing developments are separated from other land uses, like schools, shopping centers, workplaces, day care centers, garden supplies, hardware stores, film theatres, churches and workplaces. In Bloomington, the distances between these destinations are easy and fast to overcome by car, and, given the low fuel prices that prevailed for decades, it was also inexpensive. But, for most people, the current land use patterns are prohibitive when it comes to biking and walking. In some instances, residential areas actually are adjacent to shopping areas and other land uses, but there are no direct road connections between them, for fear that traffic might spill into the neighborhood.

Taking into consideration all the different things that people are accustomed to doing on a daily basis and considering that residents often make multiple trips in different directions to reach different destinations, walking and biking are just not feasible alternatives -- especially if trips involve young children, or the elderly who may move around more slowly.

Pedestrian Friendliness

Just how "walkable" is Bloomington? In effort to discern this, the Task Force analyzed the "WalkScore™" of each of the pre-defined 55 natural neighborhoods according to its WalkScore.[13] WalkScore is an algorithm for measuring the walkability of an address. The WalkScore system awards points based on proximity of an address to destinations. Walkability falls out into the following categories:

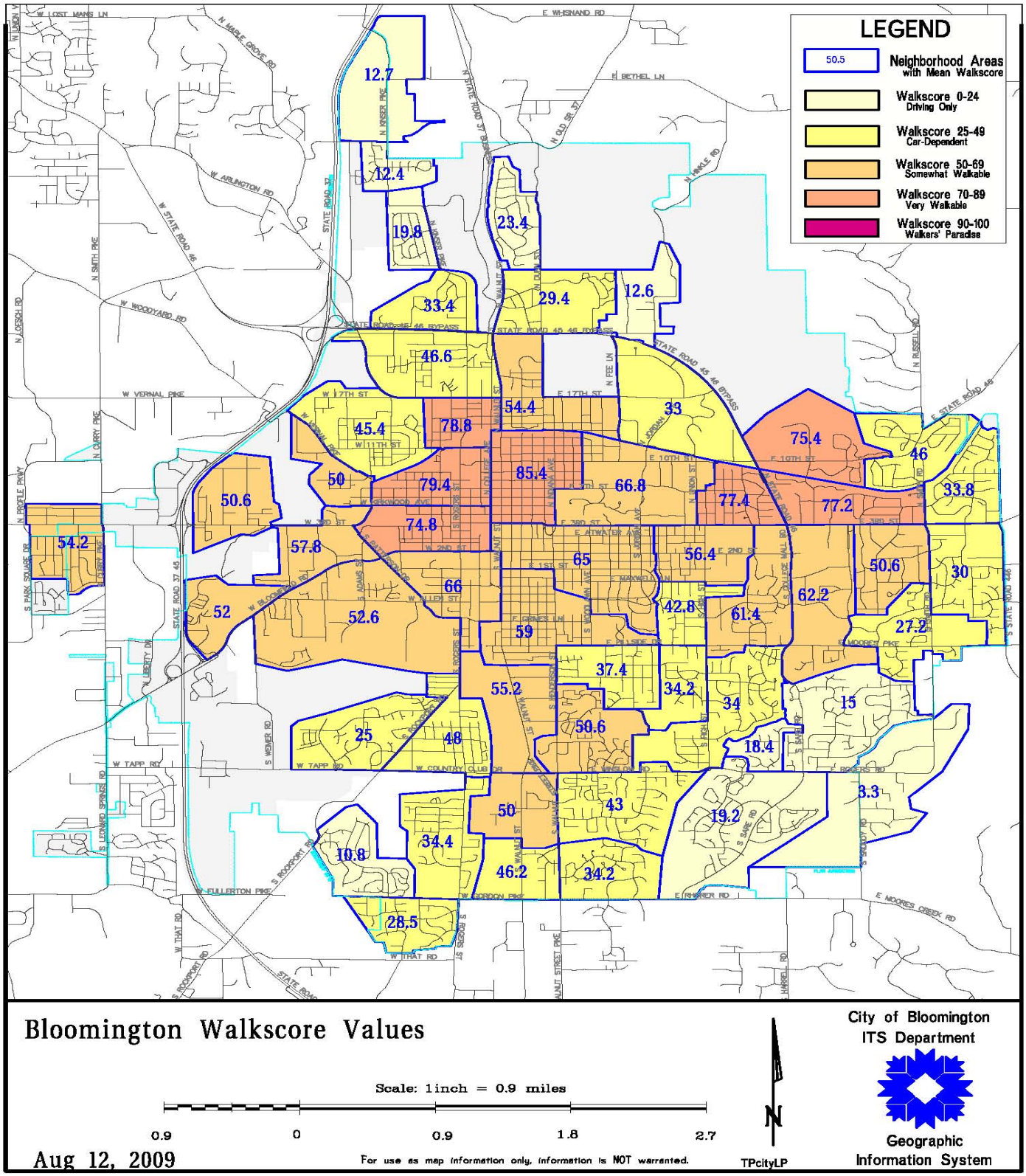
- **90–100 = Walkers' Paradise:** Most errands can be accomplished on foot and many people get by without owning a car.
- **70–89 = Very Walkable:** It's possible to get by without owning a car.
- **50–69 = Somewhat Walkable:** Some stores and amenities are within walking distance, but many everyday trips still require a bike, public transportation, or car.
- **25–49 = Car-Dependent:** Only a few destinations are within easy walking range. For most errands, driving or public transportation is a must.
- **0–24 = Car-Dependent (Driving Only):** Virtually no neighborhood destinations within walking range. You can walk from your house to your car!

If the closest amenity in a category is within .25 miles (or .4 km), WalkScore assigns the maximum number of points. The number of points declines as the distance approaches 1 mile (or 1.6 km)—no points are awarded for amenities further than 1 mile.

[13] www.walkscore.com

Indeed, a "walkability" analysis of the entire City reveals that no neighborhoods are considered a "Walker's Paradise" and only 7 are considered "Very Walkable."

It should be noted that when WalkScore maps proximity to a designation, it does so without regard to the *nature* of the destination. All destinations are granted equal weight: grocery stores, taverns, coffee shops and nail salons, to name a few. The Task Force attempted to take a more refined look at the activity of each neighborhood, by mapping only essential services. Please refer to the *Land Use* chapter of this report for an analysis of the *Activity Nodes* map (Map A). While WalkScore does not prioritize destinations, it is nevertheless an important heuristic in understanding the pedestrian friendliness of the City's neighborhoods.



MAP E: WalkScore Analysis of 55 *Natural Neighborhoods*

Cyclist using bike lane on Washington Street

Perhaps the biggest hurdle to biking in and around Bloomington, is the lack of facilities on arterials. The Bloomington Growth Policies Plan (GPP) gives priority to biking by suggesting all primary arterials, secondary arterials, and primary collectors within the City be constructed with four-foot bike lanes in both directions.

Yet, as pointed out in the MPO's *2030 Long-Range Transportation Plan*:

> Many existing primary and secondary arterials were constructed prior to this new emphasis on alternative transportation, and thus lack adequate alternative transportation facilities. … The obstacles are arguably greatest for bicyclists on these roads due to the lack of multi-use paths/bike lanes, narrow travel lane widths, and vehicular speeds which create uncomfortable and potentially unsafe riding situations.[14]

While the City has made great efforts to improve bicycle transportation and bicycle safety, the City should accelerate its effort to foster safe bicycle riding on major arterials and highways such as: Old State Road 37, North Dunn Street, West 2nd and West 3rd, as identified in the City's *Bicycle, Pedestrian and Greenways Plan* and incorporated into the *MPO's 2030 Long-Range Transportation Plan*. It is imperative that local governments aggressively pursue funding to build these projects as soon as possible.

[14] p.68

VULNERABILITIES: BICYCLE & PEDESTRIAN

The most salient vulnerabilities of our bicycle and pedestrian infrastructure include the following:

1. **Most destinations are located distances significantly distant from where people live. Such distances are not realistically travelled by foot or bike on a daily basis.**

2. **Most City neighborhoods are not very walkable.**

3. **Major arterial streets in the City lack adequate bicycle facilities.**

THE CURRENT SITUATION: PUBLIC TRANSPORTATION

Public transportation in our community is primarily provided by three bus services: Bloomington Transit Corporation, Indiana University Bus System and Rural Transit. Neither the City nor the County have light rail nor are we connected to surrounding communities by way of high-speed passenger rail.

Bloomington Transit and Indiana University Campus Bus System

Bloomington Transit (BT) is a full-featured bus service that operates nine routes within the corporate boundaries of the City of Bloomington. The regular BT fare for non-IU students is $1; monthly passes are available at $30; semi-annual passes at $150, with free transfers to other BT and Rural Transit routes. Bloomington Transit does not operate on Sundays with the exception of one route. Reduced service is offered on Saturdays. All fleet buses are equipped with bike racks. Bloomington Transit also operates BT Access, a transportation service for passengers with disabilities who cannot use the "fixed route" bus system.

Between 2006 and 2008, BT ridership increased by 20 percent.[15] In part, this number was shaped by an increased student population, but it was also informed by increased gasoline prices. The growth in ridership demonstrates that behavior in Bloomington tracks national trends. According to the American Public Transportation Association, on average there was an increase in bus use across the nation by 3.9 percent, "but in communities with a population of less than 100,000, bus services saw an increase of 9.3 percent in 2008."[16]

The Indiana University Campus Bus System (IU) travels to all points on campus, to downtown Bloomington, and to the College Mall. The campus bus service is available every day of the week, with reduced service during breaks and on holidays.
Both BT and IU provide free rides to students. BT initiated its free-to-students initiative in 1999 and saw a marked increase in student ridership. Currently, students comprise

[15] 2,363,526 in 2006; 2,570,117 in 2007; 2,829,950 in 2008 (via Lew May, BT General Manager).

[16] American Public Transportation Association, *Transit News*, March 9, 2009. http://www.apta.com/media/releases/090309_ridership.cfm

approximately two of every three BT riders. While BT is free to students, the IU buses are free to everybody.[17]

Rural Transit

Rural Transit is a bus service administered by the Area 10 Agency on Aging. The service is available for everyone -- regardless of age -- in Monroe, Owen and Lawrence Counties. To travel within one county, adults pay $.75. Two-county fare is $1.50 for adults. Senior citizens are asked to donate the full fare amount. Monthly passes are available. One-county monthly passes are $15.00 while two-county monthly passes are $18.00. Transfers to and from Bloomington Transit and the Indiana University Campus Bus Service are free. This transfer agreement is key as Rural Transit provides an important connection for trips originating in Bloomington bound for destinations outside City limits.

Indianapolis Airport Shuttles

Bloomington Shuttle and Star of Indiana are private companies that provide shuttle services to the Indianapolis airport. Bloomington Shuttle picks up and drops off passengers at four locations within Bloomington. The Star of Indiana picks up and drops off passengers at one location.

Source: http://transitionnetwork.org/Primer/TransitionInitiativesPrimer.pdf

[17] This free-fare system is financed by a universal transportation fee charged to IU students. Notably, The City of Bloomington and Monroe County governments both provide BT bus pass access to all their employees.

Hoosier Bus

Hoosier Bus is Indiana University's express bus service from IU to the Chicago area for key holidays, semester breaks, and select weekend trips. Ft. Wayne and South Bend routes are in the planning stages.

No Transit Service to Downtown Indianapolis, or Other Neighboring Cities

There is currently no regular bus service, private or public, that connects Bloomington with downtown Indianapolis, or any other larger city in the region. The Bloomington downtown Greyhound station was closed several years ago. To reach the Indianapolis passenger train station, a traveler without a car would have to take the shuttle to the Indianapolis Airport, and then a bus from the airport to downtown Indianapolis.

Vulnerabilities: Public Transit

Currently, public transit comprises a small portion of the transportation pie. Too few people use public transit. As discussed earlier, only 2.8% of all work commutes are on public transit in Bloomington.[18] Similarly, a study conducted by the Indiana Department of Transportation in 2008 found that public transportation serves just 1.4 percent of all Bloomington's travel demands.[19]

1. Increasing Fuel Prices & Price Volatility

While transit is often seen as an alternative to driving when gas prices are high, it is important to remember that transit itself is vulnerable to increased fuel costs and decreased revenue. Furthermore, public transit is certainly not immune from fuel shortages. According to a recent article in the *New York Times*, "more people used transit in 2008 than in any year since 1956," but at the same time, many "transit systems across the country are raising fares and cutting service as the tax revenue they rely on plummets during the recession."[20] This constitutes a problem, considering that extreme swings in fuel prices are expected to continue as petroleum supplies diminish worldwide. As discussed earlier, high fuel prices will drive demand destruction, and stifle economic activity, leading to recessions and wild price fluctuations.

In 2008, as fuel prices soared, BT was forced to reduce the frequency of its service on some campus routes. This was because IU was not able to increase its contributions to BT to keep up with fuel costs. With IU only able to commit to a reimbursement schedule on a biannual basis, due to its State-mandated budgeting process, BT could not receive additional funding from IU in a non-budget year. The IU campus bus system itself also reduced service due to the same budgeting process dilemma.

[18] 2000 U.S. Census

[19] This compares to a "transit share" of 0.4% in the Indianapolis metro area.Overall, in Indiana, the current urban transit mode share for Indiana is 0.46% of all trips. Indiana Department of Transportation, December 2008, Executive Summary, *Indiana Mass Transit Studies* PL 203-2007.

[20] Michael Cooper, "Transit Use Hit Five-Decade High in 2008 as Gas Prices Rose," *New York Times*, March 9, 2009. http://www.nytimes.com/2009/03/09/us/09transit.html?_r=1

BT owns 42 conventional diesel buses and 2 diesel-electric buses. In 2008, BT consumed 283,699.5 gallons of diesel. Based on rapidly-increasing fuel costs in 2008, BT proposed a 84 percent increase in the fuel/oil line item for it 2009 budget – from $702,000 in 2008 to $1,296,108 in 2009. During this time, BT's total operating expenses increased from $5,724,498 to $6,603,059 -- a difference of $878,561.

Bloomington Transit Fuel Cost Increases, 2008-2009

Year	Fuel Costs		Operating Budget	Fuel Costs as % of Total Budget
2008	$702,000		$5,724,498	12.26%
2009	$1,296,108		$6,603,059	19.63%
% Increase	**85%**		**15%**	

Source: Bloomington Transit

2. Inadequate Fuel Reserve

BT is also vulnerable to acute fuel shortages, as it stores only a four-day supply (20,000 gallons) of fuel. Even the shortest of disruptions of supply could shut down the public bus system, right at a time when the need for a public transit system is probably the greatest.

BT has already taken steps to reduce its dependency on fossil fuels, and has demonstrated a firm commitment to transitioning away from fossil-fuel reliance where possible. In addition to 42 conventional diesel buses, BT has 2 diesel-electric hybrid buses in its fleet and will add four more by the end of 2009. At the time this *Report* was issued, BT was seeking federal funds to buy an additional five diesel-electric hybrids. In addition to using less fossil fuel, hybrid buses, average about 25 percent better mileage than convention diesel buses of the same size.

Given public transit's very small mode share, increased fuel prices and a peculiar federal funding formula essentially making transit reliant on the federal gas tax, it is critical that

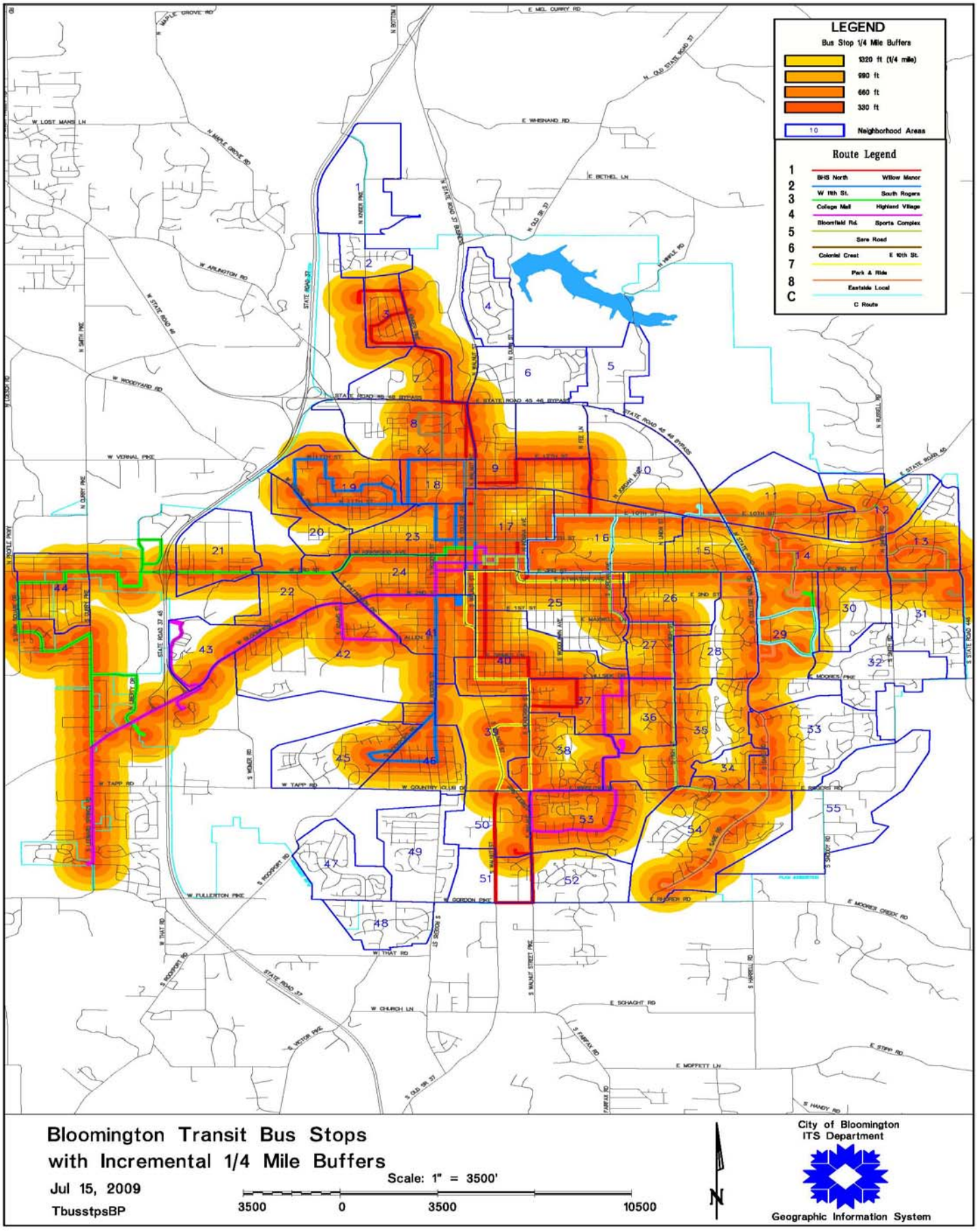
we invest much more substantially in public transit to make it a realistic alternative to personal automobile use.

3. Transit Is Still Not Convenient For Many

As fuel prices skyrocketed in 2008, people in cities with a well-developed public transit system left their cars at home and switched to public transit.[21] However, switching to transit will likely come at a time expense. Given our reliance on the personal automobile, we are accustomed to being able to go where we want to go, when we want to go, relatively quickly. However, as with biking and walking, public transit in Bloomington (in its current state) is likely to take considerably more time than driving and the costs in terms of time may be prohibitively high. While it is likely not too difficult for most people close to the City's center to find a bus stop within walking distance, once a patron is on the bus, oftentimes, s/he is faced with a long ride to get to a destination as the bus often does not follow the direct route one would follow when driving. Oftentimes, to get to a destination, a patron may have to transfer to another bus line at the downtown hub. In short, for many, the switch to public transit will be difficult because of the time it takes to use the system. If people continue to drive for this reason, they may experience increased financial hardship.

However, with adjustments, transit can be made a viable transportation alterative for more residents. For one, BT has impressive number of bus stops – 500. Not only is the number impressive, but most bus stops are within a walkable distance (.25 mile) of most neighborhoods (*See* Map F, following page). To make BT a more viable and attractive alternative to the automobile, it would have to offer more frequent service, including weekends and late-night service and add routes to previously under-served areas. This would require considerable increases in funding for BT. Unless funding is secured in anticipation of future episodes of dramatic fuel price spikes, we may be faced again with a situation where, as in 2008, bus service actually has to be cut, when it should be expanded.

[21] American Public Transportation Association, *Transit News*, March 9, 2009. http://www.apta.com/media/releases/090309_ridership.cfm



MAP F: Walkability of BT Bus Stops

4. Funding is Inadequate

That securing funding for transit improvements will be critical, is confirmed by INDOT's 2008 *Mass Transit Study*.[22] The study states that "Local bus systems are undersized in Indiana's cities, and thus currently serve a primarily transit-dependent population."[23] To attract additional riders, the study opines that "service expansion should focus on building fleet sizes and adding more frequent service in the existing service areas, with limited expansion to new destinations that are focused on access to employment (i.e. Express Bus). Low-frequency service is currently a barrier to higher utilization of the system, especially by choice riders."[24]

What is of special interest for this *Report* and the assessment of vulnerabilities is that the INDOT *Mass Transit Study* also states that the current mix of transportation funding available to improve transit systems does not generate sufficient revenue to even accommodate the recommended transit investments that are necessary to meet the unmet demands. While the funding shortfall identified might have been mitigated somewhat by the *American Recovery and Reinvestment Act of 2009*, the pattern outlined in the study still holds: the national trend of driving less translates into reduced federal fuel tax revenues which mean means fewer federal tax dollars are available for transit and highway programs in the State of Indiana. That transit is funded through the federal gas tax is truly a peculiar paradox.

On the other hand, much of federal funding is based on ridership. Investing in our public transit infrastructure to make it even easier for people to use the system, will render greater ridership. Greater ridership will translate into greater funding to make up for the shortfall lost to decreased revenue from the federal gasoline tax.

[22] Indiana Department of Transportation, December 2008, *Executive Summary*, *Indiana Mass Transit Studies* PL 203-2007, p. E-6.
[23] "Transit-dependent" refers to people who cannot drive because they are poor, sick, too old, or disabled.
[24] *Ibid*.

5. Intercity Rail is not available.

Intercity passenger rail is currently not available, even though there is some interest in developing a Bloomington-Indianapolis rail or commuter bus connection at the State level.[25] Having intercity rail or a commuter bus system fueled by renewable fuels would be a great benefit for Bloomington and Monroe County, and would be a necessary complement to a well-developed local transit system. Together, these modes would significantly help reduce our collective reliance on the personal automobile.

6. Ride Shares and Car Pools not prevalent

Informally, people commuting to Indianapolis to work or study often informally arrange for ride shares to cut down on driving time and to save fuel. Ridesharing in Indiana is becoming a bit more organized thanks to on-line tools whereby Bloomingtonians and other can arrange car pools for daily commuting, for cross country travel, for short occasional trips such as shopping, going to the doctor, or to the airport and even for car-sharing.[26]

7. Monroe County Community School Corporation is completely dependent on

Like other major regional institutions, the Monroe County Community School Corporation (MCCSC) is highly reliant on petroleum and is vulnerable to a decline in cheap oil. In 2007, MCCSC consumed 189,000 gallons of liquid fuel. That's about 1,050 gallons per day for the 180 days that school is in session. MCCSC has a storage capacity of 24,000 gallons - 12,000 gallons of unleaded and 12,000 gallons of diesel. All the school buses run on diesel; while the maintenance vehicles run on gasoline.

MCCSC buses run about 11,000 miles per day, and get between 6 and 10 miles per gallon. This means that daily fuel use for buses is somewhere between 1,800 and 1,100 gallons per day. With a 12,000 gallon tank for diesel, this means that MCCSC has only between 6.5 days and 11 days worth of supplies when all tanks are filled 100%. Depending on the frequency of fuel deliveries, actual reserves on hand at any one time could be far less.

[25] See, *Indiana Department of Transportation*, *Final Report: Central Indiana Commuter Rail Feasibility Study*, August 2008.

[26] *See* for example http://www.erideshare.com/statecity/IN.htm and http://www.carpoolworld.com/ for details

Like Bloomington Transit and the IU Campus bus system, MCCSC struggled with finding ways to cover increasing fuel costs in 2008. Indeed, by September 2008, the school corporation found itself with a $150,000 shortfall in its transportation budget. MCCSC struggled to meet this shortfall by consolidating programs, transferring money from its school bus replacement fund and charging student athletes with a transportation fee.

MITIGATION GOALS & STRATEGIES

In the Summer of 2008, households, businesses and public entities responded to higher fuel prices in very predictable and pragmatic ways: they cut unnecessary trips; sought ways to increase fuel efficiency and switched to public transportation options, if available. In this period, the number of miles traveled by residential vehicles in the U.S. fell by 3.6 percent.[27] Such a reduced reliance on the car is good practice for preparing for a permanent decline in the availability of cheap oil, but we need to invest in both infrastructure and a change in the cultural valorization of the personal car to fully prepare for peak.

In planning for this transition, it is important to realize that within the coming 10-15 years, it is unlikely that we will see the drastic, across the board increases in vehicle fuel efficiency that will be needed to fully compensate for the effects of price increases or reduced availability of fuels. Nor are alternative fuels likely to be available at the scale and price that people got used to with regard to petroleum based fuels.

Therefore, as petroleum supplies diminish and prices increase, we can anticipate that:

- Higher fuel prices will consumer greater proportions of budgets;
- The distance that raw materials, goods and people must travel to reach their endpoint must be reduced;
- Where distant transport of raw materials, goods and people is critical, much more efficient modes of transportation must be identified; and
- To reduce the risks from fuel shortages, we need to convert our vehicles to alternative fuels, or make sure we invest in fuel storage.

In proposing the measures below, our premise is that the best way to mitigate the social and economic disruptions from declining petroleum supplies is to proactively embrace, plan, prepare for and support the necessary restructuring and adaptations in local public and private transportation systems. Therefore, most of the mitigation measures proposed

[27] U.S. Department of Energy, "U.S. Transit Use Up, Driving Down in 2008," *Energy Efficiency and Renewable Energy News*, March 11, 2009, http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=12283

below are focused on implementing strategies in the very near term with the aim of realizing a substantive reduction in oil reliance in the long term.

SHORT-TERM (1-5 Years)

1. Use "Lows" in Fuel Price Swings Wisely: Reduce Consumption, Establish a Designed Emergency Fuel Fund

It is unclear how long the current recession will last and how long fuel prices will remain relatively low. It may be years until the world economy - and fuel prices - rebound, or it may happen rather quickly. Several public entities responded to the price spikes in 2007 and 2008 by increasing fuel budgets for 2009. Then fuel prices declined. This is the price oscillation symptomatic of oil price volatility.

Public and private entities, including the City of Bloomington, City of Bloomington Utilities, Bloomington Transit, Indiana University, Monroe County, the Monroe County School system, as well as households, businesses, churches and other institutions, can benefit by planning for future increases in fuel prices now.

In anticipation of price volatility, public and private entities should use current and future temporary reductions in fuel prices to redirect already budgeted higher fuel expenses into:

a) investments that promise lower fuel consumption in the future; and/or
b) special emergency funds that can help buffer spiraling fuel costs in the future.

Over time, these funds should become less and less important. They are only helpful as long as needed reductions in travel demands are not yet accomplished, and/or there is a continuing need for fossil fuels. Basically, this amounts to planning upcoming budgets as if fuel prices were to remain chronically high and to direct any surplus funds during times of low prices into projects that reduce fossil fuel demand in the long run, or into emergency funds to buffer price spikes.

2. Develop a Community Cooperative Ride-Share System

One of the greatest transportation vulnerabilities stems from current land use and commuting patterns. About 19 percent of the Monroe County workforce commutes from surrounding counties. Even within the County, there are pockets of low-density exurban settlement that are sufficiently distant from activity nodes and for which it is costly to provide public transit.

In the short-term, one of the easiest and most effective ways to drastically increase fuel efficiency is not the purchase of more fuel efficient vehicles, but to decrease fuel use per passenger mile by maximizing the capacity of our community's existing vehicles. Over the next five years, the community's biggest employers – Indiana University, the City of Bloomington, Monroe County, Bloomington Hospital, schools and other organizations – should work cooperatively to establish an electronic carpooling match system whereby employees of any of these institutions can identify ride-share opportunities with the employees of any of the other entities. By combining all the workplaces, the pool of people seeking and offering ride shares is increased, making it more likely that people who commute from other counties and live spread out over a large area, will find someone else close by with whom they are able to share the commute.

Having a well-designed car-sharing system like this in place would provide much needed insurance against sudden price spikes and fuel shortages. The higher prices rise, the more attractive it would be to participate in the system, the benefits to each participant would be immediate and major disruptions from people not being able to afford the trip to work could be avoided. Smaller employers who are not a part of this cooperative network should be encouraged to:

- Educate customers, clients, members, etc. re: carpooling;
- Provide carpooling websites themselves or point to existing sites;
- Cooperate with other entities located in close proximity to facilitate ride; and sharing among all their customers, clients, members, etc.

3. Implement a Car-Sharing Program.

A natural complement to a ride-share program is a car-share program. Car sharing is an urban car rental service whereby customers who sign up as members can reserve a rental car for periods of time as short as one hour. Patrons pick up the car at a designated place in their neighborhood and return it to the same spot. Car sharing allows people who only occasionally need a car, to get rid of their car. To take advantage of such a program, participants become members of a car-sharing coop or program. Rates are affordable and include fuel, maintenance, insurance and parking of the vehicle at its home site.

Car sharing allows for those commuting *via* ride share, transit, bike or foot to have short-term access to a car when needed. Car sharing is widely recognized to be a key component of an integrated, mobility-management system and enjoys wide-spread use in cities such as: Seattle, Chicago, Portland, Long Beach, Los Angeles, Denver, San Diego, Toronto, Boston, New York, and Washington, DC. In these cities, for-profit or non-profit organizations maintain the car sharing fleet and reservation website. Recently, the City of Baltimore, Maryland issued a Request for Proposals to establish a car share program for its residents.[28]

Car sharing: A Brief Review

Car sharing in the US has gained increasing popularity ever since the first program began in Portland in 1998. A car sharing system has a relatively small fleet of vehicles available at designated stations exclusively for use by members of the program. Members reserve vehicles on an hourly basis, and may do so online or by phone.

Car sharing allows individuals to gain the benefits of a private vehicle without having to own one. In some cases, car sharing can make having a car-free home feasible.

Car sharing improves mobility, reduces vehicle miles travelled, reduces greenhouse gas emissions, reduces traffic congestion and parking problems, increases alternative transportation options, offers savings for members and expands access to cars to individuals who do not own a vehicle.

Municipalities can play a role in helping to incentive car sharing. To wit: Seattle, has parking stalls designated specifically for car sharing vehicles. Austin provides parking spaces for car sharing vehicles and exempts them from parking meter charges. San Francisco requires dedicated parking for car sharing vehicles for all new residential projects with 50 units or more.

The City should work to either establish or encourage the establishment of a City-wise car-sharing program. Car sharing not only reduces the need for personal vehicle ownership,

[28] http://www.cmtalliance.org/news_files/carsharerfp/Car%20Share%20RFP%202009.pdf

but reduces congestion and the demand for parking. Such a program also stands to save residents money and would allow local businesses and non-profits to economize on their fleets.

4. Land Use: Making the Best of the Existing Built Environment

The goal of post-peak land use planning with regard to transportation is bringing daily necessities closer to where people live, so that biking and walking become more feasible and automobile trips become shorter. This can be done by facilitating changes in land use toward increased density and mixed use. Since the built environment changes rather slowly, the priority of this planning process within the first five years is to make the best of what we have, by starting the process of changing how existing structures can be used.

As outlined in the previous chapter on *Land Use*, one obvious improvement would be to abandon the strict separation of uses that defines most of our current zoning landscape, making it possible for small businesses to locate closer to where their customers live, thus reducing the need for automobile trips and facilitating walking and biking. Another improvement would be to allow more flexibility for home owners to divide up an existing building into smaller units, to add wings, or to add granny flats, in order to create additional dwelling units. These measures increase population density, and may meet a growing need for fairly inexpensive housing close to activity nodes, as more people want to live closer to where they work and shop. Besides facilitating walking and biking, increasing density is a very important aspect of making public transportation cost-effective and attractive for both riders and providers. To start that process, community involvement and support are necessary. Ideally, the process of allowing a more flexible use of the existing built environment should be driven from the "bottom up".

To that end, we recommend that:

- The City, in cooperation with other local entities like *Transition Bloomington*, the City Bloomington Commission on Sustainability, the Center for Sustainable Living, and others, encourages, promotes, and supports *Transition Trainings* for all 55 *Natural Neighborhoods* within the next five years.

- City staff stays in contact with neighborhoods as they engage in transition projects and assists them in formulating changes to land use regulations that help them achieve their transition goals.
- City promptly implements changes as they are proposed by neighborhoods, amending existing codes where needed.

- If neighborhoods differ greatly with respect to the changes they are willing to undertake, the City Council should consider neighborhood-specific codes (or neighborhood-specific waivers of current codes) so as to not impede progress in neighborhoods that are willing to be more bold than others. Those neighborhoods could become models for others, and pave the way for more widespread acceptance of changes in local codes. (*See also Land Use* chapter's recommendation for a pilot Nodal Overlay to the UDO).

5. Work Toward a *Unified Comprehensive Land Use and Transportation Plan*

As we revise the use of the existing built environment, we must simultaneously plan for the shape of the future built environment. In a post-peak era, we should be aiming for development patterns that lead to higher population density in areas designated as activity nodes, and that foster mixed use, walking, biking and transit use. (*See Land Use* chapter). Right now, transportation planning is largely separate from land use planning and land use planning is a largely self-contained effort: IU, Monroe County and the City of Bloomington all draft and implement their plans independent of each other. Within the next five year, the City, County and IU should work with each other and with neighborhood-based Transition groups to establish a coordinated planning process that will result in a County-wide, unified and comprehensive Land Use and Transportation Plan.

6. Update the Long-Range Transportation Plan with an Eye to Peak Oil

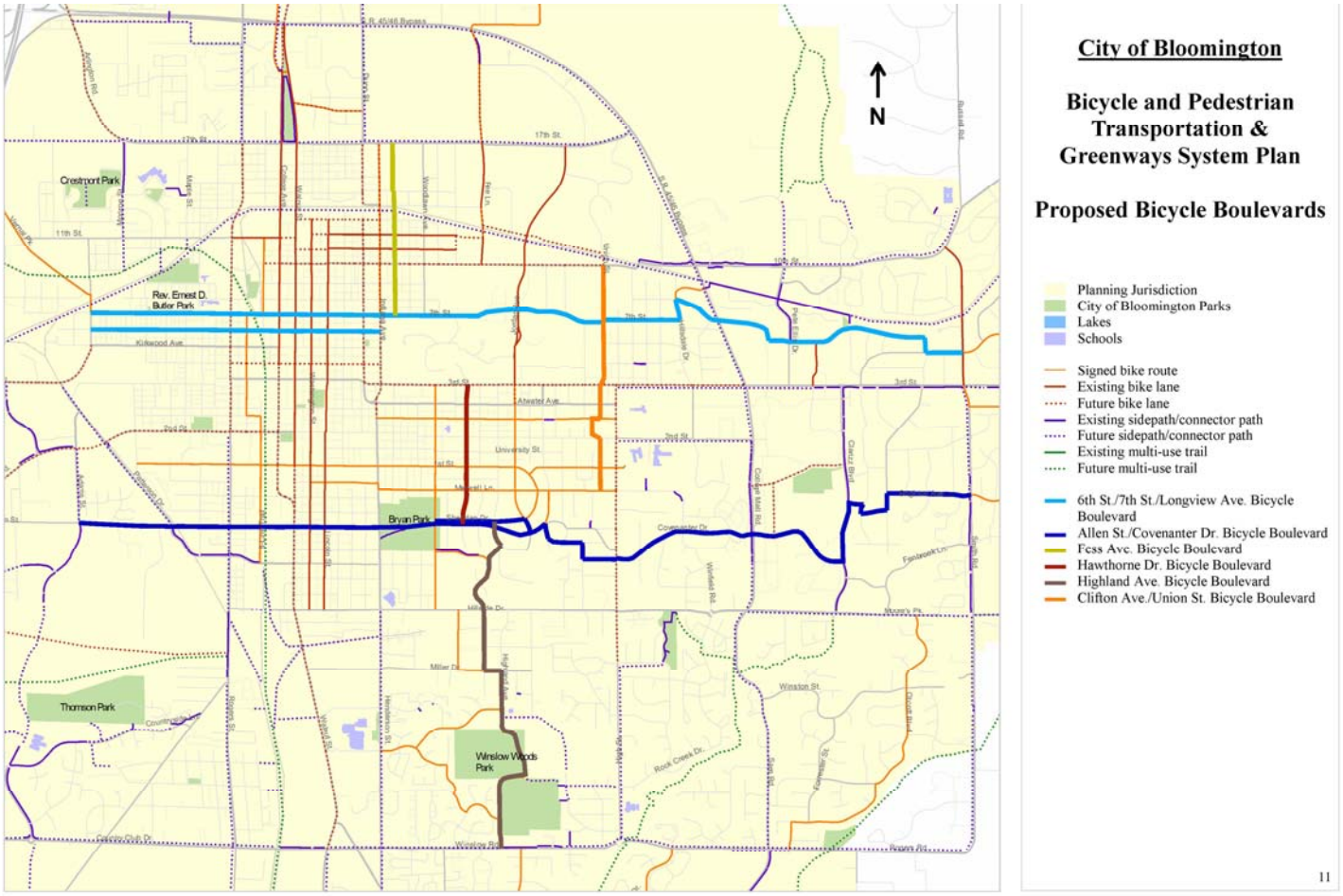
As the Monroe County Metropolitan Planning Organization prepares to update its *Long-Range Transportation Plan*, it should do so informed by the phenomenon of peak oil and the likelihood that reliance on the personal automobile will decrease while reliance of public transit, walking and biking will increase.

7. Increasing Connectivity for Bicyclists

Build Out Bicycle Boulevards

As discussed above, the City of Bloomington has made a great effort to foster a robust bicycle and pedestrian infrastructure. Bloomington's 2008 *Bicycle and Pedestrian Transportation and Greenways System Plan* makes this commitment even stronger. The *Plan* is predicated, in part, on the importance of connectivity -- of making it possible for bicyclists to reach destinations on a network of routes that provide safe and fast travel. The *Plan* gives high priority to the concept of "bicycle boulevards." Loosely modeled on Berkeley California's bicycle boulevards, Bloomington's bicycle boulevard program is intended to provide optimized accommodations for bicyclists on existing roads, the purpose of which is a "high degree of free-flow bicycle travel, access to major destinations, comfortable bicycling conditions, and minimal conflicts with motorists and pedestrians." Bicycle boulevards also provide significant east-west and/or north-south connectivity along lengthy corridors and connect people to places of work, residence, shopping, studying and play. The 2008 Plan outlines the intent to build a number of bicycle boulevards within the City and assigns these a "high priority," but does not attach a timeline to the construction of the boulevards. The City should aim for constructing all of the bicycle boulevards identified in the Plan within the next five years.

Bicycle Boulevard street markings in Berkeley, California



[sj trying to get better map here]

Amend the Bicycle, Pedestrian and Greenways Plan to significantly increase the number of planned "lengthy corridors."

At present, the *Plan* only includes two substantial east-west bicycle boulevards: the 6th/7th Street/Longview Avenue Bicycle Boulevard (from Adams Street to Smith Road) and the Allen Street/Covenanter Drive Bicycle Boulevard (from Adams Street to Smith Road). While these boulevards are critical, alone they are insufficient to foster the kind of east-west connectivity that is truly needed for bicycle riders in a post-peak environment. The City should add more east-west connective corridors by exploring options such as closing off lanes or closing streets for automobile thru-traffic and opening these streets up for bicycles, skateboards, pedestrians and other low-speed traffic. Usually bicycle boulevards do not completely exclude cars, but limit them in some ways. Boulevards are most appropriate on roads which have slower speeds and less vehicular traffic. Boulevards are generally open to emergency vehicles.

We encourage the City to pursue this option boldly. The post peak-oil economy may strap City budgets of the means to pursue investments into more costly bicycle and pedestrian facilities, including multi-use trails separate from roadways or separate side-paths along arterials dedicated to bicycles. The City should therefore put the highest priority on conversion of existing streets (or lanes) to bicycle traffic, even along now busy arterials, keeping in mind that in a post-peak future, automobile travel is likely to shrink, making this kind of conversion more feasible.

In transitioning any road to accommodate bicycle traffic, the City should aim to narrow the road for road traffic as much as possible, ideally to nine feet in width. Such narrowing will help slow traffic speeds and make drivers more aware of bicyclists and pedestrians in addition to allowing a wider space for bicycle lanes. [29]

8. Make Bus Transportation Faster and More Attractive

Bus Lanes

Likewise, dedicating a network of existing streets and lanes as bus lanes makes bus service faster and more reliable. The City should start outlining a plan for several fast east-west and north-south routes in which buses have priority. The City should implement such plans over the next fifteen years. These bus lanes should articulate well with areas of activity nodes as described in the *Land Use* chapter. At least one east-west and one north-south connection should be fully implemented within the next five years.

More bus line intersection

Another key improvement to transit is providing more opportunities for people to switch between bus lines. Currently, the bus lines intersect almost exclusively at the downtown hub. More convenient and faster connections will cut down on travel time and provide a better substitute for automobile travel. Planning for more sites of intersection should commence now and be realized over the next fifteen years. Possible ways of accomplishing

[29] Burden, Dan and Peter Lagerwey, *Road Diets: Fixing the Big Roads*, 1999, Walkable Communities, http://www.walkable.org/

this are one or more circular routes that intersect with the existing routes, or development of a system of routes that roughly follow a grid pattern.

9. Seek Cooperation for Trip Consolidation

The City of Bloomington should foster a spirit of cooperation between different private and public entities in seeking out and identifying opportunities for trip consolidations and for reductions in travel demands. For example: Meter reading for water, electricity and gas could be coordinated, and all these readings done on one trip, instead of three separate ones.

10. Seek Cooperation for "Bus Sharing"

In effort to increase the efficiency of bus operations by increasing the number of riders per bus, BT should build on the IU-BT cooperative precedent and explore cooperation with Monroe County School Corporation. School buses sit idle most of the day and night and several months during the year. Therefore, opportunities to reduce the school bus fleet, and to increase the use of BT buses by having some children picked up and taken to school by BT, should be explored. During school pick-up and drop-off times, BT buses may be scheduled to make more frequent stops in certain neighborhoods to pick up children. Also, during off-peak times, BT buses may be used for school trips. During summers, there may be opportunities to offer unused capacity for long-distance bus trips to the public. In addition, using idle buses (during daily and seasonal off-peak times) for transportation of goods, rather than people, should be explored as well. The money saved from running and maintaining a smaller fleet of buses, and from running busses more efficiently, could then be used to further increase levels of service, or to be able to more quickly replace existing buses with alternative fuel buses that are less vulnerable to fuel price spikes.

11. Seek Funding for Improvements in Transit System

As was shown above, only a public transit network that is easily accessible and offers high levels of service with regard to speed, frequency and quality of service can truly be considered a viable option for people who cannot afford automobile travel as fuel prices increase. A robust transit system includes: service at night and during weekends, dedicated

bus lanes, bus shelters and good pedestrian access to bus stops. If the transit system requires a lot of time to negotiate and is not available when people need it, its usefulness as a true transportation "alternative" will be very limited as will be its utility as a primary mode of transport.

Gas Tax

About a third of BT's budget is comprised of federal dollars – largely funds from the gas tax. Since 1993, approximately 18.4 cents of every gallon of gasoline is levied by the federal government to pay for roads, bridges and transit. The link between transit and the gas tax is problematic in at least two ways. First, the gas tax heavily favors the construction of roads and bridges over transit as fully 80% of the tax is devoted to roads and only 20% is dedicated to public transit. Therefore, the current structure of the tax just valorizes more road building over transit and actually encourages the suburbanization and a low population density that makes it difficult for BT to serve these areas. In a post-peak future, we know this is a wrong-headed approach. Secondly, the tax itself is unstable. As we saw a decreased demand for gasoline in the Summer of 2008, gasoline revenue dropped appreciably. Transit suffered.

Funding

As INDOT recommended in its recent analysis of transit in Indiana, to reach levels of service necessary to realize increased ridership, an increase in funding must come from the local or regional level.[30] Local investment becomes even more critical considering that a post-peak environment will occasion both 1) increased demand for transit and 2) decreased State and federal funding. The City should be visionary here and work with BT to start exploring possible new funding sources for: expanding public transit, increasing services and transitioning buses to non-petroleum sources of fuel.

The INDOT study recognized that the needed expansion of transit capacity must be matched with substantial investment, and toward that end, identified a number of possible funding mechanisms. Some are currently in use in Indiana for transit projects some are in

[30] Indiana Department of Transportation, December 2008, *Executive Summary*, *Indiana Mass Transit Studies* PL 203-2007.

use in Indiana, but currently not for transit projects, and some are not currently in use in Indiana, but are used elsewhere in the United States for public transportation.

Potential Public Transit Funding Sources	Currently in Use in Indiana?	Currently Used for Transit in Indiana?
FTA Section 5309 - Capital Discretionary Program	Yes	Yes
State Sales Tax	Yes	Yes
Local/Regional Sales Tax	No	No
Local Option Highway User Tax (Wheel Tax + Excise Surtax)	Yes	No
Lsocal Property Tax Increment	Yes	No
Gaming Taxes	Yes	No
Local Income Tax	Yes	Yes
Vehicle emissions tax	No	No
Vehicle Mileage Tax	No	No
Congestion Mitigation/Air Quality Program	Yes	Yes
Local Sales Tax Increment	Yes	No
Local Vehicle Registration Fee/Tax	Yes	No
Public Private Partnerships (P3)	Yes	No
Local Income Tax Increment	Yes	No
Auto Rental Excise Tax	Yes	Yes
Congestion Pricing	No	No
FTA Section 5317 – New Freedom	Yes	Yes
Local Parking Impact Fee	No	No
Right-of-way leasing (typically, for utilities)	No	No
Petroleum Severance	Yes	Yes
In-vehicle advertising	No	No

Adapted from Indiana Department of Transportation, December 2008, Executive Summary, Indiana Mass Transit Studies PL 203-2007

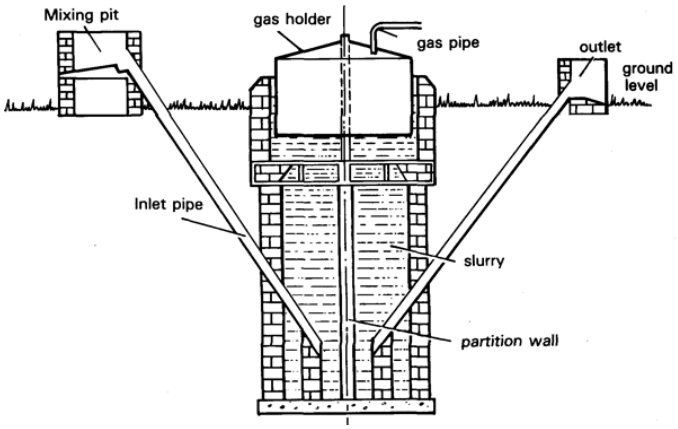
12. Explore the option of a "No-Fee" Bloomington Transit System

The IU Campus Bus system currently operates as a "no fee" system. Other communities in Indiana, such as in Marian, are operating public transit free of charge. BT should explore the possibility of implementing a "no fee" system. Indeed, on special days when BT does not charge a fee to ride the bus, it experiences a 15 percent increase in ridership. However, currently fees bring in around $400,000-$500,000 per year and cover 20-25 percent of BT's transit costs. Other communities with free systems experience that the loss in fees is made up by State and federal funds predicated on ridership.

Indeed, the City's *2002 Growth Policies Plan* prioritizes increasing transit ridership and calls for the City to "[c]oordinate with Bloomington Transit to study the feasibility of allowing universal transit access for all citizens of Bloomington." [31] The City and County should work with BT to closely examine such feasibility and both the City and County should help identify sources of revenue needed to invest in the BT infrastructure to help meet increased demand occasioned by a free fare system.

13. Explore Methane Digesters to Produce Biogas for Transportation

Organic, locally-generated waste, such as food waste, is a potential rich store of energy that could be leveraged to fuel transit buses. This waste is a source of methane -- a primary component of natural gas. As was shown above, BT stores a maximum four-day supply of fuel, and MCCSC stores a maximum of somewhere between 6.5 and 11 days of fuel under the best of circumstances, which assumes that the storage tanks are full when the crisis hits.



Source: www.fao.org

Locally-produced gas that fuels transit buses and school busses

[31] GPP, Implementation Measure, MT-5, p. 15.

would greatly reduce the risks to this community from interruptions in supply of transportation fuels.

According to a publication by the Oil Depletion Analysis Centre and the Post Carbon Institute, the great potential of biogas as a transportation fuel has already been demonstrated and acknowledged in many different countries.[32] A United Nations publication echoes:

> [a]t present biogas is the most immediately practicable means for powering a conventional internal combustion engine from biomass… In the city of Lille in northern France, 120 of the city's 400 buses run on biogas made from locally sourced food waste, with one new gas-power bus commissioned every week. By 2012 all buses will run on a mix of one-third natural gas, two-thirds biogas. The biogas is produced by an anaerobic digester at the bus terminus, which fuels not only the buses but also the lorries that collect the waste. This means there is a high degree of insulation to short term interruptions in the oil supply.[33]

According to this report, a study into the potential of biogas for Britain found that "Britain produces some 30 million dry tonnes of food waste and agricultural manure per year, and this could produce over six million tonnes of oil equivalent in biomethane. That equates to about 16 percent of total transport fuel demand, while public transport consumes less than five percent. In other words, Britain could fuel a public transport network three times bigger than today's on food and agricultural waste alone."[34]

We recommend that within the next five years:

- The City in cooperation with BT fully research conditions for the safe operation of bio-digesters in a city environment;
- The City initiate collection of food wastes from households, restaurants, and institutional kitchens, and other locally available materials that can be used in bio-digesters; and

[32] Oil Depletion Analysis Centre and the Post Carbon Institute , "Preparing for Peak Oil: Local Authorities and the Energy Crisis," http://www.odac-info.org/sites/odac.postcarbon.org/files/Preparing_for_Peak_Oil.pdf

[33] Food and Agricultural Organization of the United Nations, http://www.fao.org/docrep/010/ah810e/AH810E13.htm

[34] *Ibid*.

- According to the volume of organic wastes that is available, the City, BT, and MCCSC build and operate one or more bio-digesters designed to use all available materials. Fuels generated should be used: a) for BT, the City and MCCSC vehicles and placed in locations appropriate for fueling the respective fleets; b) for fueling vehicles that collect organic materials; c) remaining supplies will be offered to the County, and will be available for private use as fuel, or for other uses. The fertilizer that is generated as a by-product of such digesters would be useful for local gardeners and farmers.

14. Establish Public or Private Long Distance Bus Service Between Bloomington and Indianapolis & Encourage the Establishment of Commuter Rail

At present, no public transit connections exist between Bloomington and train and bus stations located in downtown Indianapolis. Currently, the only way to get downtown Indianapolis from Bloomington without a car is to take one of the two shuttle services from Bloomington to the Indianapolis airport and then to take public transit from the airport to one of the downtown sites (approximately 20 miles). The lack of a Bloomington-Indianapolis transit connection makes it difficult to connect up with trains and buses leaving from Indianapolis to Chicago, Cincinnati, Louisville and other popular regional destinations. It also makes it very difficult for Bloomington residents commuting to downtown Indianapolis to transition to mass transit. We strongly encourage the current shuttle services and other companies to explore the possibility of offering similar services to several spots in the downtown Indianapolis area within the next five years that would meet the needs of both commuters and occasional travelers.

We further encourage the City and the County to stay in active dialog with the State to insure that Monroe County is part of any commuter rail system planned by the state. Currently, the Indiana Department of Transportation is considering a rail or bus route between Indianapolis and Bloomington.[35]

[35] INDOT, *Final Report Central Indiana Commuter Rail Feasibility Study*, August 2008.

MEDIUM-TERM (5 -15 Years)

1. Use "Lows" in Fuel Price Swings Wisely

Public and private entities should continue to plan upcoming budgets as if fuel prices were staying high all the time, and to direct any surplus funds during times of low prices into projects that reduce fossil fuel demand in the long run, or into emergency funds for buffering price spikes.

2. Continue to Review and Revise the Land Use Plan, Regulations (Development Codes) and the Unified, Countywide, Comprehensive Strategic Transportation Plans

Plans and codes developed over the first five years, should continue to be adapted to provide the best possible framework for the adjustment of the local transportation and land use systems to a drastically reduced availability of fossil fuels. Planners should continue to seek and encourage proposals from Transition Movement groups that have been established during the first five years.

3. Increase Connectivity and Safety for Bicyclists

Within the next 5- 15 years, there should be at least 4 east-west and 4 north-south bike boulevards fully operable, and fully extending to the boundaries of the City. All major arterials should be outfitted with sidepaths or bike boulevards.

4. Improve Levels of Service for BT

Within the next 5-15 years, plans developed in the first 5 years shall be implemented with regard to larger number of dedicated bus lanes, and creation of multiple points where riders can switch bus lines. If the efforts of the first five years of developing additional funding sources and cooperation with MCCSC were successful, levels of service should be steadily increased during the following years, by increasing frequency of service, adding new lines, expanding service on Saturdays and Sundays, and later into the night, providing bus shelters and easy access to bus stops.

5. Implement the Use of Methane Digesters to Produce Biogas for Transportation

The City should continue to expand its collection of organic wastes for biogas production, and expand the production of biogas accordingly. In addition, plans should be made for the replacement of the current sewage treatment plants with systems of anaerobic digestion that make it possible for the City to use this resource for local energy generation.

LONG-TERM (15+ years)

1. Shrink Road Width and Automobile Road Infrastructure

As fuel supplies dwindle and vehicle miles travelled contract, and as carpooling, transit use, car sharing, walking and biking expand, there should then be considerably fewer numbers of vehicles on the road. After 15 years, the City may consider: shrinking its road infrastructure dedicated to automobiles, by reducing road widths, and making multi-lane roads into two-lane roads. This would help the City reduce road maintenance operations, and would free up funds that probably will be sorely needed for other purposes.

2. Continue the Expansion of Public Transit Through Compact Urban Form and Intra-City Connections

Fifteen years down the road, population density should map better onto Activity Nodes – area were essential services like grocery stores, schools, pharmacies, post offices, public libraries, restaurants, hardware stores, department stores and farmers' markets. This will allow BT to run bus lines more efficiently, since more people are likely to board at each stop, and buses will be fuller. This will put Bloomington Transit into a positive feedback loop, where increased ridership encourages increased levels of service, and vice versa. We recommend that BT continues its path of carefully-planned improvements in the levels of service, that attracts more and more riders. Once the local transit system is well developed, the feedback loop will be further enhanced by having transit connections with other cities besides Indianapolis. We recommend the City work towards establishing those connections.

HOUSING

> *"Peak oil and climate change require a revolutionary change to all aspects of our lives. The energy used and CO2 generated by the automobile or from food production is much less than the energy consumed by US buildings. Furthermore, building energy consumption has been continually increasing in spite of improvements in building efficiency."* - Pat Murphy, *Plan C*, p. 143

Although oil is not directly used by most homes in the US for heating and cooling, the production and delivery of other energy sources are dependent on oil and will therefore be affected by changes in the availability and price of oil. For instance, the coal that is used to produce 95% of Indiana's electricity requires oil for mining and transportation, so a scarcity of oil may result in higher prices for electricity.

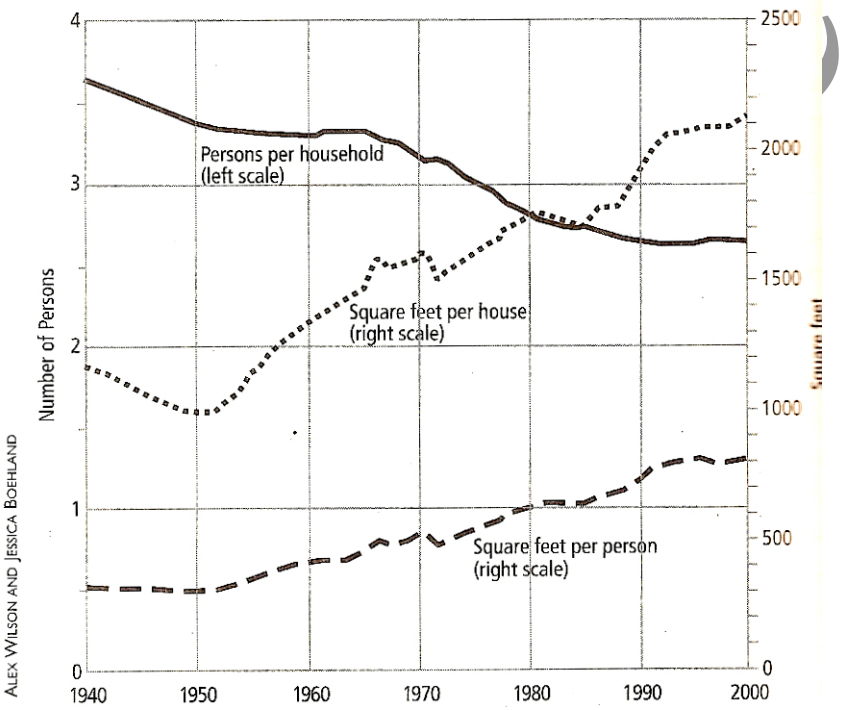
In addition, as oil becomes more expensive, homeowners will look to other sources of energy, such as natural gas. As more people rely on natural gas, the price of natural gas will increase. Likewise, the power grid will be called upon to fill gaps, causing potential for overloads on an already aged system. All of these effects comprise what is referred to as "peak energy", which will have significant impacts on our ability to heat and cool our homes.

Most of the housing in use in Monroe County was built in an era of cheap energy and materials. As a result, residential buildings tend to be large and inefficient compared with buildings in the rest of the world.[1] Improvements in efficiency have not resulted in energy savings, because of our trend toward larger houses with fewer people, and more energy-consuming appliances than ever.[2] As Patrick Murphy states in *Plan C*, "the more improvements are made relative to housing and appliance efficiency, the more these improvements are cancelled out by larger buildings, more lights, more machines and other accoutrements which reflect our consumption orientation. Without a significant change in

[1] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 145.
[2] *Ibid*., 147.

these cultural values, no technological advances will solve the US's energy and emissions problems."[3]

In 2005 the national average household size was 2.6 people. In Monroe County the average was 2.46 people while in the City of Bloomington the household size was 2.3 people.[4] As shown below, this is significantly less than the average in 1940, while over that same time period the number of average square feet per house, and per person, has increased:



10.2: *Change in Household Size, House Size and Square Feet Per Person – 1940 to 2000*

Change in Household Size, House Size, and Square Feet Per Person – 1940-2000[5]

From 2000 to 2009, homes built in Monroe County had an average of 2,547 square feet, almost 400 square feet larger than the average home.[6]

[3] *Ibid.*, 157.
[4] U.S. Census, 2005
[5] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 146
[6] Personal communication, Monroe County Building Department

As Murphy points out, we, as a society, missed an opportunity thirty years ago or so to change direction: "During the first energy crisis of the 1970s, a cultural choice could have been made to increase expenditures on efficiency rather than on size. Unfortunately the nation chose differently and now has an enormous investment in large and inefficient buildings where Americans spend 90% of their time. American residences are now at least twice the size of typical homes in Europe and Japan and consume 2.4 times the energy of European homes."[7]

As the world faces shortages in oil supplies, the ramification of choices made with regard to energy efficiency will be magnified. People will choose to live closer to amenities of everyday life, such as grocery stores, schools and transportation. For these reasons, population densities will shift to city centers. The price of heating and maintaining a home will become more costly. Housing costs will consume a larger share of household budgets and push people toward different housing choices. For example, as energy costs rise, some homeowners may need to relocate to less expensive dwellings such as apartments, or housing that is less expensive because it has not been maintained or is in an undesirable location.

To begin to grasp how residential energy consumption could be reduced, it may be helpful to break down the sources of energy use:

- **Construction**: orientation to the sun, thickness of walls, location of pipes, size, type, and location of windows, insulation
- **Systems**: heating, ventilation and cooling
- **Content**: size, number, and efficiency of appliances, electronics, tools, etc.
- **Practices**: lifestyle choices, habits and expectations such as thermostat settings, water heater setting, use of clothes drier, lights, electronics, etc.

Clearly, some decisions affecting a home's energy needs are made at the time of construction, and are not likely to be changed. Others can be modified but at considerable cost. However, many of the decisions affecting a home's overall energy use are decisions we make every day, often out of habit, and perhaps unaware that there is a less energy-intensive way to do something.

[7] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 156.

REVIEW OF THE CURRENT SITUATION

The current housing profile of the community points up our exposure to a decline in cheap oil. First, as discussed above, as the number of people per household decreases, the average square feet per home in Monroe County has increased. Secondly, this inverse relationship is even more telling in light that ours is a community populated by a substantial number of renters.

Rental Units

Currently, Bloomington has 112,657 housing units within its corporate boundaries. Approximately 35% (29,070) of these units are rentals.[8] As defined by the U.S. Census, a housing unit is, "a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters."[9] Importantly, "housing unit" does not necessarily mean a "house." Given the fact that renter-occupied units account for a substantive portion of housing, it is important to think through ways the City can incentivize landlords to make their rental properties more efficient, especially those who require tenants to pay utility bills.

Age of Houses

Of the 32,651 homes in the City of Bloomington, almost half of the homes were built between 1960 and 1989.

Age of Bloomington Houses

Year Structure Built	Number	Percent
March 2000 to present[10]	4,256	13
1995 to March 2000	3,621	11.1
1990 to 1994	2,661	8.2
1980 to 1989	4,501	13.8
1970 to 1979	5,833	17.8
1960 to 1969	4,799	14.7
1940 to 1959	4,152	12.7
1939 or earlier	2,792	8.6
Total	32,651	

Source: U.S. Census Bureau, 2000 Census

[8] Circa 2008, STATS Indiana,

[9]

[10] Estimated; note that projections after 2000 are unreliable. The 2000-present figure is predicated on the 1990-2000 annual rate of increase of 2.61%.

As the table above indicates, approximately 68% of the City's total housing stock was built prior to 1990. (*See* Map E below). The Energy Information Association reports that houses built prior to 1990 are less efficient than those built after that year, using more energy per square foot. Nationally, pre-1990 houses use an average of 47.4 thousand BTUs while post-1990 houses use 35.6. Houses have become more efficient each decade, with the exception of houses built from 1960 to 1969, which were less efficient that the previous decade.[11] This is significant since only 32.3% of the homes constructed in the City were built after 1990.

MAP G: INSERT HERE

Home Heating Fuel

The type of fuel used to heat homes and the design of the homes themselves have an obvious impact on the efficiency of fuel usage and the amount of fuel used. In both Bloomington and Monroe County, most heating fuel is either utility, bottled, tank or LP gas or electricity.

Fuel Type	**Bloomington**	**Monroe County**
Utility Gas	54%	59%
Electricity	35%	38%
Bottled, tank, or LP gas	8.5%	1.2%
Wood	1.5%	0.3%
Fuel Oil, kerosene, etc.	1.1%	0.2%
Coal or coke	0.1%	0.2%
Solar	0.0%	0.0%
Other fuel	0.2%	0.3%
No fuel used	0.2%	0.3%

Source: US Census, 2000

In 2006, natural gas accounted for 59.71% of total kWh consumed in the Bloomington residential sector, while coal accounted for the remaining 40.29%. The total amount of

[11] 2005 Residential Energy Consumption Survey, U.S. Energy Information Administration, http://www.eia.doe.gov/emeu/recs/recs2005/c&e/summary/pdf/tableus1part1.pdf

coal consumed (95% of electricity production) was 292,424,591 kWh. Also that year, 433,462,717 kWh of natural gas was consumed (heating plus 5% of electricity generation).[12]

Energy Consumption Distribution

It is instructive to look at *where* we consume energy. According to the below table, in residential buildings, space heating and cooling, lighting, and water heating account for 66% of the total energy consumption. Therefore, it is in these areas we must focus conservation and efficiency efforts.

End Use	Residential		Commercial		All Buildings	
Space Heating	6.7	31%	2.5	14%	9.2	23%
Lighting	2.4	11%	4.6	26%	7.0	18%
Space Cooling	2.7	12%	2.3	13%	5.0	13%
Water Heating	2.7	12%	1.2	7%	3.9	10%
Refrigeration	1.6	8%	.7	4%	2.4	6%
Electronics	1.6	7%	1.1	6%	2.7	7%
Cooking	1.0	5%	0.4	2%	1.3	3%
Wet Clean	1.0	5%			1.0	3%
Ventilation			1.1	6%	1.1	3%
Computers	0.2	1%	0.6	3%	0.8	2%
Other	0.8	4%	2.4	13%	3.2	8%
Adjusted to SEDS*	1.0	5%	1.0	5%	2.0	5%
Total	21.8	100%	17.9	100%	39.7	100%

* State Energy Data System
Energy consumed is shown in quads and % of totals

US DOE *2007 Buildings Energy Data Book*

10.6: *US Buildings — Primary Energy Consumption Distribution*

Incentives

State and Utility Residential Renewable Energy and Efficiency Incentives

A wide array of residential renewable energy and efficiency incentives is available for homeowners and mobile home owners in the State of Indiana. These incentives range from property tax credit, to State grants and rebates, to private utility grants and rebates. Some of the incentives have expired; however, it may be helpful to know of their specifications as

[12] *Greenhouse Gas Inventory for the City of Bloomington, Indiana: Footprint, Projections, and Recommendations* City of Bloomington Environmental Commission & City of Bloomington Commission on Sustainability (May 2009) https://bloomington.in.gov/media/media/application/pdf/5047.pdf

some of them have recently been renewed to include similar provisions.[13] Information about specific programs can be found at the following websites:

- *Summary of Tax Credits for Homeowners* www.energystar.gov/index.cfm?c=products.pr_tax_credits#chart
- *Duke Energy's Smart Saver Program* http://www.duke-energy.com/indiana/savings/smart-saver.asp
- *Indiana Department of Energy Development's Grant Program* www.in.gov/oed/2376.htm
- *South Central Indiana REMC - Residential Geothermal and Air Source Heat Pump Rebate Program* http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IN13F&state=IN&CurrentPageID=1&RE=1&EE=1

City Incentives for Private Developers

The City of Bloomington recognizes sustainability as a key component of nurturing Bloomington's long-term environmental, economic and social integrity. The City's Unified Development Ordinance offers developers certain bonuses and allowances for buildings including features that help meet particular sustainability goals. These benefits are for developers, not individual residents. For a full description of the incentives, see section 20.05.049 of Bloomington's Unified Development Ordinance.

Sustainability Goals:

Energy and resource efficiency. Features that meet the energy and resource efficiency goal include green roofs, improved building performance rating, the use of non-polluting and/or renewable on-site energy sources, recycling and/or salvaging at least 50 percent of non-hazardous construction and demolition debris, or utilizing building materials and products sourced within a 500 mile radius.

Landscape and site design. Qualifying designs include the use of at least 25 percent permeable pavement, utilization of natural vegetation and other techniques to convey and filter storm water, employ systems to recycle at least 50 percent of greywater and storm water, retention of 90 percent of area tree canopy, and/or conservation of land with a slope of 12 percent or greater.

Public policy. Public policy commitments include incorporating mixed use development, providing 100 percent of the required long term bicycle parking spaces, decreasing automobile parking while increasing bicycle parking, and providing subsidized Bloomington Transit passes or a private van or shuttle.

Public Transportation. Qualifying projects are located near a transit stop, activity center, downtown, public school or park, or multiuse trail.

[13] A good resource to find incentives offered around the state as well as in every other state in the country to be potentially used for comparison is the Database of State Incentives for Renewables and Efficiency located at http://www.dsireusa.org.

Incentives are based on a three tiered system, with bonuses accorded to the number of sustainable practices included in the projects.

To date, however, no residential developments have taken advantage of these incentives.

Other City Incentives
The City has also taken progressive measures in fostering energy-efficient, affordable housing. A number of programs, plans, and incentives are currently in place to achieve these goals.

- **Evergreen Village.** Evergreen Village was developed by the City of Bloomington's Housing and Neighborhood Development Department and is a 12-unit subdivision which incorporates many environmentally-friendly designs. These plans include a storm water design system that incorporates a restored creek and naturalized rain gardens, a walking path constructed of pervious pavement and homes built using LEED standards and requirements to insure energy efficiency. Photovoltaic panels for solar energy production were donated by Duke Energy. Combined, these energy efficient designs coupled with the solar energy production make these green homes extremely cost-effective to run[14].

- **Furnace Insulation Program.** The City's Housing and Neighborhood Development Department has plans for a furnace insulation program for both owner-occupied and rental housing units. They also have plans for a program to assess draft in homes.

- **Loans to Developers.** Loans to developers for construction or rehabilitation of affordable owner-occupied homes;

- **Direct Assistance to Homebuyers.** Direct Assistance to Homeowners to purchase or rehabilitate homes.

- **South Central Community Action Program (CAP) Weatherization Program.** "The Weatherization Program is an energy efficiency program that assists low-income households reduce their energy consumption. Certified Weatherization technicians use advanced energy audits and diagnostic equipment to lower a household's energy bills, stay comfortable year round, and save money."[15]

- **Change a Light, Change the World.** In 2007, the City promoted the Change a Light, Change the World Campaign. This initiative encouraged City residents to conserve energy by switching incandescent light bulbs to compact fluorescent light bulbs.

- **Energy Efficiency Seminars.** The City of Bloomington Commission on Sustainability, along with EnergyPros and Earth Care host regular seminars , focusing on home construction and remodeling for energy conservation.

[14] See http://bloomington.in.gov/evergreen for more information
[15] http://www.sccap.monroe.in.us/

VULNERABILITIES

1. Potential for power grid failure in peak oil scenarios

As Clifford Wirth points out in *Peak Oil: Alternatives, Renewables, and Impacts*, "oil shortages and natural gas shortages will generate multiple crises for the nation."[16] Specifically, he predicts, "the power grid for most of North America will fail due to a lack of spare parts and maintenance for the 257,000 kilometers of electric power transmission lines, hundreds of thousands of pylons (which are transported on the highways), and hundreds of power generating plants and substations, as well as from shortages in the supply of coal, natural gas, or oil used in generating electric power. Power failures could also result from the residential use of electric stoves and space heaters when there are shortages of oil and natural gas for home heating. This would overload the power grid, causing its failure."[17] In the event of long-term grid failure, "homes across the U.S. will lack heating and air conditioning. Even if homes are retrofitted with wood stoves, local biomass is insufficient to provide for home heating, and it will not be possible to cut, split, and move wood in sufficient quantities."[18] Thus, failure of the electric power grid is one of the potential scenarios that must be considered in Peak Oil planning.[19]

2. Limitations of Green Building Programs

While several programs exist with the aim of encouraging efficiency in new construction, the impact of these programs has been limited. In general, programs tend to be too limited in their goals, and/or in the quantity of buildings affected. We need to do much more. The following observations are taken from Pat Murphy's critique of green building programs in *Plan C: Community Survival Strategies for Peak Oil and Climate Change.*

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[16] Wirth, Clifford [SOURCE?]
[17] Wirth, p. 46-47
[18] Wirth, p. 48
[19] From report from the UK Industry Task Force on Peak Oil & Energy Security, "The Oil Crunch: Securing the UK's Energy Future" (October 2008). http://peakoil.solarcentury.com/wp-content/uploads/2008/10/oil-report-final.pdf

Energy Star – *joint program of the U.S. EPA and the U.S. Department of Energy*[20]

To qualify as an Energy Star, homes must be at least 15% more energy efficient than homes built to 2004 International Residential Code (IRC) requirements. An objective this low does not approach the scale of change needed.

LEED -- *Leadership in Energy and Environmental Design, est. in 1993*

From 2000 to mid 2005, a total of 1,538 buildings were LEED certified. This is insignificant compared with total of approximately 5 million commercial buildings and 83 million residential buildings in the US. In addition, many of the LEED features are not relevant to a building's operating energy use: for instance, in the LEED rating system a bicycle rack earns as many points as 5% of the building's energy comes from renewable sources. While LEED has had an impact, it is a very small start and not necessarily focused on cutting energy consumption.[21]

Zero Energy -- *US Dept of Energy established this program in 2002*.[22]

Zero Energy Houses (ZEH) have an average of 32% energy savings from energy efficiency and 19% savings from the PV panels for a total of 51%. This is an impressive reduction, but the term Zero Energy is a misstatement of what has been achieved.[23]

Building America – *industry-driven research program, sponsored by the U.S. DOE*

This program was designed to accelerate the development and adoption of advanced building energy technologies in new and existing homes.[24]

The goals of this research are to:

- Produce homes on a community scale that use on average 40% to 100% less source energy
- Integrate onsite power systems leading to zero energy homes, that produce as much energy as they use, by 2020
- Improve indoor air quality and comfort
- Help home builders reduce construction time and waste
- Implement innovative energy- and material-saving technologies
- Improve builder profitability
- Provide new product opportunities to manufacturers and suppliers
- Dramatically increase the energy efficiency of existing homes.

About 40,000 Building America homes have been built to date, compared with 113 million households living in 83 million residential buildings. Many of the so-called "green" efforts are applied to large homes, so the efficiencies gained via new technologies are lost to the inherent inefficiencies of size.

[20] http://www.energystar.gov/index.cfm?c=about.ab_index
[21] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 153.
[22] http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10360
[23] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 153.
[24] http://www1.eere.energy.gov/buildings/building_america/about.html

Passive Solar -- *Grassroots movement in US during energy crisis in the 1970s.*
About 180,000 passive solar houses built during the energy crisis in the 1070s. These typically use about 20% of the heat required by conventional homes[25] Another 70,000 have been built since then, resulting in a total of approximately 250,000 passive solar homes (about 1/3 of 1% of the total of 83 million residential buildings in the US).

3. Inefficiencies due to low occupancy of large spaces

Like most Americans, Monroe County residents tend to live in large spaces with few occupants relative to how people live or have lived in other places and times. As fuel becomes more scarce and electricity prices rise, it will become increasingly difficult to heat and cool these large spaces; many families will likely face tough choices such as downsizing to a more moderately-sized space, doubling up households, closing off unused rooms, and/or remodeling underutilized areas to create living space for additional household members who can contribute to the cost of utilities and maintenance.

4. Lack of incentive for Landlords to make rental units energy efficient

While there are some conscientious landlords who seek to increase the energy efficiency of their rental units for the sake of environmental concerns or the well-being of their tenants, there is rarely a financial incentive for a landlord to do so. In fact, a condition exists that is known as "Split incentives": landlords pay for upgrades to more efficient appliances and better insulation, but tenants reap the financial and comfort benefits. Renters, of course, usually have no long-term commitment to a property so investing in upgrades rarely makes financial sense for them either. Since the number of rental units in Bloomington and Monroe County is so large, this problem is likely to be significant in the face of peak oil.

5. Restrictions from homeowner associations

Many residents are subject not only to state and local laws regarding their property, but also the rules set by homeowner associations. "Twenty percent of Americans now live in homes subject to rules set by homeowner associations, or HOAs. These

[25] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 154.

private imitation governments have sweeping powers to dictate almost any aspect of a member's property, from the size of the residence down to changes in trim color and the placement of a basketball hoop.[26]

In Bloomington, there are several HOAs with rules against clotheslines and other energy saving devices. Whether or not these rules are enforced, their existence perpetuates a stigma around practices that ought to be encouraged.

6. Difficulty in changing habits

Preparing for oil scarcity will take a great deal of work. However it is not only time and resources that will be required; people will likely also need to change some aspects of their lifestyles. As Murphy points out, "…One can see both the depth and breath of possible reductions in building energy use. However, one also sees how difficult it is to make substantial changes. The difficulties are not merely technical, like changing standard construction practices. They are also cultural, including resistance to giving up our values of convenience, comfort, style and guaranteed economic payoff."[27]

A significant portion of the population is not well informed about peak oil and the energy uncertainty that will likely result. It will likely be difficult to persuade people to take action if they are unconvinced of the coming crisis. Even those who are aware may be unwilling to make changes of the magnitude required. And finally, even those who are aware and willing to act may find it difficult to sustain lifestyle practices that differ substantially from what they've known to be "normal" their entire lives.

7. Lack of retrofitting expertise in community

If the residents of Bloomington and Monroe County were persuaded to make the sorts of deep changes in their homes and habits as seem to be necessary for survival in a post-

[26] http://www.landinstitute.org/vnews/display.v/ART/2008/08/11/48a0b3c650e26)
[27] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 156.

petroleum world, it is questionable whether there are enough people with the knowledge and skills to help us figure out what to do. Many services are currently offered in this area, such as home energy audits, site assessments for renewable energy, landscaping design, and basic home improvements. A list of local resources can be found at http://bloomington.in.gov/green-building-local-resources. However, once a homeowner has completed the basics of sealing air leaks, insulating, and replacing windows, there are few who know how to assess a particular site and advise how to take it to the next level. *Should I install a south-facing window? Build a water storage tank? Add thickness to the walls? Plant a shade tree?*

MITIGATION GOALS & STRATEGIES

These need to be classified re: temporal scope

1. Conserve Energy

The first step in reducing vulnerability to power grid failure is to conserve. It's estimated that 50% of electricity use in the US is simply wasted; we can make huge improvements merely by identifying the points of waste and eliminating them.[28] As Greg Pahl observes:

> conservation is the least expensive strategy we have available and the least harmful to the environment. It can be used to reduce our consumption of a wide range of resources, including, but not limited to, fossil fuels, electricity, and water. … These reductions can be achieved through a combination of initiatives, including the use of energy-efficient building materials, appliances, and other technologies, coupled with imaginative thinking about living better with less.[29]

Tips for energy conservation are widely-available on the internet and include those offered by the City's Environmental Commission in its Bloomington Environmental Quality Indicators Report (BEQI Report) *Energy-Saving Tips*.[30] As the typical household spends $1,900 on utilities[31], BEQI offers that residents can reduce energy costs by 10-50% by implementing relatively simple energy-savings measures. (Please see the chapter on *What Can You Do: Opportunities for Citizen Action*.)

2. The City's Team Process should explore the possibilities for municipal power generation.

As of 2008, there were 72 cities in Indiana which had municipally-generated power utilities. The Indiana Municipal Electric Association lists those communities in Indiana which own and/or operate their own utilities[32].

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[28] Grant Smith, Executive Director of Citizens Action Coalition, personal communication, 11/15/08

[29] The Citizen-Powered Energy Handbook: Community Solutions to a Global Crisis, p. 29.

[30] http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

[31] http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

[32] See http://www.imea.com for more information

3. Community Energy Production

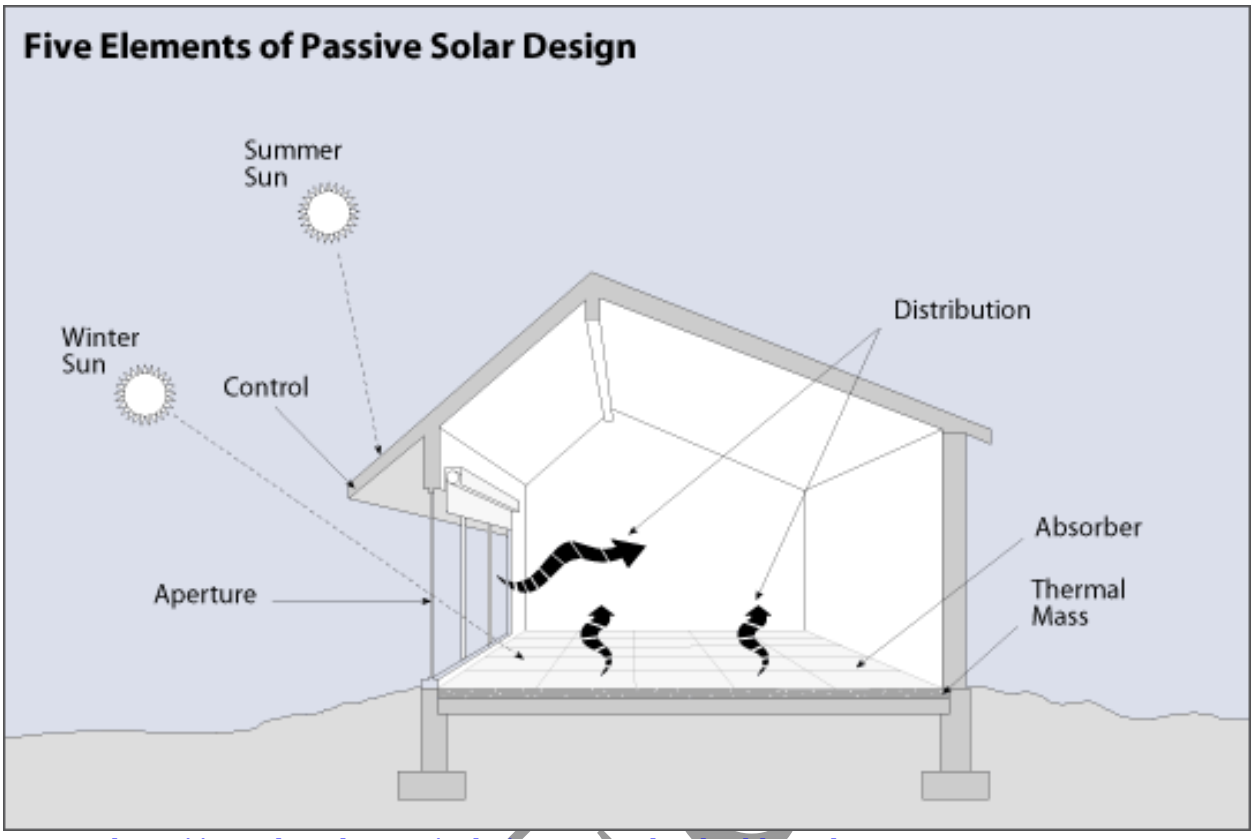
In response to a measure passed by the citizens of Berkeley, the Berkeley City Council has enacted a plan in which homeowners can apply for a municipal loan of up to $22,000 to help pay for the upfront costs of installing a new solar system.
http://solar.calfinder.com/blog/news/berkeley-finalizes-solar-lending-program/

Some communities are literally buying into community energy, or the development of clean energies with substantial community involvement and ownership.
http://www.nwcommunityenergy.org/

4. Effective Green Building Programs

New construction should feature significantly increased efficiency, and smaller size homes. Some examples of the type of construction we should be looking for include Passive Houses, High-performance Buildings, and possibly Laneway Houses or Micro Houses. Passive Houses[33] refers to a Northern European concept which uses the passive solar concept as a starting point. In addition to being oriented properly to take advantage of the sun, Passive Houses are well-insulated and feature an airtight building envelop. The walls are 19-inches thick, compared to the standard 3.5-inch thickness of typical US homes. These houses are built with extremely high performance objectives: to reduce energy use 90% in new construction and 80% in existing buildings[34]

[33] http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10250
[34] p. 155

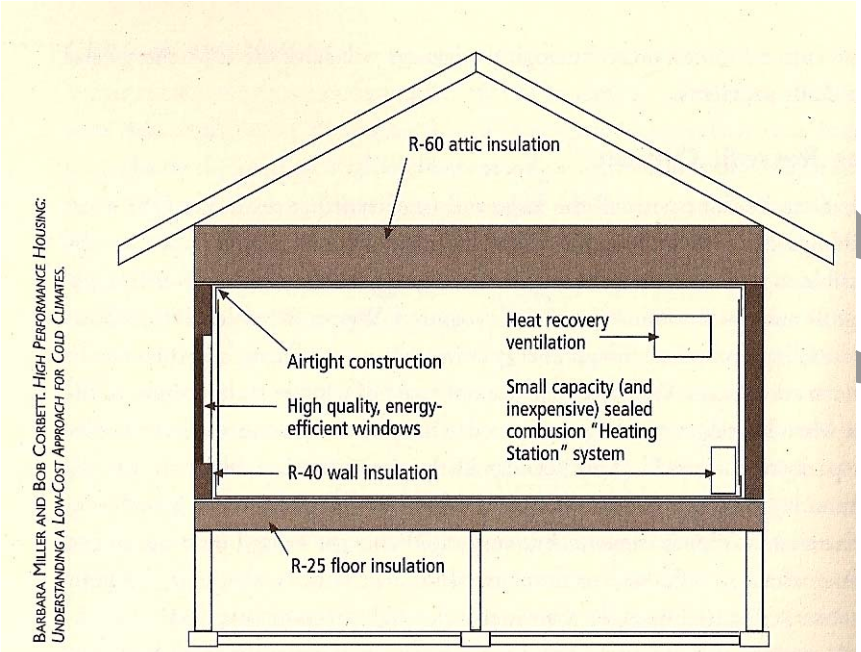


Source: http://en.wikipedia.org/wiki/Passive_solar_building_design

A passive solar house is designed to make use of the sun's energy for heat and light, but unlike active solar heating systems, "passive solar design doesn't involve the use of mechanical and electrical devices, such as pumps, fans, or electrical controls to move the solar heat."[35]

[35] http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10250

Passive houses take the concept even further, adding building design features as described above and as illustrated below:



10. 8: *House Section Showing Thick Shell and Heating System in Conditioned Space*

High Performance Buildings[36] are being developed by the Building Technology Center (BTC), which built 5 small high-performance homes in Tennessee with Habitat for Humanity. These homes feature thick Structural Insulated Panels (SIPS), high R-values (R-40 vs. R-11), and very tight building envelopes. BTC has now begun evaluating ways to retrofit existing homes.

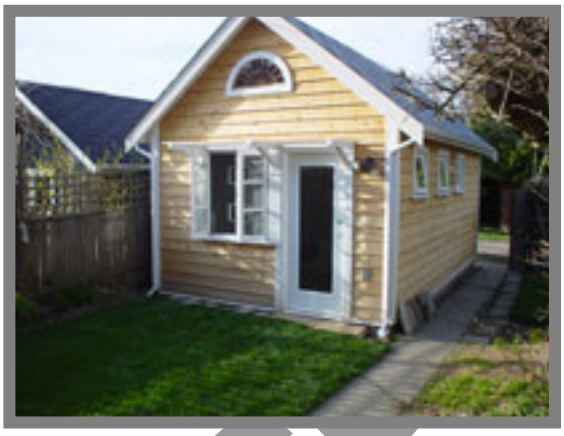
[36] http://www.ornl.gov/sci/btc/index.shtml

Micro houses[37] are, as the name implies, extremely small houses, ranging in size from 50 square feet to 500 square feet. While such houses might not be suited for Bloomington, it may be useful to consider the extreme – how much space does one really need? Houses in Bloomington could be constructed with as little as 120 square feet (11 square meters) of gross floor area as stipulated by the Monroe County building code. Most people probably find these types of housing options unthinkable, but in the future as energy prices rise these ideas may become more palatable.

The Loftcube, a microhouse designed to be placed on the roof of an existing building

Laneway houses,[38] described as "a small home in the back yard or, rather, in the space typically occupied by a double garage, typically 60 to 70 square metres." have been approved for use in Vancover, Canada as a solution to the shortage of building space there. The advantage is that these houses tuck into alleys, adding density while not appearing to since they are not visible from the road.

[37] http://www.buildinghomegarden.com/micro-homes.html
[38] http://www.straight.com/article-102875/laneway-houses-prove-smaller-can-be-better



In Bloomington, there has been opposition to accessory dwelling units (ADUs or "Granny Flats") due to the potential for crowding too many students into an otherwise quiet, family-oriented area.[39] An ADU is a self-contained apartment in an owner occupied single-family home/ lot that is either attached to the principal dwelling or in a separate structure on the same property. While some residents have concerns about students inhabiting such structures, ADUs have been shown to increase the community's supply of affordable housing and enhance the social stability and mix of neighborhoods with little or no negative impact on the physical character of the neighborhood. They effectively improve the affordability of housing for both homeowners and renters at all stages in their lives. ADUs also help to maximize use of existing public infrastructure and services and reduce the pressure on open space and farmlands from sprawling development.

However, there are over 50,000 existing residential structures in Bloomington and Monroe County, which would obviously not be affected by any new standards for new construction. For these existing structures, Murphy recommends the following: "Retrofit all buildings to reduce energy consumption: make the buildings as small as possible, make its envelope as thick as possible and make it as airtight as possible, with all furnaces and heating ductwork placed within the conditioned space.[40] Although every building is different in its needs, priorities, and potential, generally any retrofitting efforts should address the following areas: lighting, infiltration (leaks), windows, the building envelope, furnaces, attached solar spaces (i.e. greenhouses or sunrooms), and appliances.

5. Establish an Alternative Technology Advisory Committee.

[39] Herald Times, May 5, 2009, p. A6.
[40] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 157.

Since many ideas for energy efficiency will involve uncommon techniques or materials, it may be helpful to follow the City of Portland's lead in establishing an Alternative Technology Advisory Committee. This Committee evaluates and potentially eases the permitting process when requests are made for structures using innovative designs and construction methods. More information can be found at http://www.portlandonline.com/bds/index.cfm?c=48661.

6. Expertise in the community

With the current economic conditions unfavorable to home construction, there are likely to be many people with knowledge of buildings who might be interested in training to become home performance specialists. This sort of training takes place in weeklong intensive courses. It may be possible to provide scholarships to a training program, and requiring in return a certain number of free or reduced-rate home assessments for low-income residents and/or non-profit organizations, once certified. Home assessment training programs typically cost $1,200 - $2,500; there is a program in Indianapolis called Energy Efficient Homes Midwest (EEHM)[41], and one in North Carolina called Southface.[42] And another one called Building Performance Institute (BPI).[43]

7. Increase number of occupants per structure

To address the problem of low occupancy per square foot of housing, some people will choose to double up households[44] or form housing co-ops. The City should ensure that

[41] *See* Energy Efficient Homes Midwest, http://www.eehmidwest.com/Energy_Efficient_Homes_Midwest/Home.html.

[42] *See further*, Southface , http://www.southface.org/web/programs&events/courses&training/sf_courses-trainings.htm.

[43] *See* Building Performance Institute, Inc., http://www.bpi.org/content/home/index.php for more information.

[44] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 157.

there are no legal barriers to these sorts of actions; specifically, the City may wish to re-think its prohibition against 4 unrelated adults permitted in a rental property.[45]

8. Help Promote Efficiency Programs

- **Energy Efficient Mortgages**

The City should work with local banks to promote Energy Efficient and Energy Improvement Mortgages – the former is a is a mortgage that credits a home's energy efficiency in the mortgage itself, while the latter allows borrowers to include the cost of energy-efficiency improvements to an existing home in the mortgage without increasing the down payment. EIMs allow the borrower to use the money saved in utility bills to finance energy improvements.
http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.energy_efficient_mortgage

- **Cash Incentives**

Work with the State and federal governments to explore and promote cash incentives for the installation of solar panels on homes.

9. Incentives for landlords & renters

A number of local governments have implemented programs to either provide re-imbursements to landlords who weatherize their rental units or allow tenants to allot a portion of their rent to efficiency improvements. Various locales have developed programs that provide incentives for landlords to upgrade their properties for energy efficiency. Some examples are described below:

a. Minnesota - Rental Energy Loan Fund

The Rental Energy Loan Fund provides financial assistance to owners of residential rental properties to increase the energy efficiency of their buildings. It is not restricted to low-income owners, and covers a wide range of efficiency improvements for a property. Borrowers must have at least one-third interest in the property, or be purchasing it through a mortgage or contract for deed. The property must contain at least one rental dwelling unit and have been built prior to May 1, 1989.

The maximum loan under this program is $5,000 and the maximum term is 5 years. The interest rate on all loans is 4.0% and there are no penalties for prepayment. On-site building analysis as well as prioritization, decision-

[45] Bloomington Municipal Code, Title 16

making, and submission assistance is also provided. The fund is run by the Center for Energy and Environment's Financial Resources, and is sponsored by the Minnesota Department of Commerce.[46]

b. The New York Energy $mart Multifamily Performance Program

The New York Energy $mart Multifamily Performance Program harnesses the latest in building science technology and applies it specifically to a building's design and daily operation. Using a partner network, made up of engineers, energy consultants, and other industry professionals, the Multifamily Performance Program uses a customized approach to address the specific energy and operational needs of buildings.

In the Existing Buildings Component eligible buildings are required to benchmark their energy performance compared to a set of similar buildings. Depending on their relative rank, they are assigned a performance target to achieve. Implementation of an Energy Reduction Plan and confirmation of achievement of the target make the buildings eligible for incentives.

Participation in the Multifamily Performance Program is intended to improve the value of the building, provide tenants with a comfortable and affordable living environment, and save thousands on annual energy costs. [47]

c. Chicago – "Repair and Deduct" Program

The "Repair and Deduct" program allows tenants to deduct half of one month's rent annually to spend on improvements of their choice.[48]

[46] Center for Energy and the Environment, http://www.mncee.org/programs_residential/rental_rehab_financing/rental_energy_loan_fund/index.php

[47] New York State Energy Research and Development Authorityhttp://getenergysmart.org/MultiFamilyHomes/ExistingBuilding/BuildingOwner.aspx

[48] Chicago Residential Landlord and Tenant Ordinance, 5-12-110(c); *See also*, Chicago Metropolitan Tenants Organization, Chicago Tenants Rights Pamphlets (English #2 of 3); http://www.tenant.net/Other_Areas/Illinois/mto/english2.html#Rent%20Withholding%20%20and%20Repair%20and%20Deduct

10. Educating and Motivating People

As Pat Murphy points out, "Changing habits is as important as changing infrastructure."[49] He goes on to specify what some of those changed habits might look like: "The world functioned without air conditioning for thousands of years, and it may be necessary to abandon it. Consider eliminating some appliances and doing the work by hand. …Keeping water hot day and night may not be viable in the future. Washing clothes in cold water should become the norm. Hanging laundry outside on sunny days or on an inside rack when it rains, as they do in Europe, makes good sense. Cooking with pressure cookers saves more than half the cooking energy. Canning and drying of food can replace freezing. There are may other personal measures we can take to reduce energy use. They may be uncomfortable and inconvenient until we adjust, but they are necessary to reduce energy consumption to a sustainable level and stop global warming."[50]

Here are several strategies that may be useful in helping people understand the need to make changes and learn how to do them.

Reading/Discussion

A good way for people to become familiar with the topic of peak oil is to read and discuss with others. It might be worth nominating a book for Bloomington's program, One Book One Bloomington to help increase public awareness of the magnitude of the problem we face and wise courses of action.

Existing book clubs could also be encouraged to choose one title related to peak oil, and new reading groups could be encouraged specifically to study this issue. Perhaps the Monroe County Public Library, and/or local bookstores, might help promote the issue and the books.

"Efficiency Pioneers" Program

[49] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 162-3.
[50] Murphy, Pat (2008). *Plan C Community Survival Strategies for Peak Oil and Climate Change*, p. 162-3.

While it may take some time before most people are convinced to take significant action, there are always some who grasp the urgency of a situation quickly and are ready to do what needs to be done. Efficiency Pioneers is one suggestion for making good use of the experiences of the "early adopters" to motivate and educate others.

The City would invite households to apply to be one of 100 "Efficiency Pioneers," who would be chosen based on their stated commitment to energy reduction and to sharing information with others. An effort would be made to ensure that the households varied by size, age, location, type of construction, and so on. These Efficiency Pioneers (EPs) would undergo a home energy audit subsidized by the City, in order to discover best ways to drastically reduce utility use. EP households would hold regular open-house or neighborhood events, showcasing what changes had been made, discussing issues, brainstorming solutions to similar problems in other houses, and so on. All changes would be documented in writing and photos; results would be disseminated on a website and also possibly in book form (proceeds could fund future projects). The program could be underwritten by area businesses (home assessors, lumber yards, building suppliers, architects, contractors), the City of Bloomington, utilities, and philanthropies. The intended effect would be that these 100 Efficiency Pioneers would model the retrofit process, results, and benefits; homeowners would commit to educating their friends and neighbors and promoting energy efficiency.

Conservation Competitions

Once the need for conservation is well established in the community, a friendly competition could be established for the lowest utility use (or the household where usage is most drastically reduced). This could become a competition among individual households, neighborhoods, dorms, schools, churches, and so on. Bloomington could even challenge a similar city, such as Lafayette, to lower its per capita energy usage.

Throughout the competition, educational opportunities would be provided: seminars and workshops, classes offered through People's University or Parks and Recreation, stories in the Herald-Times, webinars, programs on CATS, displays in the Library, film showings, book clubs and so on.

Winners could be awarded a solar panel or some other component of a renewable energy system, reinforcing the concept that renewable energy makes sense only after reducing energy use as much as possible.

This idea is based on a competition being planned by SIREN; perhaps the City could partner with SIREN in order to broaden the reach and effectiveness of the competition.

"Energy Savings Accounts"

Ideally, people would implement the easiest and least expensive conservation strategies first, and then apply the money saved toward more expensive projects. However, it is easy for money not spent on utility bills to be spent somewhere else, so that the larger projects always stay just out of reach. "Energy Savings Accounts" would circumvent that problem with the help of local banks.

Customers would set up an Energy Savings Account with their local bank. A baseline utility use would be established, along with a direct payment program. Each month, customers would pay their baseline utility rate to the bank, which would then pay the actual amount owed to the utilities. The difference, presumably saved by conservation and other changes, goes into the individual's Energy Savings Account, where it is saved for future home efficiency improvements, renewable energy projects, and so on. (If utility use increased, some provision would need to be in place for the customer to pay the additional amount.) Perhaps it would be possible to negotiate a special interest rate, or a matching funds program for those who participate.

Amend the Unified Development Ordinance to allow Accessory Dwelling Units.
As there is still considerable community concern regarding the siting of ADUs in residential neighborhoods, the City should engage in greater public awareness regarding the benefits of ADUs. Within the next five years, the City should amend its Unified Development Ordinance to allow accessory dwelling units.

Establish a plan for retrofitting 5% of existing City housing stock per year.

Establish efficiency performance standards for housing and retrodfits that receive local assistance.

Set up a fund for efficiency improvements.

Municipal Services

[photos to be added]

Identifying and mitigating community vulnerabilities is probably one of the more important – if often unwritten – expectations we have of our local governments.[1]
--- Daniel Lerch, Post Carbon Cities

Three challenges are converging to shape the way City Hall carries out its business of protecting the health, safety and welfare of the people of Bloomington: weaning the community from its dependence on oil, climate change and the resultant uncertainties of both.[2] These challenges present us with an unprecedented moment when it comes to the way the City carries out it duties. But it also provides us with opportunity. Peak oil requires that the City take a *systemic* look at its consumption of liquid fuels and electricity and match each dependency with greater conservation, greater efficiency and new, renewable energy sources.

To be sure, the City has already implemented some very forwarding-thinking steps to reduce our reliance on petroleum:

- The Mayor recently announced his *Sustainability City Initiative* whose mission is to "to promote economic vitality while improving the human condition and preserving the community character of our City. It operates on the principle that Bloomington can achieve environmental health, economic prosperity and social justice through sustainable development;"[3]
- in 2005, the City shifted to a biodiesel-only diesel purchasing policy;
- in 2007, the City engaged in an energy audit of City Hall, the result of which was a series of HVAC upgrades resulting in monthly reductions in energy consumption by 10-15% and yielding a 32% savings – or $45,634.66 – within its first year;
- the City has established an internal team to examine vehicle acquisition, energy consumption and purchasing policies;
- the Office of the Mayor and City of Bloomington Commission on Sustainability continue to actively promote the "Change a Light, Change the World" program which encourages citizens to replace incandescent light bulbs with compact fluorescents (CFLS). By partnering with the local grocery cooperative Bloomingfoods, a

[1] Lerch, Daniel. *Post Carbon Cities: Planning for Energy and Climate Uncertainty. A Guidebook on Peak Oil and Global Warming for Local Governments*, p.4. Post Carbon Press. 2007
[2] *Ibid.* at v.
[3] http://bloomington.in.gov/documents/viewDocument.php?document_id=2121

conservative estimate on the number of CFLs distributed to the local community is about 25,000 bulbs with a total estimated savings of $1.1 million over the life of these bulbs;

- all City traffic signals have been retrofitted with LED technology;
- the City recently passed a Green Building Ordinance calling for all occupiable City structures be brought up to LEED Silver standards, provided they meet a payback test;
- Low-flow, sensored faucets and fixtures have been installed at most occupied City facilities;
- The City has reduced its mowing frequency from once every 7-10 days to twice per month and is experimenting with "no-grow" or "low-mow" grasses to reduce mowing and well as instituting a number of naturalized lawn projects on City property;
- The City's Environmental Commission and Sustainability Commission work very hard to foster policies that nurture environmental, social and economic health and have issued critical reports on the City's greenhouse gas emissions, environmental quality indicators, sustainability indicators and greenspace; [4]
- The City has been named *Tree City USA* for 24 consecutive years. The City nurtures more than 18,000 trees in the urban forest and thousands more in the City's parks.

These are laudable efforts. However, to mitigate the effects of peak oil, we need to do *far* more. Responding to peak oil, climate change and energy uncertainty requires an across-the-board dedicated shift to reduced energy consumption and greater local production.

In thinking through what the advent of peak oil means for the operation of government, it is important to keep in mind that the Task Force is *not* anticipating reduced or somehow compromised City services. To the contrary. Instead, the Task Force urges us to think through ways the City will fulfill its role of protecting community well-being by being smart and creative about our energy consumption and production.

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[4] *Greenhouse Gas Inventory for the City of Bloomington, Indiana: Footprint, Projections, and Recommendations* City of Bloomington Environmental Commission & City of Bloomington Commission on Sustainability (May 2009) https://bloomington.in.gov/media/media/application/pdf/5047.pdf; *2006 Bloomington Environmental Quality Indicator (BEQI) Report, Environmental Commission* http://bloomington.in.gov/beqi/; *Bloomington Sustainability Assessment Report,* Bloomington Commission on Sustainability (2008) http://bloomington.in.gov/media/media/application/pdf/4660.pdf; *Greenspace Trends in Bloomington, Indiana 1993-2007, City of Bloomington Environmental Commission* http://bloomington.in.gov/egov/docs/1196711026_93260.pdf.

VULNERABILITIES

Among many services the City provides, among the most critical are: the provision of potable water, a sanitary sewer system, police and fire protection and waste removal. All of these municipal roles are energy intensive and expensive. A decline in cheap oil exposes the following vulnerabilities:

1. **Direct Increase in Costs & Price Volatility**
   As the price of oil both becomes more volatile and more expensive, so will the price of electricity, natural gas and other energy resources. It will become more expensive for the City to: treat and pump drinking water; treat its wastewater; provide fuel for law enforcement and fire protection; heat and cool municipal buildings and pick up trash and recycling.

2. **Indirect Increase in Costs & Price Volatility**
   Because energy is embedded in just about everything we do and purchase, it is expected that the City will also experience an increase in cost of just about anything that relies on energy to produce and transport it. Notably, the City will experience an increase in costs of products in which oil and oil by-products are used: asphalt, plastics and chemicals. Perhaps one of the most severe indirect impacts will be an increase in the cost of food as the cost of production and transportation increases.

3. **Ever-increasing Energy Shortages and Outages**
   As the supply of cheap oil continues to drop, we can expect greater oil scarcity (with its attendant hoarding and likely inequitable distribution) and periods of blackouts and brownouts (when power is reduced). We must prepare the City's storage, back-up generation and primary energy generation systems for this shift.

These exposures to a decline in cheap oil call for a plan that seeks to build both resiliency and redundancy into the City infrastructure. The following sketches out the City vulnerabilities as it relates to: municipal water, wastewater, trash, law enforcement, fire protection, departmental operations and maps out ideas for an "energy descent" that meets the needs of the community efficiently and fairly. As this *Report* enters the community's conversation, it is assumed -- and expected – that both the City and its residents will have even more ideas about how to plan for peak oil. The intent of this chapter is to problematize the issue and offer some suggestions in the interest of getting the conversation started.

THIRSTY WATER: THE WATER SUPPLY

Since the first cisterns were built on the Courthouse Square in 1860, the City has experienced water shortages caused by weather, lack of natural water supplies and storage imbalances. However, the present conditions pose another vulnerability: the grid. Water treatment requires electricity (a functioning grid) or back-up electricity generation using diesel fuel. Without a steady supply of electricity of diesel fuel, the City will experience a significant reduction or suspension of water treatment services.

The City's water supply is sourced from Lake Monroe. Lake Monroe is located approximately seven miles southeast of Bloomington and has been in operation since 1966. Lake Monroe has been the City's sole source of treated water since the Griffy Lake Water Treatment Plant was retired from service in 1996. The City of Bloomington Utilities department (CBU) provisions for the treatment and distribution of the community's water supply.

Lake Monroe was constructed and is owned by the U.S. Army Corps of Engineers (USACE) and is managed by the Indiana Department of Natural Resources (IDNR). The lake is owned by the USACE, and is used for water supply, flood control and recreation. Between the silt pool elevation of 515 feet (ft) mean sea level (msl) and the flood control pool elevation of 538 ft msl, the reservoir will provide a total storage capacity of 159,900 acre feet.[5] The City purchases raw water under an existing purchase agreement with IDNR for the Monroe Water Treatment Plant (WTP) for $33.00/million gallons. The City pumps an average of 14 million gallons of water per day. Its agreement with IDNR allows for the City to purchase water up to a limit of an annual average daily withdrawl of 24 million gallons per day.[6] The City has frequently come close to this maximum withdrawl[7] and has recognized potential shortcomings in treatment capacity since 1998.

[5] The lake has a drainage area of 432 square miles, a spillway elevation of 556.0 ft, and a maximum water elevation of 556.2 ft msl recorded on May 15, 2002.

[6] *Water Supply Evaluation,* Black & Veatch, p. 4-1 (2007).

[7] In 2006, the City received an "Early Warning Order" from the Indiana Department of Environmental Management that the City's highest daily pumpage, as reported over the previous two years, exceeds 90 percent of the system's 24 million gallons-per-day capacity. The Order advised that a failure to implement any proposed improvements "is cause for imposing a connection ban on your system."

Treatment of water from Lake Monroe includes rapid mixing, sedimentation, filtration, and disinfection. The facility is connected to the Bloomington water distribution system by a single 36-inch transmission main that conveys treated water approximately eight miles from the plant to the City. As stated in a commissioned evaluation of the City's water supply, "Any interruption in service, either at the water treatment plant, along the transmission main, or with any of the critical ancillary water treatment facilities, for more than a few hours could result in a significant reduction or total suspension of water service to CBU's customers."[8]

Currently, the City maintains two back-up diesel generators: one at the Low Service Pump Station – 800 KW with a 1,000 cap and one at the main treatment plant – 1,000 KW with a 1,000 gallon cap. Both of these generators are designed to run 17 hours on a full fuel tank, or 57.8 gallons per hour under full-load conditions.

The City currently maintains seven active water storage tanks and is requesting an additional tank. However, with seven active tanks, the City has approximately eight hours of capacity. When combined with the 17 hours of power provided via generators, the City has something like 25 hours of water service in the event of a catastrophic grid failure and/or fuel shortage.

VULNERABILITIES

The treatment and pumping of Bloomington's water is energetically expensive and produces a large quantity of Bloomington's greenhouse gas emissions. The treatment and pumping of water requires approximately one million kilowatt hours per month. The power to pump and treat this water is provided by Duke Energy at an average cost of almost $60,000 per month. [9]

[8] *Water Supply Evaluation,* Black & Veatch, p. ES-4 (2007).

[9] This energy supplied by Duke Power primarily from coal combustion plants. Because of combustion inefficiencies and transmission line losses, an estimated 6,600 short tons of coal per year are burned to generate the power to treat and pump water to Bloomington area residents, resulting in carbon dioxide releases to the atmosphere of about 19,000 tons, or 1 lb. of CO2 for each 134 gallons of water treated and delivered. Ironically, mercury released by the combustion of coal is a significant pollutant of all Indiana waterways so that the act of pumping drinking water from Lake Monroe also contaminates it. About 300 grams of mercury per year are released as a result of electricity generation to pump and treat Bloomington's water. This is enough mercury to make four millions pounds of fish unsafe to eat regularly.

That our current electrical grid is both aging and overloaded is well documented.[10] Indeed, the U.S. National Power Grid received a "D+" by the American Society of Civil Engineers in 2009.[11] Peak oil has immediate implications for the grid. First, in Indiana, the grid runs primarily on coal and coal relies heavily on liquid fuels for its extractions. Secondly, the grid will be even more taxed as we start powering our cars, buses and trains with electricity rather than oil and start heating our homes, offices, businesses, etc. with electricity rather than natural gas.[12] The grid might also experience more stress if people perceive electricity as bearing a significantly smaller carbon footprint than petroleum. However, fully ninety-five percent of Indiana's electricity is generated by coal, while 5% is generated by natural gas.[13] The finite supply of Indiana's coal is discussed elsewhere in this report (*See* Appendix I).

This means two things. First, as oil becomes more costly, it is reasonable to anticipate that individuals and institutions will power their vehicles and heat their homes and other buildings with electricity. This will put increased strain on an aging grid and will trigger more frequent grid failure. Therefore, we must think through ways to provide water in light of a compromised grid. Secondly, we know that as the demand for electricity rises, so too will its price. It is only sound fiscal policy that we address ways in which we might lower the cost of treating water. Given the City's commitment to reducing greenhouse gas emissions, any prudent remedy will not call for increased carbon emission.[14]

Lastly, Bloomingtonians use a lot of water. Subtracting out the IU on-campus housing population, Bloomington residents use an average of 85 gallons per capita per day.[15] [Is this total residential usage/person/day? Do we have local figures on how much of this 85 g figure is devoted to indoor use and how much is devoted to outdoor use?] In the U.S., typical

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[10] Cite to Matt Simmons article.

[11] *2009 Report Card for America's Infrastructure*, American Society of Civil Engineers. http://www.infrastructurereportcard.org/sites/default/files/RC2009_full_report.pdf

[12] See this *Report's* Introduction for a discussion of the peaking of natural gas.

[13] Energy Information Administration. State Electricity Profile: Indiana http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=IN.

[14] Mayor Kruzan has signed the Mayor's Climate Protection Agreement and the City Council has endorsed ratification of the Kyoto Protocol. *See* http://bloomington.in.gov/media/media/application/pdf/927.pdf

[15] *Water Supply*, note 6 above.

domestic indoor per capita water use is 80-100 gallons per capita per day[16]; yet outdoor water use can increase domestic up to 165 gallons per day.[17] Meanwhile, the average (western, industrialized) European uses an average of 53 gallons per day.[18]

[16]U.S Environmental Protection Agency, National Performance Track, "Water" http://www.epa.gov/performancetrack/tools/wateruse.htm

[17] *Managing Wet Weather with Green Infrastructure: Municipal Handbook – Rainwater Harvesting Policies*, Kloss, EPA-833-F-08-010 (December 2008).

[18] Water Aid 2006.

MITIGATION GOALS & STRATEGIES

A commitment to smart water management involves comprehensive planning to meet the long-term needs of the community joined with greater efficiencies and a strong conservation ethic.

SHORT-TERM STRATEGIES (1-5 years)

1. Hybrid Energy Generation

The Monroe Water Treatment plant enjoys some flexibility to scale down production by using Adjustable Frequency Drive pumps to deliver a minimum of about 3.0 million gallons per day (about 12.5% of capacity). However, it does not have the capacity to run without power. Water production requires a continual input of power – the treatment plant cannot be completely shut down and then turned on again. To address this concern, we need a second layer of pumps of a smaller capacity that could use a single filter in the event of a power failure. These pumps should be powered by a combination of both solar energy and hydroelectricity from the Monroe Dam: solar power would call for less than an acre for locating solar cells and could be leveraged during the summer months and sunny winter months; hydroelectric power could be leveraged during the Indiana spring rains, when we've both substantive cloud cover but a great deal of untapped energy flowing over the dam. Cities such as Newark, New Jersey and Boulder, Colorado have recognized the importance of transitioning their water and wastewater treatment to solar power.

This hybrid configuration would provide 10-15% treatment capacity and would allow the Utilities to provide residents with water sufficient for drinking and cooking.[19] The City should explore getting this project shovel-ready as soon as possible.

2. Advocate a tiered pricing system whereby consumers pay a rate based on consumption.

The Mayor has expressed an interest in pursuing a tiered rate structure to encourage water conservation.[20] The proposal is currently under review by the Indiana Regulatory

[19] Cite to the Black & Veatch study – Can we get a copy of any written documentation here?

Commission.[21] Such rates would mean that the unit price of consumption would increase after household usage exceeds a predetermined basic monthly usage. While any such rate must be non-discriminatory (e.g, must not discriminate against larger families), linking price to use will go some distance in reducing demand – peak and otherwise. Indeed, in Athens-Clarke County, Georgia – on oft-cited college town comparable to Bloomington – rates are based on each customer's winter average. Officials in that community estimate to save approximately one million gallons of water per day in the summer when use is at its peak.[22]

3. Encourage Rainwater Capture

Outdoor water use can comprise 25% to 58% of overall domestic water demand.[23] Rainwater harvesting has significant potential to reduce stormwater runoff while conserving potable water. Rainwater capture offers a number of advantages:[24]

- provides an inexpensive supply of water;
- reduces stormwater runoff and pollution;
- reduces erosion in urban environment;
- provides water that needs little treatment for irrigation or non-potable indoor uses;
- helps reduce peak summer demands; and
- helps introduce demand management for drinking water systems.

The City can do much to encourage and increase rainwater capture for use on lawns and gardens. Following the lead of other communities, the City should:

- Provide rain barrels to community members at a reduced cost, much the way it did when it offered compost bins at a reduced rate (and in cooperation with the Center

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[20] *State of the City Address, 2009*.

[21] Indiana Code § 8-1.5-3-8 governs rates and charges for municipal utilities and requires that rates must be "nondiscriminatory, reasonable, and just." "Reasonable and just" charges are defined as paying for all of the necessary costs of the utility, including maintenance, operating charges, upkeep, repairs, depreciation, bond interest, and the costs of extensions and replacements.

[22] http://www.athensclarkecounty.com/documents/pdf/publicutilities/water_conservation_rates.pdf

[23] *Managing Wet Weather with Green Infrastructure: Municipal Handbook – Rainwater Harvesting Policies*, p.1, Kloss, EPA-833-F-08-010 (December 2008). http://www.epa.gov/npdes/pubs/gi_munichandbook_harvesting.pdf

[24] Texas Rainwater Harvesting Evaluation Committee, *Rainwater Harvesting Potential and Guidelines for Texas*, Report to the 80th Legislature, Texas Water Development Board, Austin, TX, November 2003.

for Sustainable Living). It is estimated that a 55 gallon rain barrel can save approximately 1,300 gallons of water in peak summer months;[25]
- Implement a rain barrel rebate program;[26]
- Require greywater and roofwater catchment as part of the City's Unified Development Ordinance (UDO). Currently, the UDO incentivizes the use of greywater, but does not require it.[27] The City might look to Tuscon, Arizona – the first city in the US to require rainwater harvesting for landscaping use. In Tuscon, effective June 1, 2010, 50% of a commercial property's irrigation water must be supplied from rainwater. In addition to cisterns, the regulations allow berms and contoured slopes to be used to direct rainwater to trees and landscaped areas;[28]
- Require that bio-swales and permeable paving be required for any new development; and
- The City should lead by example by installing cisterns and rain barrels to provide for its own landscaping needs.

4. Offer other efficiency incentives:

The City should implement incentives to encourage water conservation through:

- providing subsidies for low-flush toilets and low-flow shower heads, toilet displacement devices and faucet aerators;
- Rebates for energy-efficient appliances, such as washing machines; and
- Please refer to the *Sustenance* chapter for further household-based incentives.

5. Added Storage.

Expanding storage capacity may be prudent for limited-time emergencies and should be explored. However, this is mitigation for the short term, not one for the long emergency. As spelled out in a recent water supply evaluation commissioned by the City:

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[25] U.S. Environmental Protection Agency, *What is a Rain Barrel?* http://www.epa.gov/Region3/p2/what-is-rainbarrel.pdf

[26] For example, see the cistern rebate program offered by James, Virginia http://www.bewatersmart.org/RebatePrograms/rainbarrelrebateprogram/FAQ.html#rainbarrel

[27] §20.05.049, Bloomington Municipal Code. The incentives are summarized by the City's Environmental Commission:
- ***Energy and resource efficiency***. Features that meet the energy and resource efficiency goal include green roofs, improved building performance rating, the use of non-polluting and/or renewable on-site energy sources, recycling and/or salvaging at least 50 percent of non-hazardous construction and demolition debris, or utilizing building materials and products sourced within a 500 mile radius.
- ***Landscape and site design***. Qualifying designs include the use of at least 25 percent permeable pavement, utilization of natural vegetation and other techniques to convey and filter storm water, employ systems to recycle at least 50 percent of greywater and storm water, retention of 90 percent of area tree canopy, and/or conservation of land with a slope of 12 percent or greater.
- ***Public policy***. Public policy commitments include incorporating mixed use development, providing 100 percent of the required long term bicycle parking spaces, decreasing automobile parking while increasing bicycle parking, and providing subsidized Bloomington Transit passes or a private van or shuttle.
- ***Public Transportation***. Qualifying projects are located near a transit stop, activity center, downtown, public school or park, or multiuse trail. http://bloomington.in.gov/green-building-incentives

[28] http://www.ci.tucson.az.us/agdocs/20081014/oct14-08-564a.pdf

> During short-term maximum water use conditions, it may be possible to utilize additional storage in the distribution system. The implementation of additional storage within the distribution system should be carefully analyzed with distribution system operations and is not recommended for long periods of maximum water use. The use of additional storage may lead to water quality concerns within the distribution system under maximum and normal operating conditions. Additionally, the ability to replenish the distribution system storage would be limited by the existing treatment and pumping capacity and may not be available for effective use during long periods of maximum water use.[29]

6. Transition all back-up generators to renewable sources of energy, such as biomass.

As discussed earlier, both back-up generators for the City's water treatment are designed to run 17 hours on a full fuel tank of diesel. In the interest of redundancy, we should explore how these generators might be transitioned to renewable sources of energy. At minimum, the generators should be flex-fitted to run on biodiesel. Ideally, such generators could be run on biomass, such as wood.

7. The City should re-examine the "Summer Sewer Average"

With the "Summer Sewer Average," utilities customers' wastewater bills during the summer months are based on their pre-summer average water usage, rather than actual water usage. This practice only encourages discretionary watering in the summer – lawn watering, car washing, etc. While an end to this average would likely foster greater conservation, the City should explore whether, in light of anticipated increased urban gardening, ending this practice would be prudent.

8. Develop an Emergency Ration & Education Plan

From time-to-time, the Utilities department has been called upon to create contingency plans. To date, the department has not experienced an emergency with which it has not been able to sufficiently cope. However, complete grid failure presents a different picture. The department currently has "What to do if" emergency guides for each physical location, but

[29] *Water Supply Evaluation,* Black & Veatch, p. 4-1 (2007).s

they are limited to identifying hazards and suggesting notification and evacuation scenarios. They are not up to date. The Utilities department should develop a comprehensive, system-wide emergency ration and education plan to prepare for complete grid failure.

MEDIUM-TERM (5-15 years)

1. Explore the possibility of using smart meters to track water consumption.

A smart water meter would both identify consumption in more detail than a conventional meter and would communicate that information back via a network to CBU for monitoring a billing purposes. This would both give the consumer better feedback on use and cut out the need for staff to visit individual homes to read meters. Such technology has been successfully implemented in college communities such as Ann Arbor, Michigan[30] and was recently instituted throughout Britain.[31]

2. The City should aim at continuing to expand its alternative energy generation so that it derives 25% of its water treatment from alternative energy by 2025.

LONG-TERM (15+ years)

1. The City should strive to make its water treatment – both treatment and processing completely grid independent.

2. The City should work toward more neighborhood-based cistern options for potable water.

While potable water use is possible for harvested rainwater, the required on-site treatment and perceived public health concerns represent cultural hurdles. A long-term goal is to transition to more use of neighborhood cisterns.

3. Explore re-activating the Lake Griffy Treatment Facility.

The Lake Griffy Treatment Facility was decommissioned in 1996 and currently exists in emergency back-up capacity. In 2003, the City's Long Range Water Capital Plan (LRWCP examined the possibility of reviving Lake Lemon/Bean Blossom Creek and Griffy Lake as alternative sources. Subsequently, it has been determined that these sources should not be

[30] http://blog.tdworld.com/briefingroom/2009/03/25/city-of-ann-arbor-wins-metering-international-award-with-implementation-of-the-aclara-star-network-system/

[31] *Britain Announces Broad Smart-Metering Plan*, James Kanter, The New York Times, May 12, 2009 http://greeninc.blogs.nytimes.com/2009/05/12/britain-announces-broad-smart-meter-plan/?scp=4&sq=peak%20oil&st=cse

considered due to higher costs associated with capital improvement projects, water quality concerns, and concerns on sufficient yields from these sources.[32]

Lake Griffy is significantly closer to Bloomington residents (approximately 3.23 miles from the City center), than the at least eight miles water is pumped from Lake Monroe to the City. Given the proximity to the City and the need to build in more redundancy into a highly-centralized water treatment system, this option warrants re-examination.

[32] *Water Supply Evaluation*, Black and Veatch, p. 4-1 (2007).

WASTE DISPOSAL:
THE DETRITUS OF CONSUMPTION

Waste is a systemic, essential and productive aspect of our community. Yet, our ever-increasing consumption of goods and their facile disposal has led to a very energy-intensive waste disposal infrastructure. Re-thinking our consumption and disposal habits through a peak oil lens has the potential to lead to greater cost savings to the taxpayers, increased efficiencies and greater community resilience.

SOLID WASTE & RECYCLING

Trash inhabits an important, but invisible, cultural space in our community. It requires setting boundaries and setting margins, both physically and symbolically.[33] Out of sight, out of mind. At certain intervals – usually weekly – we put our garbage out by the curb and a truck takes it away. Yet, making trash "go away" by putting it on a truck is a fuel-intensive process.

A REVIEW OF THE CURRENT SITUATION

The City of Bloomington Sanitation Department collects residential solid waste, yard waste, and recyclable material from approximately 15,500 households within City limits. The City collects neither trash nor recyclables from residences of four or more units. Bloomington residents pay a $2.00 fee for each 35-gallon trash bag or container collected by the city, and a $1.00 per bag fee for yard waste. Curbside recycling, which began in 1991, is free of charge. Materials eligible for recycling in Bloomington and Monroe County include paper products, glass containers, steel cans, aluminum cans and plastic bottles.

The City also provisions for leaves and yard "waste." The City's Sanitation department picks up yard waste from early March to early January where it is taken to Good Earth, LLC for mulching. Both the City's Sanitation Department and Street Department provide leaf pick-up services. From early November to late December, residents are afforded three options to

[33] Mary Douglas, *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*, Routeledge, 1966.

dispose of their leaves.

- City Sanitation crews will collect yard waste every week on your scheduled trash day in the free leaf collection bags.
- Residents can drop leaves off at any of five collection sites.
- The Street Department provides a curbside leaf pick up on a regular basis Monday through Friday.

While the leaves collected by the City are taken to Good Earth, LLC for composting, the leaves collected by the Street department are taken to a decommissioned City wastewater plant contaminated by PCBs where the leaves are used for fill.

The City's Sanitation Department owns approximately 17 vehicles. In 2008, the Department consumed 1,584.84 gallons of unleaded and 24,475.79 gallons of diesel.
The Sanitation Department has gone to a condensed work week of four 10-hour work days and has cut its unleaded fuel costs by 37% while its diesel costs have remained largely unchanged, despite increasing fuel prices.

Until recently, much of the solid waste generated locally was taken to the Monroe County Landfill, which has operated by the Monroe County Solid Waste Management District. However, the Landfill suspended operations during the summer of 2004 after it erupted into flames, and has subsequently closed and is under contract to remain closed until 2024. At present, the majority of the City's solid waste is hauled to Sycamore Ridge Landfill, located in Pimento, IN (Vigo County), about 55 miles from Bloomington.

In 2007, 159,968 tons of solid waste was generated in Monroe County.[34] Based on US Census figures, Bloomington residents constitute about 56% of the Monroe County population. [35] Therefore, we might estimate that Bloomington residents generated about 89,582 tons of

[34]Indiana Department of Environmental Management, *2007 Solid Waste Facilities Report* http://www.in.gov/idem/files/solid_waste_far07.pdf

[35] Sources: US Census Bureau; Indiana Business Research Center

garbage in 2007.[36] The U.S. Environmental Protection Agency estimates that since 1960, the amount of waste each person generates has increased from 2.7 pounds per day to 4.62 pounds per day – from 985 pounds a year to 1,686 pounds per year.[37]

VULNERABILITIES

1. The collection of waste and recyclables are essentially trucking functions, wholly reliant on liquid fuel for operation.

While the City's Sanitation department has taken the prudent step toward reducing vehicle miles travelled and saving the taxpayers money by moving to a four-day work week, its functioning is still wholly dependent upon liquid fuels. Given a dramatic decline in cheap fuel, the department would have to reduce all collection services and possibly eliminate its appliance collection service and/or pass on the substantive increased costs to residents. This might result in some residents not paying for trash disposal and instead illegally dumping their garbage in undesirable places.

A fuel shortage might also result in an inability to pick up trash, resulting in illegal trash dumping and/or accumulation of trash at residences – both threats to public health.

2. The transport of our community waste 55 miles away is wholly dependent on the availability of liquid fuel.

In the absence of a local disposal site, the community would likely have to continue shipping its waste out of the community. Again, such costs would likely be passed on to residents and the afore-mentioned consequences are likely to obtain.

3. Yard trimmings and food waste unduly burden the City's waste collection operations.

[36] Note that this figure includes trash picked up by the City from residences with four or fewer unit and multi-family units serviced by private haulers and trash hauled from Indiana University.

[37] U.S. Environmental Protection Agency, Municipal Solid Waste in the United States: 2007 Facts and Figures, EPA530-R-08-010, p.134;Cf. Elizabeth Royte, *Garbage Land: On the Secret Trail of Trash*, p. 275 (2005).

The U.S. Environmental Protection Agency estimates that yard trimmings and food residuals together constitute 24 percent of the U.S. municipal solid waste stream.[38]

In 2008, the Sanitation Department collected __ truck loads of yard waste and __ truck loads of leaves (still waiting on data!). In 2008, the Street department collected 420 truck loads of leaves. As leaves are nutrient-rich and good for improving lawns and gardens, the City's provision of leaf-removal services is not only expensive and fuel intensive, but it discourages a change in thinking whereby more residents think of leaves as food for the soil, rather than "waste."

While the City has in place a program for picking up yard waste, it does not provision for compostable food residuals. That's a lot of waste to send to landfills when it could become useful and environmentally beneficial compost instead! [39] Not only does the collection and transport of such material consume a lot of waste, but such organic matter produces significant greenhouse gas emissions when landfilled.

MITIGATION GOALS & STRATEGIES

SHORT-TERM STRATEGIES (1-5 years)

1. Buy less stuff – especially non-local stuff.

According to the U.S. Environmental Protection Agency, "source reduction" is one of the most effective ways to waste disposal and handling costs, because it avoids the costs of recycling, municipal composting, landfilling, and combustion. Source reduction also conserves resources and reduces pollution, including greenhouse gases that contribute to global warming.[40]

[38] US Environmental Protection Agency. *Wastes - Resource Conservation - Reduce, Reuse, Recycle – Composting*. http://www.epa.gov/waste/conserve/rrr/composting/basic.htm
[39] *Ibid*.
[40] US Environmental Protection Agency. *Wastes - Resource Conservation - Reduce, Reuse, Recycle – Reduce and Reuse*. http://www.epa.gov/wastes/conserve/rrr/reduce.htm

Most of what we buy is decidedly not local. More effective than recycling and reusing is just buying less stuff. Not only will limiting consumption, save money, but if paired with a "buy local" prioritization of basic goods (see *Economy*), it will go some distance in both reducing the volume we send to the landfill, and work to re-localize our economy.

2. The City should provide educational outreach to the community about the benefits of composting leaves and table scraps with the goal of reducing its leaf pick-up services by 50% in five years.

Like other recycling efforts, the composting of yard trimming and food scraps can help decrease the amount of solid waste that must be sent to a landfill, thereby reducing disposal costs. Indeed, the US EPA estimates that organic food waste alone comprises about 12 percent of what a typical US American throws away every day; yet, only two percent of that is composted.[41] At the same time, composting yields a valuable product that can be used by homeowners, farmers, landscapers, horticulturists, government agencies, and property owners as a soil amendment or mulch. Cities such as Toronto, Oakland, Seattle and Portland have implemented City-sponsored composting programs.

3. The City should establish a neighborhood compost collection program and should use this compost for community gardens, especially those which benefit local hunger relief programs.

As described in the *Sustenance* chapter, a decline in cheap oil will result in greater food insecurity especially among the economically vulnerable population. Programs for growing food within the City will need to be expanded. The City should begin to identify sites for neighborhood composts within each of the pre-defined 55 Natural Neighborhoods outlined in the *Land Use* chapter.

4. The City should work toward requiring apartment complexes to provide recycling services to its tenants.

Currently, the City picks up waste and recycling only from residences which contain four or fewer units. Buildings of five or more units variously provide recycling services. The City should work toward requiring such buildings to provide recycling to its tenants.

MEDIUM-TERM STRATEGIES (5-15 years)

1. The City should establish landfill diversion targets and waste reduction goals.

[41] *Supra* note 15.

Based on City waste collection data, the community recycles approximately 34% of its waste. In the interest of reducing the amount of waste sent to the landfill, many other communities have established waste-reduction targets and many have set zero waste goals.[42] Bloomington should set an ambitious goal for a *Zero Waste Bloomington* by 2040. To get there, the City should resolve to:

- reduce per capita waste disposal by 20% by 2014;
- Encourage composting on residential, industrial and commercial sites; and
- Require recycling and composting materials for all new development.

2. The City should consider ways in which it could promote the processing and use of locally-generated recyclable material.

Specifically, the City should sponsor a study to evaluate the potential for local manufacturing of products, utilizing the supplies of locally-generated recycled materials. For example, the City of San Francisco has implemented an innovative trash-into-fuel program whereby fats, oils and grease from households, restaurants, etc. are diverted away from the solid waste and wastewater streams and toward the City fleet by converting the waste to biofuel. Not only does such a program foster energy independence, but it provides alternate fuel for the City fleet and provides businesses and residents with a cheaper and cleaner option to dispose of such matter.[43]

[42] Zero waste goals have been set by a number of other communities, such as San Francisco, CA; Austin, TX; Portland, OR; Oakland, CA; Seattle, WA

[43] *See* http://www.sfgreasecycle.org/thedish.shtml

LONG-TERM STRATEGIES (15 +years)

1. Re-open the Monroe County Landfill and tap it for biogas.

That the City ships almost 86,000 tons of waste 55 miles poses a serious threat in a post-peak Bloomington. The City should work with other community stakeholders to examine the feasibility of re-activating the Monroe County Landfill after its contractually-required closure period ends – 2024. The Monroe County Solid Waste Management District is investigating the feasibility of a biogas-to-energy system at the Landfill. The City should fully support such an inquiry.

If re-opening the Monroe County Landfill is not feasible, the City should work with other community stakeholders to explore establishing a new, local landfill and tapping it for biogas.

According to the EPA:

> Municipal solid waste landfills are the second largest source of human-related methane emissions in the United States, accounting for nearly 23 percent of these emissions in 2006. At the same time, methane emissions from landfills represent a lost opportunity to capture and use a significant energy resource.[44]

Rather than allowing the release of landfill gas to migrate into the atmosphere, it can be captured, converted, and used as an energy source. Such biogas can be used to generate energy, to directly offset the use of another fuel (e.g., natural gas, coal, oil), for co-generation (producing both electricity and thermal energy), and even to produce alternate fuels (delivered to the natural gas pipeline and/or converted to vehicle fuel in the form of compressed natural gas and liquefied natural gas.[45]

Landfill biogas-to-energy systems are not uncommon. As of December 2008, the EPA reports that there were approximately 480 operational LFG energy projects in the United States and 520 landfills that are good candidates for projects. Indeed, at least three landfills in Indiana are generating energy.[46]

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[44] Landfill Methane Outreach Program, http://www.epa.gov/landfill/overview.htm

[45] *Ibid*.

[46] Logansport, Liberty and Clark & Floyd counties. Cf. A description of the Logansport and Liberty projects at: "2 Indiana Landfills now generating electricity," *The Chicago Tribune*. http://archives.chicagotribune.com/2008/oct/20/news/chi-ap-in-trashtoenergy

Re-establishing a local landfill will be critical in a post-peak community. Not only will the re-localization of our waste drastically reduce the amount of fuel used to transport the trash, but a landfill using a landfill-to-biogas system strengthens our community's commitment to cleaner air, renewable energy, economic development, improved public welfare and safety, and reductions in greenhouse gases.

"Together, the Logansport and Liberty landfills now generate enough electricity to power about 5,100 homes. Beasy said that the 3.1-megawatt Oakridge plant generates the same amount of electricity each year as 50,000 barrels of oil. Since going online, he said the site has produced 131 million kilowatts of electricity – or the equivalent of 267,917 barrels of oil. He said the Oakridge facility about 40 miles northeast of Lafayette uses four generator engines that churn out 3,100 kilowatts of electricity per hour."

Clark-Floyd Landfill Methane Generation Project description via Hoosier Energy:
http://www.hepn.com/clark-floyd.asp

- Hoosier Energy has constructed an electricity generation plant at the Clark-Floyd Landfill that produces two megawatts of renewable energy
- At two megawatts of capacity, the $4 million landfill generation project provides enough electricity for about 1,200 typical homes. The landfill is located on a 400-acre site in Clark County.
- The project received a $100,000 Alternative Power and Energy Program grant from the Indiana Office of Energy and Defense Development.

WASTEWATER

The City operates two wastewater treatment facilities – the Dillman Road Treatment Plant and the Blucher Poole Plant. Both employ systems of aerobic digestion as part of their treatment processes. The Dillman Plant has a design capacity of 15 million gallons daily and a peak hydraulic capacity in excess of 30 million gallons daily. The Blucher Poole Plant has a design capacity of 6 million gallons per day and a peak hydraulic capacity of 12 million gallons per day.

VULNERABILITIES

The treatment of the City's wasterwater consumes approximately 2,000 KWh per month. [This figure is wrong, and I'm not sure where it came from. Seems 200,000-300,000 KWh per month is more on target. John Langley: Feedback?] As with water treatment, the electricity required to run these plants relies on the burning of coal. The extraction of coal relies heavily on petroleum inputs. Therefore, our wastewater treatment processes are vulnerable to volatile oil prices and an aging grid.

MITIGATION GOALS & STRATEGIES

SHORT-TERM STRATEGIES (1-5 years)

1. Encourage Greater Water Conservation

The vulnerabilities inherent in the treatment of wastewater are closely linked with that of water. Perhaps the most immediate, and decidedly low-tech solution to a vulnerable wastewater system, is to encourage less wastewater circulating through it. Conserving water and using energy-efficient appliances will help reduce some of the pressure on the system. These mitigation strategies are mapped out in the *Water Supply* section above.

2. Transition all back-up generators to renewable sources of energy, such as biomass.

Currently, both treatment plants rely on diesel back-up generators. The Dillman Plant has one generator on site that holds 1,000 gallons of fuel and will provide 8 hours of power. The Blucher Plant has one generator on site that holds 3,000 gallons of fuel and will provide 60 hours of power.

As is recommended for the treatment of water, the Task Force recommends that the City should explore how these generators might be transitioned to renewable sources of energy. At minimum, the generators should be flex-fitted to run on biodiesel. Ideally, such generators could be run on biomass, such as wood.

3. Make better use of biosolids.

At present, the Utilities Department deposits all treated sewage sludge – biosolids -- at its Dillman Road Treatment biomass landfill. This landfill is quickly nearing capacity. [TIMEFRAME?]. If Utilities continues to landfill the sludge, it will have to send it the way of all other City solid waste – to the Sycamore Ridge Landfill, 55 miles away. However, this sewage sludge is a potential resource. In the US, approximately 50% of suitable biomass is recycled to land in the form of fertilizer.[47] Such fertilizer reduces the need for chemical fertilizers. As in discussed in the *Sustenance* chapter, insofar as chemical fertilizers are reliant on petroleum inputs, this is both good ecosystemic practice and necessary to mitigate anticipated shortages of agricultural chemicals. However, as is required by the EPA, it is imperative that any biomass spread on local fields be free of harmful contaminants.

LONG-TERM (15+ years)

1. Explore Sludge-to-Biogas Energy Generation

Wastewater is a rich source of organic matter, nutrients and minerals. The products of such wastes are potentially valuable resources, both as energy and as reusable compounds such as phosphorous.[48] Indeed, research has demonstrated that sewage actually contains 10 times the energy needed to treat it.[49] Because this process is energy intensive and contains

[47] Note that to apply biomass to land, the biomass must meet strict quality criteria as spell out in 40 CFR Part 503, S*ee* http://www.epa.gov/OW-OWM.html/mtb/biosolids/503pe/index.htm

[48] Phosphorus is a growth-limiting nutrient that is discharged to the environment through municipal sewage. The impacts of phosphorus discharge include severe eutrophication of fresh water bodies. The US EPA has made clear that the future sustainable use of phosphorus must include recovery from municipal sewage and reprocessing as a fertilizer. Phosphorous Recovery From Sewage, U.S. Environmental Protection Agency (2005) http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/7345/report/F; Cf. *Phosphorus Recovery Technology Modeling and Feasibility Evaluation for Municipal Wastewater Treatment Plants*, *Woods*, et al, Environmental Technology 20(7), July 1999, pp. 663-679.

[49] *State of the Science Report: Energy and Resource Recovery from Sludge*, Global Water Research Coalition (2008) http://www.werf.org/AM/CustomSource/Downloads/uGetExecutiveSummary.cfm?File=ES-OWSO3R07.pdf&ContentFileID=6450

valuable resources, a number of widely-tested energy recovery technologies have emerged which produce energy from sewage.

Perhaps the most common way to extract energy is the sludge-to-biogas (methane) process. However, such a process is reliant on anaerobic digestion. While it would likely be cost-prohibitive to transition the City's current aerobic digestion system to an anaerobic one capable of producing energy, the City should explore such a shift in the long term. Such energy could be used directly for wastewater treatment, reducing the facility's dependency on conventional electricity. Using solids as a resource rather than a waste may help stressed public budgets as well. Wastewater solids must be processed prior to disposal, and solids handling accounts for as much as 30 percent of a wastewater treatment facility's costs.[50]

Furthermore, as energy costs increase, elements like phosphorous are becoming increasingly scarce and the recovery and renewability of these resources is becoming economically and ecologically attractive. Phosphorus recovery can reduce sludge volumes produced by up to 30 percent. In addition to exploring sludge-to-biogas production, the City should closely examine the feasibility of phosphorous recovery.

[50] *Id*.

POLICE, FIRE & OTHER EMERGENCY SERVICES

Police and fire protection and other emergency services are among the most important services a government can provide; however, they are also the most vulnerable to a decline in cheap oil. Peak oil presents emergency services with twin challenges: a decline in fuel with which to respond to emergencies and increased social unrest due to fuel shortages and economic disruptions.

POLICE DEPARTMENT

The City of Bloomington Police Department is a full-service police agency, providing police protection to a city of approximately 72,000 residents and a land area of approximately 20 square miles. The Police Department employs 92 sworn officers and 36 civilian employees.[51] The Department is a very visible one and such visibility helps keep crime low in our community.

The Police Department maintains 45vehicles. Over the last three years, the Police Department has averaged about 5,300 gallons of gas a month. That's keeping about 10 police cars on the street patrolling and responding to calls. Indeed, the Police Department is one of the most fuel-intensive departments in the City. In 2008, the Department used 57,626.28 gallons of unleaded fuel and 73 gallons of diesel – about 9,500 gallons less fuel than it used in 2007. Yet, despite this reduction, its fuel budget increased from $169,191 in 2007 to $229,800 in 2008.

The Department is working to use vehicles that consume less energy where it can. For example, the Department has added a few motorcycles that use less gas than patrol cars. They've purchased a few electric Segways for downtown and trail patrol, and they employ bicycle and foot patrols where appropriate. The Department purchased a hybrid vehicle for its school liaison officer and has begun shutting down their vehicle engines when not being driven.

[51] http://bloomington.in.gov/documents/viewDocument.php?document_id=580

FIRE DEPARTMENT

The City's Fire Department provides fire suppression, emergency medical services and rescue services for vehicle accidents and other rescue needs. The Department provides community protection at all times.

The Department employs 99 full-time firefighters, maintains five fire stations, 23 vehicles of which six are fire trucks. The Fire Department's six pumpers, two aerial trucks, one brush truck, one confined space truck and three rescue trucks all run on B20 biodiesel – the Department's ten remaining vehicles are used for administrative purposes and run on gasoline. In 2008, the Department made approximately 3,300 runs – approximately 37% of those were for rescue or emergency medical services.

At minimum, the department estimates that it needs a minimum of 22,000 gallons of biodiesel to provide services.

VULNERABILIES

1. The Police Department relies on the availability of gasoline to keep our community safe and is totally exposed to cost increases.

As one of the most fuel-consumptive departments, the Police Department is perhaps one of the most vulnerable to a decline in cheap oil. At the present moment, the Department would not be able to fulfill its duties without gasoline.

2. The Fire Department relies on B20 biodiesel and is largely exposed to cost increases.

B20 is a fuel blend composed of 20% biodiesel and 80% petroleum diesel. [52]

[52] *Biodiesel Basics*, National Biodiesel Board, http://www.biodiesel.org/resources/biodiesel_basics/

3. There is a potential for increased social problems resulting from peak oil and economic dislocation.

The recent experience with escalating gas prices, the attendant increase in food, the mortgage crisis and the recession have put great pressure on our community's residents as well as social service providers. As explained in the *Economic Context* section of this report, it is anticipated that our current period of economic distress will last for some time. It is well documented that, in times of economic hardship, illegal activity and violence tends to increase.[53] Observers point out that every recession since the late 1950s has been marked by an increase in crime, particularly property crime and robbery.[54] Indeed, the Police Executive Research Forum, conducted a survey of 233 police agencies and found that 44 percent reported a rise in certain types of crime they attributed to the current economic climate. The study also found that 63 percent of departments were making plans for overall cuts in their funding for the next fiscal year. [55]

Peak oil, exacerbated by the current economic climate, translates into more economic dislocation. It is likely that some citizens, out of both frustration and despair, will look for extra-legal ways to sustain themselves.[56] This puts increased pressure on the Police Department to keep the City safe and for the Fire Department to provide valuable emergency medical treatment. If social services are increasingly strained or otherwise compromised, police may be called upon to fulfill this role as well.

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[53] Alfred Blumstein and Richard Rosenfeld, "Factors Contributing to U.S. Crime Trends" in *Understanding Crime Trends: Workshop Report,* Goldberger and Rosenfeld, eds, 13-44 (National Academies Press: Washington, D.C, 2008). Lesley Williams Reid, *Crime in the City: A Political and Economic Analysis of Urban Crime* (LFB Scholarly Publishing LLC: New York, NY, 2003).
See also, David Streitfield. "The Recession Made Them Do It, N.Y. Times, May 10, 2009.
http://www.nytimes.com/2009/05/10/weekinreview/10streitfeld.html?scp=14&sq=recession%20violence&st=cse

[54] Ross Colvin, "Economic Downturn Hits U.S. Police With Double Whammy," Reuters, October 21, 2008
http://www.reuters.com/article/newsOne/idUSTRE49K0VH20081021

[55] Police Executive Research Forum Survey on Policing and Economy, 2008.
http://policeforum.org/upload/PERF%20Survey%20on%20Policing%20&%20Economy_908860847_222009153254.pdf

[56] Energy Watch Group, *Crude Oil: The Supply Outlook* (2007).
http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Oilreport_10-2007.pdf

4. Peak oil will likely present additional fire safety concerns.

Peak oil also presents fire safety concerns. It is likely that as oil become more and more expensive, some residents might try to stockpile gasoline – a practice that presents substantive safety risks. It is also expected that, as electricity and gas become more expensive, more residents will turn to heating their homes with wood and biomass. Both stockpiling and heating with wood and biomass will call for more fire suppression and will require the Fire Department to engage in even more fire-safety community awareness efforts.

MITIGATION GOALS & STRATEGIES

SHORT-TERM (1-5 years)

1. Priority should be granted to Police and Fire in adding new staff to the City.

2. The City should develop a fuel allocation plan wherein, in the event of a fuel shortage, the Police and Fire Departments should be given greatest priority.

3. The City should plan for shortages and supply disruptions and transition back-up generators away from diesel fuel.

4. Anticipating a period of growing social problems, the Police Department should work with Neighborhood Associations to develop neighborhood patrols.

5. The Department should continue to invest in bicycles, neighborhood electric vehicles, etc. and should consider the use of horse patrols where appropriate. Anticipating more fuel stockpiling and non-conventional home heating practices, the City should work with the Fire Department to provide more community outreach on the dangers of stockpiling and how to practice safe home heating using biomass**.**

6. As the City's firetrucks are powered by B20, the City should investigate to what extent the firetrucks could be retrofitted to run on B100. B100 holds the possibility of fueling fire trucks by use of locally-derived lipids – such as restaurant grease.[57]

[57] The National Biodiesel Board advises that "high percent blends can impact fuel system components (primarily fuel hoses and fuel pump seals) that contain compounds incompatible with B100. Manufacturers recommend that natural or butyl rubbers not be allowed to come in contact with pure biodiesel or biodiesel blends higher than B20. Over the past 15 years of use, blends of B20 or lower have not exhibited problematic elastomer degradation and no changes are

For example, as discussed elsewhere, the City of San Francisco has implemented an innovative program whereby fats, oils and grease from households, restaurants, etc. are diverted away from the solid waste and wastewater streams and toward the City fleet by converting the waste to biofuel.[58]

MEDIUM-TERM (5-15 years)

1. The Police Department should consider ways in which it might transition pursuit vehicles away from fossil fuel reliance.

Most patrol cars used by the City are Ford Crown Victoria models. The City should explore the emerging field of non-fossil fuel reliant pursuit cars. While we've described why bio-diesel is not a remedy for the advent of peak oil, we will have to look toward interim remedies that help us bridge the gap to energy independence. The BPD could reduce its reliance on petroleum by shifting in the short-term to a biodiesel pursuit vehicle. For example, Carbon Motors offers a fully-spec pursuit car that can run on biodiesel.

2. The Police Department should look to replace a number of patrol cars with electric cars.

There are few locations in the City where a high-speed chase is likely to occur. As part of the shift away from car culture, streets could be made unsafe for vehicular traffic above a certain speed, for example, 35 miles-per-hour. Traffic calming, narrower roads, more pedestrian-friendly roads and a denser settlement pattern will make automotive hijinks rather difficult and far less likely. Small electric patrol vehicles might be adequate when combined with a few big cruisers and coordination with the Sheriff's Department.

3. Provide additional First Responders and EMTs.

As most of the Fire Department's calls are for medical events, it may be prudent to add more First Responders and EMTs staff and to purchase an energy-efficient dual-use fire/EMT vehicle that runs on biodiesel or another non-fossil fuel.

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recommended. If a fuel system does contain these materials and users wish to fuel with blends over B20, replacement with compatible elastomers is needed." *Guidance on Blends Above B20*, http://www.biodiesel.org/pdf_files/Biodiesel_Blends_Above%20_20_Final.pdf.

[58] *See*, http://www.sfgreasecycle.org/thedish.shtml

LONG-TERM (15+ years)

1. Implement distributed, regional police stations rather than one, centralized station.

A neighborhood police station has the potential to not only decrease the response time for emergency and non-emergency calls, but also would enable local residents to become more involved. Successful examples of neighborhood-sited police stations include Oakland, Chicago and Boston.[59]

2. Electric fire engines are still largely in development. However, as they are perfected and become affordable, the City should explore this option.

[59] For example, with Chicago's CAPS (Chicago's Alternative Policing Strategy) the entire Police Department is being decentralized to the neighborhood level. *See*, *City of Chicago's CAPS. See further*, *CAPS at Ten: Community Policing in Chicago - An Evaluation of Chicago's Alternative Policing Strategy*-- a ten-year evaluation of the program.

OTHER EMERGENCY SERVICES

Non-routine police and fire emergency services are provided to the City of Bloomington by the Monroe County Emergency Management Agency. As required by State statute, the Agency is charged with establishing and maintaining "a progressive emergency management program that promotes the mitigation of, preparation for, the response to and recovery from emergencies and disasters impacting the public, government and business of the communities of Monroe County." This program is mapped out in the *Monroe County Comprehensive Emergency Management Plan*.[60]

As spelled out in the Plan's "Situation and Assumptions" section, the *Plan* anticipates the following hazards: floods, winter storms, tornadoes, earthquakes, terrorism and hazardous materials releases on transportation corridors or at a facility."[61] These are the hazards anticipated most emergency planning, planning which assumes:

- The disaster will happen at some time in the future;
- The specific time of the event is known;
- The event will be localized, so that the community can rely on outside assistance within a relatively short amount of time; and
- That the goal is to minimize damage and maximize recoverability *to pre-disaster conditions* as quickly as possible.

VULNERABILITY

With a decline in cheap oil, there will not be a tidy return to pre-disaster conditions. Systemic as our reliance is on petroleum, planning for peak oil is planning for a *long emergency*.[62] For vital communications and other back-up generators, reliance on fossil fuel will be a long-term vulnerability. The County Emergency Management Agency should plan for supply interruptions and shortages.

[60] *Monroe County Comprehensive Emergency Management Plan*, Basic Plan, (2003).
[61] *Ibid*, 4.
[62] The term "long emergency" is borrowed from the novel by James Kunstler, *The Long Emergency: Surviving the Converging Catastrophes of the Twenty-first Century* (Grove/Atlantic, 2005). The book explores the effects of peak oil on society. The book points out that a post-peak world will force us all to live in more localized, self-sufficient communities.

MITIGATION GOAL

SHORT-TERM (1-5 years)

1. Plan for the Long Emergency

We suggest that MCEM integrate planning for peak oil into its plan to ensure that power and fuel required for maintaining services is available without the expectation of outside assistance. In the long emergency, mitigation, response and recovery should be informed by local, renewable sources.

FLEET & STREET:
CARBON WEBS & ASPHALT CONNECTIONS

The City's reliance on petroleum is most immediately apparent in the operation of its fleet and the paving and maintenance of its streets. Both the City's Fleet and Street departments have implemented laudable conservation and efficiency improvements to reduce reliance on petroleum. However, peak oil means that the provision of these services will become increasingly expensive. Congruent with the City's commitment to reducing greenhouse gas emissions, peak oil provides the City with the opportunity to think through new ways to provide for safe streets and an efficient fleet while reducing our reliance on fossil fuels.

THE MUNCIPAL FLEET

The City's fleet is composed of 466 vehicles and equipment: 235 unleaded vehicles[63](including four hybrids), 115 diesel vehicles and one electric GEM car used by the City's Downtown Specialist. It owns 85 pieces of diesel equipment, 20 pieces of equipment using unleaded fuel, 5 electric and 5 propane pieces.[64] Since 2005, the City has abided by a bio-diesel only-purchasing policy for its 200 diesel-powered cars and equipment. The City uses these vehicles for police and fire protection; for enforcement of the Bloomington Municipal Code (parking enforcement, zoning compliance, housing and neighborhood inspection); for maintaining parks, trails, the golf course and other recreational facilities and programs; for street and sidewalk repair and maintenance and by the Utilities department in its sweeping charge to provision for the City's water and wastewater needs.

The City owns a total of six fuel tanks: three unleaded tanks that have a capacity of 10,000 gallons each and three diesel tanks – two with a capacity of 10,000 gallons each and one with a capacity of 20,000 gallons. As these tanks can only be filled to 90% capacity, the City

[63] City Fleet advises that only 25 cars are flex-fuel capable; the rest of the fleet cannot be "retrofitted" for flex-fuel capacity.

[64] The following numbers reflect all vehicles and fuel-powered equipment attributed to each department:: Police (45), Public Works (6), Engineering (11), Housing & Neighborhood Development (9), Parking Enforcement (4), Planning (2), Risk Management (2), Traffic (9), Fire (23), Fleet Maintenance (5), Street (96), Utilities (169), Parks and Recreation (85), the Animal Shelter (3), Sanitation (17) and ITS (2).

has storage capacity for approximately 27,000 gallons of unleaded fuel and 36,000 of diesel fuel. Fleet purchases an average of 8,500 gallons of unleaded fuel and 7,500 gallons of biodiesel each month. The City does not maintain a fuel reserve; however, it has contracts with three providers for unleaded and two for biodiesel. In the event of a fuel shortage, the City is considered a "priority customer" and would receive first opportunity to claim fuel.

Over the last number of years, the City has experienced an appreciable increase in the cost of fuel while the gallons consumed have variously decreased or remained constant. From 2003 to 2008, the unleaded fuel costs to the City increased 130% while the cost of diesel increased 177%.[65]

Year	Unleaded Gallons Purchased	Unleaded Cost	Diesel Gallons Purchased	Diesel Cost
2003	169,974	$203,720.47	118,368	$129,847.67
2004	170,797	$256,439.92	119,795	$167,175.36
2005	159,573	$312,295.19	108,563 (biodiesel)	$220,910.97
2006	156,831	$349,444.10	109,036 (biodiesel)	$255,217.04
2007	154,764	$377,731.50	116,829 (biodiesel)	$296,984.55
2008	162,590	$467,872.85	102,121 (biodiesel)	$359,016.52

As a result of the oil spike of Summer 2008, in 2009, the amount budgeted for fuel increased by almost 20% -- from $679,091 to $810,791. Meanwhile, the percentage of the overall City budget constituted by fuel has doubled over the last six years: in 2003, fuel constituted 0.63% of the entire City budget; in 2009 fuel comprises 1.32% of the budget.

In an effort to save money, reduce reliance on petroleum and to reduce the City's carbon emissions, many City departments have already implemented some forward-thinking measures to reduce the City's reliance on liquid fuels. For example, the City has purchased four hybrid cars and one electric car; all departments have implemented "no idle" policies; suppliers travel to the City for re-stocking; and most enforcement departments have greatly

[65] Again, in 2005, the City began only buying biodiesel to power their diesel vehicles and equipment. Note that Fleet does not currently track the total number of miles driven.

consolidated their trips – now most inspection is based on location rather than inspecting a complaint as soon as it is lodged; departments encourage carpooling; reducing the acreage of turf mowed in City parks; experimenting with "low-mow" or "no-mow" grasses and purchasing energy efficient maintenance equipment. Importantly, the City has established an internal working group, *Team Process*, to audit the current fleet and develop a vehicle replacement plan.

VULNERABILITIES

While the City staff has taken impressive measures to reduce the City's consumption of oil, the City of Bloomington is just as vulnerable to a decline in cheap oil as its residents.

1. Without mitigation, increased costs to operate City vehicles could throw the City into a deficit and would require it to reduce its services.

When inquired of each department how it would respond if required to cut its fuel usage by 50%, all departments indicated that, without mitigation, a 50% reduction in fuel use would translate into substantial reduction in services.

2. Maintenance would be compromised in the interest of emergency-only repairs.

3. For Code Enforcement operations, the City can anticipate a loss of revenue.

From 2006-2008, the City received an average of $1,050,774 in fines per year. The bulk of these fines derive from the enforcement of the City's parking rules: in this time frame, the City received an average of $827,500 from the payment of parking tickets alone. As both the enforcement of parking rules becomes more expensive and as residents increasingly are unable to drive nearly as much, the City will likely experienced a marked decrease in this source of revenue. A decline in cheap oil, without a mitigation plan in place, would likely translate into less timely inspection of zoning and neighborhood inspections

4. The City currently employs 692 full-time employees and 200 temporary employees. A sustained and serious fuel shortages or price increases will impact the availability of commuting employees.

MITIGATION GOALS & STRATEGIES

SHORT-TERM STRATEGIES (1-5 years)

1. **Establish a fuel reserve to prepare for a fuel shortage.**
   The City should shift its practices to maintain a reserve of fuel in the event of a shortage and/or drastic price increase.

2. **Establish a measurable goal for reducing total vehicle miles driven**.
   Toward that end, the City should start tracking total miles driven on each vehicle

3. **Encourage *Team Process* to develop a plan for a *Model City Green Fleet*.**
   As the City's *Team Process* examines and audits the current City Fleet and prioritizes acquisition, it should do so with an eye to discerning which vehicles might be eliminates and how we might maximize fuel efficiency in the short term, and in the long term, transit our fleet away from reliance on fossil fuels. Some ideas *Team Process* might pursue, include: reducing the size of the City Fleet through partnerships with car sharing groups (this might be a consortium of City, County, the schools and IU) and requiring best-in-class purchases, with priority given to electric and plug-in hybrid electric vehicles as appropriate

4. **Encourage use of more bicycles, Segways, motorized bikes and/or electric cars in code enforcement, where feasible.**

5. **Establish a City Bicycle Fleet**
   Institute a City bicycle fleet whereby City employees have the option to ride a City bicycle rather than driving a City vehicle. Currently, the City's Parking Enforcement Department owns two bicycles for use by two of its nine parking enforcement officers. Each employee using such a program would likely have to have her/his own helmet. While liability concerns may inhere in such a proposal, it should be noted both that: employees already often walk or ride their own bikes for City business where appropriate and many other municipalities successfully maintain a bicycle fleet for

employees and have addressed liability concerns.[66] Establishing a City bicycle fleet would help the City prepare for peak oil while reducing the community's greenhouse gas emission and improving employee wellness.

6. Direct Departments to develop fuel-reduction implementation plans.
All City departments are already engaging in laudable efforts to reduce their reliance on oil; however, we can do more. All City Departments should outline a plan in the interest of achieving a 50% reduction in petroleum consumption by 2024.

7. Carpooling Incentives.
While the City has established an electronic carpooling "match" system, to date it appears to be only very lightly used, if at all. The City should establish some sort of reward for those who choose to carpool, e.g, gas cards, bonus for three or more employees in one car, free oil changes, etc.

8. Pay for Parking.
Currently, City employees pay $2 for an annual parking permit. The City should explore a "sliding scale" permit system whereby higher wage earners above a certain threshold, pay more to park. This should be a progressive measure, not one that burdens low-earning employees.

9. The City should implement one-day-a-week telecommuting options for non-manual work employees where appropriate.

As discussed in the *Transportation* chapter, the average Bloomington worker commutes about 15-16 minutes to their workplace. This figure remained surprisingly constant from 1990 to 2000. Almost half of Bloomington workers reported spending between 10 and 19 minutes getting to work daily. Between 1990 and 2000, the portion of workers with commutes less than 10 minutes declined by 4%. Excluding

[66] Examples of municipally-owned bicycle fleets include: San Francisco, CA; Berkeley, CA; Tucson, AZ; Houston, TX; Louisville, KY and Minneapolis, MN.

residents who work from home, however, this group declined by 6%. Meanwhile, the portion of workers with commutes between 20 to 44 minutes increased by 10%.[67]

The City should seriously examine a telecommuting policy wherein appropriate employees are encouraged to work from home once a week. A number of municipalities have already implemented such policies.[68] Not only does such a policy reduce the City's reliance on petroleum to get employees to work, but it also decreases the City's electricity consumption, reduces greenhouse gas emissions while improving employee morale and retention.[69]

10. The City should explore a four-day work week.

Both the City's Sanitation Department and the Monroe County Highway Department have moved to four-day work weeks in an effort to save fuel. The City should identify positions for which such a configuration might make sense. If paired with some form of telecommuting configuration, this promises to substantially reduce employee drive time.

11. Explore partial park maintenance by volunteers, neighborhood associations, etc.

This would reduce the number of vehicles travelling to parks to mow and maintain facilities. The City might begin such an initiative with a few trial, *Adopt-a-Park*, runs to assess how such volunteer provisioning would best work.

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[67] Source: 2000 US Census. Cf. Bloomington Environmental Quality Indicators Report http://bloomington.in.gov/beqi/commuteToWork.htm

[68] E.g., San Francisco, San Diego, Portland, OR; Atlanta; Virginia Beach and Denver. Indeed, US cities have experienced high growth in rates of telecommuting to work from 2006 to 2007, most likely a direct impact from rising fuel prices. Oakland had the highest telecommuting rate, at 7.6% in 2007, while six US cities—San Francisco, San Diego, Portland, OR; Atlanta; Virginia Beach and Denver--had more than 5% of their total workforce being primarily home based. Karlenzig, *Major US City Post-Oil Preparedness Ranking Which Cities and Metro Areas are Best or Least Prepared for Price Volatility, Supply Shocks and Climate Change Regulations?* http://www.commoncurrent.com/pubs/MajorUSCityPost-OilPreparednessRanking.pdf

[69] *The Good, the Bad, and the Unknown about Telecommuting: Meta-analysis of Psychological Mediators and Individual Consequences*, Gajendran, Ravi S.; Harrison, David A. Journal of Applied Psychology. Vol 92(6), Nov 2007, 1524-1541.

MEDIUM-TERM GOALS & STRATEGIES (5-15 years)

1. Reduce the size of the City Fleet by at least 25% though partnerships with car-sharing groups.

Other communities have successfully implemented such programs. For example, the City of Philadelphia has a municipal fleet of approximately 6,000 vehicle and joined with the PhillyCarShare[70], the community's non-profit car-sharing service in 2004.[71] This was the first system worldwide in which government employees and local resident shared vehicles by the hour in a major effort to reduce the number of vehicles in the community. Within the space of four years, the project helped the City of Philadelphia eliminate 330 vehicles and save taxpayers almost $2 million annually. Please consult the *Transportation* chapter of this report for details on car-sharing programs.

2. Implement a pilot *Grease-to-Biofuel Program* whereby the City offers local restaurants free vegetable oil collection to be rendered into biodiesel to fuel the City fleet.

Other communities such as San Francisco[72] and Seattle have started to leverage restaurant grease to fuel municipal vehicles as concern over the environmental harm of soy biodiesel mounts.[73]As discussed elsewhere in this report, this would divert harmful fats, oil and grease away from the City's sewer system

[70] http://www.phillycarshare.org/.

[71] http://www.mayorsinnovation.org/pdf/PhiladelphiaFleetManagement.pdf; The City's effort landed it as a 2006 finalist for Harvard's Innovations in Government Award http://www.innovations.harvard.edu/awards.html?id=15709

[72] San Francisco's initiative can be found here: http://www.sfgreasecycle.org/thedish.shtml; notably, converting grease into biofuel requests some processing including filtering, settling and decanting. If the City led the way in creating a demand for such product, it could help foster a whole new local green industry.

[73] In May 2009, Seattle Mayor, Greg Nickels, directed the Seattle Fleet department to stop buying soy biodiesel after the EPA issued a report stating that ethanol production was potentially worse for the environment than gasoline. *City of Seattle Halts Biodiesel Purchases, Looks for Greener Fuel*, Seattle Post-Intelligencer, Chris Grygiel, June 19, 2009.

LONG-TERM GOAL (15 + years)

1. Realize the *Model City Fleet*.

All City vehicles, especially emergency vehicles, should be transitioned away from fossil-fuel reliance.

MAINTAINING CITY STREETS

Everything we do relies on oil.[74]
-- Bobby Chestnut, Street Commissioner, City of Bloomington Street Department

The City's Street Department provides maintenance and repair for The City of Bloomington 237 miles of streets. Its functions primarily include: street resurfacing, the repair and construction of sidewalks and curbs, snow removal, street sweeping and leaf collection. In 2006, the City paved 2.5 million square feet of streets; in 2007, it paved 1.5 million square feet and in 2008, it paved 906,710 and in 2009, it is scheduled to pave a little over 1 million square feet.

The Street Department has used a petroleum-based asphalt for the last 35 years. This is a product with a life span of 3-4 years. The City repaves according to a plan that calls for paving all arterial streets every ten years, all collector streets every 12 years and all local streets every 20 years.

The price of asphalt is closely connected to the price of oil. Asphalt paving materials represent a mix of aggregate (stone), sand or gravel, and crude refined Bitumen, also called "liquid asphalt." Liquid asphalt is a sticky black residual obtained from the refining of crude oil and acts as the binding agent for asphalt. Since liquid asphalt is a residual from crude oil refining, as oil prices rise, liquid asphalt prices increase. According to the Bureau of Labor Statistics, liquid asphalt has increased 250% during the past five years and has led to a doubling of total asphalt paving costs.[75]

The City has experienced this marked upswing in asphalt prices. In 2006 the City paid $27.90/ton; in 2007, $33.65/ton; in 2008, $32.15/ton and in 2009, $48.25/ton.[76] In 2008, the Street Department used 20,000 tons of asphalt.

[74] Boyd, James, *Police Agencies Cutting Gas Use a Prices Rise Bloomington Police, Monroe Sheriff's Office Finding Ways to Save*, Bloomington Herald Times, May 28, 2008.
[75] http://www.bls.gov/
[76] Asphalt is bid out at the beginning of the year in interest of that year's paving season.

The City's Public Works Department and the Street Department have worked to extend the life of extant roads and mitigate the need for repaving by using an asphalt compound sealant. The sealant extends the life of the road by 3-5 years.

VULNERABILITY

While the Street Department has made impressive efforts to reduce its consumption of asphalt by recycling its asphalt on projects where the City mills existing road, the Department is nevertheless very exposed to volatile and increasing asphalt prices. As oil becomes more costly, so too does the price of road maintenance. Road maintenance material is heavily-dependent upon transportation. Currently, Bloomington has one asphalt plant.

MITIGATION GOALS & STRATEGIES

SHORT TERM (1-5 Years)

1. **Explore mixes that require less energy to produce, can use a greater percentage of recycled asphalt and are longer lived.**

2. **Explore the use of bioasphalt made from bitumen and other non-petroleum based paving materials, such as Road Oyl a bio-based binder that is an emulsion of half water and half pine resin and pitch.** [77]

3. **Instead of a paving plan whereby every inch of every street is repaved within 10, 15 or 20 years, prioritize major arterials and tend to others on an "as needed" basis. As private automobile traffic dissipates, it is unlikely that such an aggressive re-paving plan will be necessary.**

MEDIUM TERM (5-15 Years)

1. **Reduce road width where appropriate (*See Transportation* and *Land Use chapters*).**

LONG TERM (15+ Years)

1. **Low-use roads might safely be transitioned to gravel, dirt or other non- fossil fuel materials.**

[77] http://www.gtkp.com/uploads/public/documents/Knowledge/Eco-road%20Technologies%20Review-a.pdf; http://www.sspco.org/naturalpavexl/naturalpave_OV.html

CITY BUILDINGS

As has been discussed earlier in this section, the City has done much to make its buildings more efficient – from upgrading the HVAC system in City Hall to use 15% less energy to installing LED traffic lights to installing low-flow sensored water faucets to the City's LEED-focused Green Building Ordinance. All these efforts are vital to reducing the City's reliance on the grid, but we can do even more.

MITIGATION GOALS & STRATEGIES

SHORT TERM (1-5 Years)

1. **While Police and Fire Departments have priority, all back up generators for all City buildings should be transitioned away from diesel fossil fuel reliance.**

2. **Implement the Green Building Ordinance with a focus on energy-saving, passive measures.**

In early 2009, the City passed a long-awaited Green Building Ordinance requiring that all new construction and major renovation of occupiable City buildings be designed, contracted and built to achieve, at minimum, the U.S. Green Building Council's LEED® Silver level of certification. The ordinance also calls for retrofitting existing buildings where said building meeting a 10-year payback period. This is an important start to fostering sustainable building standards. However, LEED standards do not always address peak oil concerns, as many of the LEED features are not particularly relevant to a building's energy use. As summarized by Pat Murphy in *Plan C*:

> [P]lacing a bike rack near the building earns one point, which is the same value earned if 5% of the building's energy comes from renewable sources. Likewise, installing a metal grate at the entrance to reduce particle count earns one point while increasing energy efficiency, which might cost tens of thousands of dollars, only earns two points.[78]

In implementing its Green Building Ordinance, the City should prioritize energy-saving measures – particularly passive measures (those that require no on-going energy use). These

[78] Murphy, Pat. *Plan C: Community Survival Strateis for Peak Oil and Climate Change* (New Society Publishers: Gabriola Island, Canada, 2008).

include insulation, efficient windows, weather stripping, natural ventilation, passive solar and the planting of deciduous foliage on south and west facing sides of buildings. Such measures not only save energy and money, but passive technology works even in the event of power outages or rolling black and brownouts.

CITY REVENUE

As has been documented elsewhere in this report, high gas prices have translated into reduced demand. With demand destruction, also comes lower gasoline tax revenue. Indiana is one of eight States with a gas tax in addition to the federal gas tax.[79] Revenue from the gas tax, vehicle registration fees and other sources are pooled and distributed to State entities for maintenance and construction of highways and to local entities for maintenance of roads and streets.

Like other Indiana communities, Bloomington has experienced a decrease in funds from the State's pooled gas tax funds. From 2004 to 2008, the City experienced a steady decline in revenue from these pooled "gas tax" sources . In 2004, the City received approximately $2,774,033 from these sources – approximately 5.92 % of City revenue. In 2008, funds from these sources totaled 2,481,648 (4.49% of total revenue) – a decrease in highway and gas-sourced funds by approximately $292,000.

VULNERABILITIES

As the cost of gasoline continues to oscillate, we can expect a decrease in demand, as was witnessed in the summer of 2008. As demand decreases, we expect that this revenue source will continue to shrink.

Fuel prices will also influence the ability of the City to assess fines. Approximately 2% of the City's budget relies on fines and forfeitures. As discussed above, the bulk of these fines result from violations of the City's parking rules. In 2008, parking citations accounted for $749,592.32 of the $1,068,000 in fines and forfeitures. As gas prices rise and community members increasingly walk, bike or take public transit, it is anticipated that parking enforcement revenue will decrease appreciably. Similarly, insofar as staff is limited to foot or bicycle enforcement of all of its ordinances, it is expected that fines will decrease across the board.

[79] Currently, Indiana' gas tax stands at 29.2 cents/gallon.

MITIGATION GOALS & STRATEGIES

SHORT TERM (1-5 Years)

1. **The City should consider this anticipated loss of "gasoline tax" and "fine and forfeiture" revenue in its budgeting process.**

2. **City should add energy vulnerability scenarios to its departmental budgeting process.**

3. **The City should set aside added reserves in a dedicated *Energy Transition and Community Sustainability Fund* to assist with funding necessary infrastructure and technology transition to cover increasing energy costs and increased investment in emergency and social services. To help build this reserve, the City should use prices "lows" wisely by using current and any future temporary reductions in fuel prices to redirect already budgeted higher fuel expenses into a special emergency fund** (See further *Transportation* chapter).

SUSTENANCE:
FOOD, WATER, WASTE & HEALTH CARE

The elements of sustenance, defined as food, water, waste handling, and health care, are now provided centrally by private companies, government and publicly- owned corporations. These systems are utterly dependent on fossil fuels and mechanized structures to both transport supplies from distant parts of the nation and the world and to process locally-generated water and wastes. In a medical model, Bloomington is on "life-support," with the well-being of its residents largely dependent on a source of energy that is widely expected to dissipate within the next five to fifteen years.

Sustenance for Bloomington's citizens in a low-energy future must derive significantly from the resources of the household and from forests and farms within the City and its surrounding region. The distance most food travels from field to table will shrink dramatically, and the distribution of food for sale must also move closer to consumers, who in future can be expected to travel less by car and more on foot, by bicycle, and by public transit. The process of empowering households to provide significant portions of their own food, water, waste handling, and health care, and to restructure the City's land uses and industrial capacity to support this purpose can be described as "building resilience."

We expect that it will take decades to achieve levels of self-reliance, so we must set priority on those actions which will address our greatest vulnerabilities. This process will require the recovery of old skills, the propagation of new skills, and the reorganization of public and private infrastructure within the Bloomington community. Public agencies have an important role to play in catalyzing and nurturing this transformation.

FOOD

Eating Oil

Most food we consume is supplied through national and regional food marketing systems – big box supermarket chains and institutional suppliers. This system does a remarkably good job of mobilizing tens of thousands of products for just-in-time delivery at a relatively low cost. Nevertheless, the system is almost wholly reliant on petroleum. The system relies on oil both for its production (most conventionally grown food relies on petroleum-based pesticides and fertilizers) and for transportation from the site of production to the site of consumption. Indeed, most of the food we eat travels thousands of miles on average, most of it by diesel-powered trucks. As consumers, we complete deliveries to our kitchen by commuting from our homes to half a dozen shopping hubs at major traffic junctures to the north, south, east, and west of the City center.

Despite Indiana's agricultural heritage and current large involvement in agribusiness, only a small portion of Bloomington's food is raised within the community, the surrounding countryside, or even within the State. Estimates of local foodsheds suggest that outside major producing regions such as California's Central Valley and south Florida, little more than 2 percent of food is local.[1] Indiana is a significant producer of pork, turkey, and eggs, but imports much of its beef, chicken, and some of its dairy. The State's main commodity crops—corn, soybeans, and hay—contribute to animal or fuel feedstocks, but are not consumed directly by humans. Tomatoes, melons, and snap beans are raised commercially in the state, along with mints, but these vegetable crops are only in surplus seasonally and in a few locations.[2]

Nationwide, approximately 32 percent of households have grown gardens. The National

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[1] Peter Metcalf, "The 'Process' of Rebuilding a Local Food Economy: As demand for local food increases, a resurgence of the local processing facilities that once dotted the American landscape has advocates of a more locally-based food system -- and economy – optimistic," *New West Missoula*, May 12, 2009. http://www.newwest.net/city/article/the_process_of_rebuilding_a_local_food_economy/C8/L8/

[2] Indiana Farm Direct, *Fact Sheet* http://www.indianafarmdirect.com/resource_guide/agriculture_tour.php

Gardening Association estimates that for 2009 that 38 percent of 114 million households will grow food gardens – almost 20 percent more than in 2008.[3] It can be assumed that in Bloomington, the portion of settled households gardening is similar; however, the per capita yield from home production in the City is probably less than the national average because such a large portion of Bloomington's population consists of university students -- temporary landless residents. Though considerable potential for urban food production exists, at present this potential is barely realized.

Volunteers harvesting at Banneker Community Gardens

Urban gardening and farming are much written about, but little researched. Estimates for the amount of food produced in home gardens worldwide are unreliable. Permaculture expert, Michael Pilarski, suggests that 10-20 percent of household provision may come from gardening.[4] This figure is undoubtedly too high for almost any urban community in the U.S. Fourteen small farms at a sustainable agriculture park in Burlington, Vermont produce about 6 percent of the food eaten in that City of 54,000.[5] Burlington's initiative is know as *The Intervale Project* and is widely acknowledged to be at the leading edge of urban agriculture in the U.S.

For households who do plant gardens, the average size tends to be about 300 square feet. Bill Duesing of the Connecticut branch of Northeast Organic Farming Association estimates

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[3] National Gardening Association**,** *Impact of Home and Community Gardening in America Survey*, 2009 **http://www.gardenresearch.com/files/2009-Impact-of-Gardening-in-America-White-Paper.pdf**

4 Michael Pilarski , "Feeding the People," Friends of the Trees Society, January 7, 2008. http://www.friendsofthetrees.net/images/feed_the_world2.pdf

5 Jill Bamburg, "Pieces of the Puzzle," Yes!, Fall 2002 http://www.yesmagazine.org/article.asp?ID=521; The Intervale Center, http://www.intervale.org/.

that a garden of this size may yield produce worth more than $300.[6] If so, home gardening may produce an average of as much as $100 worth of food per household member, or some $12 billion nationwide. This represents about 1.7 percent of the U.S. household food budget. Duesing also suggests that home garden production may equal half the produce output from Connecticut's 4,000 farms, lending further support to a picture of little local food production.[7]

Besides transport vulnerabilities, the current food system is extremely dependent on liquid fuels for on-farm machinery and pesticides, on natural gas for synthetic fertilizers and on a variety of dwindling energy sources from coal to oil to gas to harvest, process and store the food we eat. Heinberg and Bomford have recently estimated that 7.3 calories of fossil energy go into harvesting and serving up one calorie of solar-derived food energy.[8] Of this total, 1.6 calories go into farm operations, transport requires 1.0 calories, processing and packaging require 1.8 calories, retail sales and food service 0.8 calories, and household level storage and preparation 2.3 calories. Most Americans are literally eating oil and gas (and not a little coal). Indeed, it is estimated that the U.S. food system uses 17 percent of the total energy consumed in the nation each year -- about 10 barrels of oil equivalent per person.[9]

Source: Woodrow Wilson International Center for Scholars

6 Bill Duesing, "As Food Prices Rise, Policymakers Ignore Potential of Home and Community Gardens," Grist, April 11, 2008. http://www.grist.org/article/the-solution-beneath-our-feet/

7 *Ibid*.

8 Richard Heinberg and Michael Bomford, "The Food and Farming Transition: Toward a Post-Carbon Food System," Post Carbon Institute, 2009. http://www.postcarbon.org/food

9 Pat Murphy, *Plan C: Community Survival Strategies for Peak Oil and Climate Change*. (Gabriola Island, BC: New Society Publishers, 2008).

VULNERABILITIES: Daily Bread

The vulnerabilities in such a situation are manifold. Some of the more obvious threats to Bloomington's food security that may be anticipated due to the peaking of oil extraction worldwide and related energy shortages and supply volatility are:

1. **Food price increases due to fuel-related cost hikes affecting production, processing, and transport.**
2. **Food price increases or shortages due to falling food production because of energy-related shortages of agricultural inputs (fuel, fertilizer, irrigation water).**
3. **Shortages of grain or sharp price increases in grain, cereals, and meat and dairy products due to diversion of grain to ethanol production.**
4. **Shortages of grain due to increased purchasing by foreign governments (China, India, others) to cover shortfalls in domestic production as a result of energy, climate, or land problems.**
5. **Shortages of food due to spoilage in transit or storage because of power outages due to grid electricity disruptions.**
6. **Abrupt disruption in fuel supplies due to sudden loss of confidence in the U.S. dollar and a market or political embargo of oil shipments to this country with consequent dislocation of the trucking industry.**
7. **A trucking strike or shutdown related to fuel price rises and a squeeze on driver incomes.**
8. **Disruptions to the food supply system due to a lack of credit, bankruptcies, or other financial failures.**

Many of these threats are linked and could compound each other. In a world of contracting energy supplies, our present food system is set up to fail. Therefore, it is mandatory to begin creating an alternative system, one that strives to be free of fossil fuels by which the City and area residents may be assured their daily bread.

Local efforts in this direction began more than 30 years ago and continue to grow today. Bloomington and Monroe County are fortunate to have some important elements of a local

food system already in place: a large cooperative food merchandiser with three storefronts and many local suppliers; at least one commercial orchard, seasonal wild mushroom harvests, heritage animal breeds, two local wineries, two local breweries, well-organized food pantries for the indigent, and the most vibrant farmers' market in the State. During the past generation, the coordinated efforts of private citizens, local business, and City government have done a remarkably good job of weaving together many small contributions of food growing to create a fabric of considerable breadth and diversity that has become a regional economic attractor and an anchor for the City's downtown. However, it would be vanity to claim that this is any more than a small down payment on a local food system.

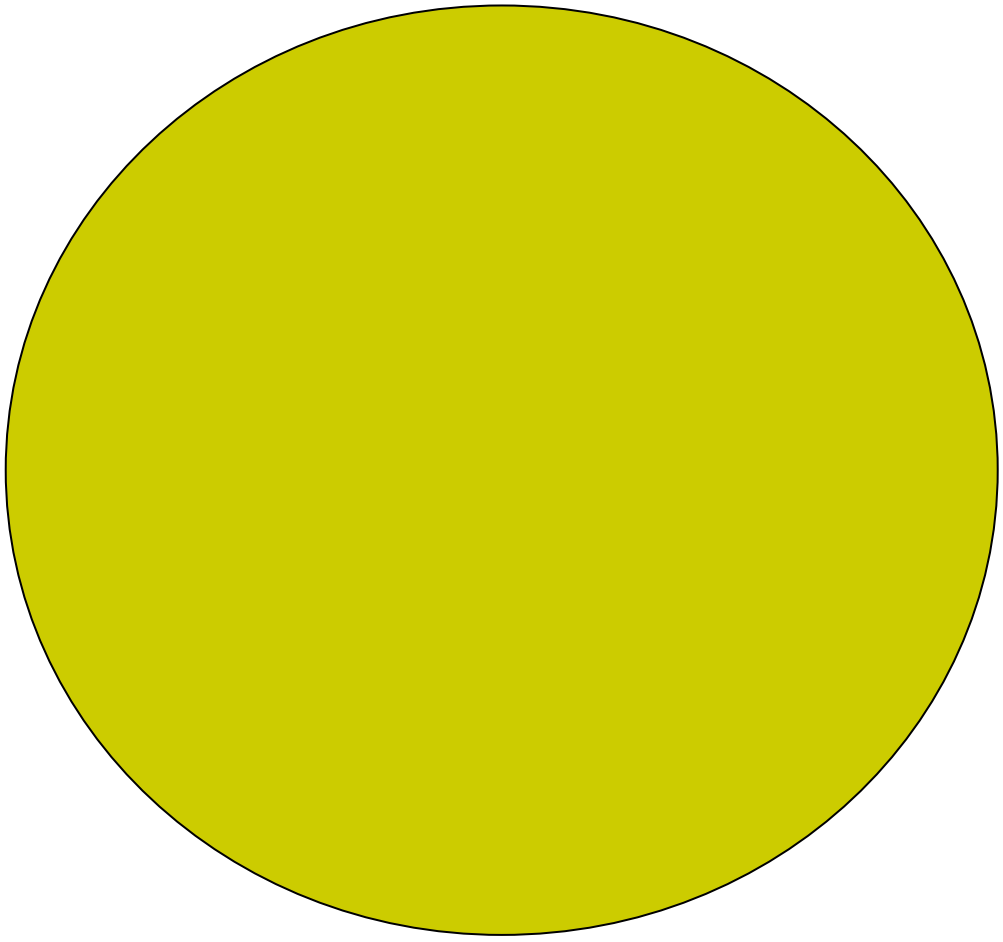
Kale at local community garden

The amount of locally-grown food sourced even through these many locally-owned and operated outlets is small in comparison to the need. Americans consume an average of about one ton of food per person per year, so Bloomington's population of about 70,000 eats about 70,500 tons of food per year, or 141,000,000 pounds. [10] Probably **less than 2 percent of the food consumed by City residents in 2009 will be grown within Monroe or its immediate neighboring counties**, and likely less than 5 percent will be produced within the State of Indiana.[11]

Indeed, most of Indiana's "agricultural" production consists of feedstocks for animals or industry in the form of corn and soybeans. Commercial vegetable production within the State is very modest, averaging less than 10 pounds per State resident. Most of this

[10] For comparison, Mother Hubbard's Cupboard serves about 1 percent of this volume to its clients each year.

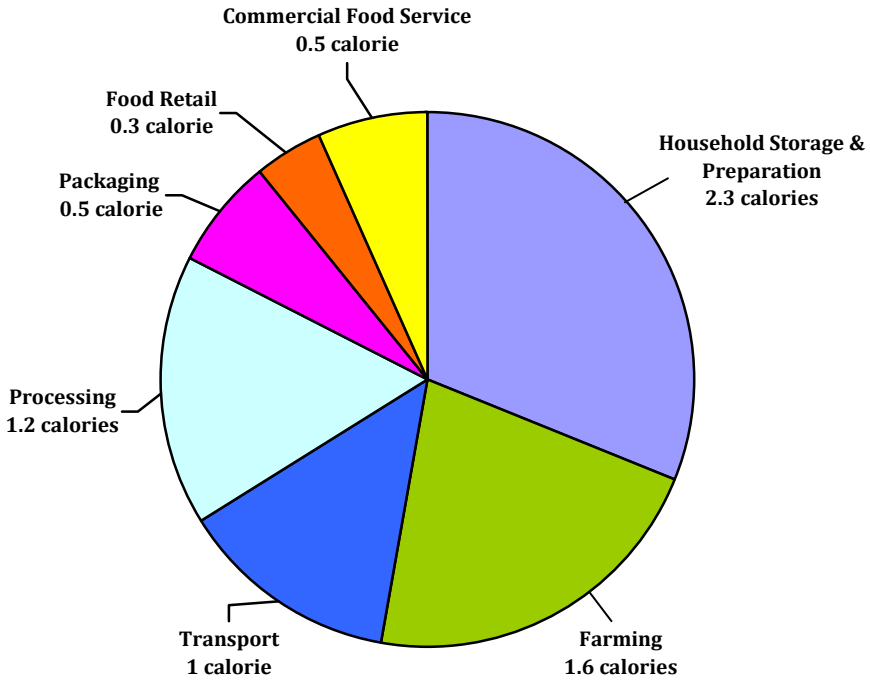
production is concentrated in areas far north and west of Monroe County, with tomatoes, melons, and green beans the chief measurable crops. Locally-raised beef, pork, and lamb can be found in town, but not in large quantities, nor in many outlets. There is no dairy in Monroe County.



[11] These estimates are based on observation of produce and other goods sold in City markets, and reasonable extrapolation from published USDA statistics on agricultural production within the State and region. See Indiana Farm Direct, Fact Sheet http://www.indianafarmdirect.com/resource_guide/agriculture_tour.php

The Current U.S. Diet and the Foodshed

Americans eat an average of just under 4,000 calories per person per day.[12] Using the previously-cited figure that 7.3 calories of fossil energy go into harvesting and serving up one calorie of solar-derived food energy[13], such consumption translates into about 30,000 calories. This is the equivalent of 45 KWh per person per day, the energy equivalent of 450 gallons of gasoline per year.



Energy Used to Yield One Food Calorie.[14] The U.S. American food system uses 7.3 calories to produce and deliver one calorie of food energy.

At present, food energy comes primarily from calorie-intense foods (meat, dairy, eggs, fats, and sweeteners) and one-third from nutrient-intense foods (fruits, vegetables, grains, nuts, and legumes.

[12] Murphy, *Plan C*,
[13] Heinberg, *Food and Farming*, p.2.
[14] Adapted from Heinberg, supra and M.C. Heller and G.A. Keoleian, *Life Cycle-Based Sustainability Indicators for Assessment of the U.S. Food System*, University of Michigan (2000).

THE TYPICAL U.S. AMERICAN DIET [15] *Annual Per Capita Consumption*				
FOOD TYPE	**WEIGHT (lbs.)**	**CALORIES/lb.**	**TOTAL CALORIES**	**% of CALORIES**
Meat-Milk-Eggs	861.0	434	373,769	26.9
Fats-Oils	93.7	3906	366,034	26.4
Grain	192.3	1655	318,230	22.9
Sweeteners	141.5	1494	209,941	15.2
Vegetables	411.6	213	87,579	6.3
Fruits	274.3	240	65,950	4.8
Nuts	9.9	2595	25,798	1.9
Legumes	7.0	1561	10,925	0.8

The following table lists per person averages of various food groups and types in lbs/yr combined with estimates of land area needed to grow each type of food. "E" indicates an estimated figure because of variations in the land intensity of products grouped together in each category. Yield figures are derived from commercial averages:

LAND USED TO SUSTAIN THE TYPICAL U.S. AMERICAN DIET			
FOOD TYPE	**LBS./CAPITA/YEAR**	**SQUARE FEET/LB.**	**ACRES/PERSON**
Dairy Products	592	100 E	1.36
Vegetables	412	22	0.21
Fruits	274	22	0.14
Flour & Cereal	192	14 E	0.06
Caloric Sweeteners	142	9 E	0.03
Red Meats	117	150 E	0.40
Poultry	99	100 E	0.23
Fats & Oils	94	44 E	0.09
Eggs	33	60 E	0.05
Misc vegetable foods	24	22	0.01
Fish (primarily ocean/import)	17	?? (44?)	??
Nuts	10	22	0.01
Beans & Legumes	7	35 E	0.01
TOTAL	**2,013**		**2.60**

[15] Adapted from Murphy, *Plan C*, pp. 205-211.

A “foodshed” is commonly understood to mean a local bioregion that grows food for a specific population.[16] Under current production methods, the land used to grow a typical diet is approximately **2.60 acres per person**. Thus, Bloomington's current foodshed amounts to **182,000 acres or 285 square miles** of productive land *distributed across the United States and the rest of the world*. The area of Monroe County is 390 square miles, most of which is not agriculturally suitable. On the face of it, Monroe County, let alone the City of Bloomington, could not hope to feed itself. But what does the picture look like if we expand the territory to include the six counties surrounding Monroe County?

16

Regional Land and Population

The prime agricultural land in the seven-county region surrounding Bloomington (Monroe, Brown, Greene, Owen, Lawrence, Morgan and Jackson counties) equals 1,232 square miles. While that is enough land to sustain over four times the population of Bloomington (based on current patterns of consumption and average agricultural yields by present methods), it is only enough for about 85 percent of the population of the region—still not enough prime farmland to feed the seven-county region a standard American diet.

PRIME AGRICULTURAL ACERAGE AND POPULATION OF 7-COUNTY REGION SURROUNDING BLOOMINGTON[17]

COUNTY	TOTAL LAND	PRIME FARMLAND	PRIME AS % OF TOTAL	POPULATION
Monroe	262,899	59,941	22.8	128,643
Brown	203,137	16,251	8.0	14,760
Greene	349,637	175,518	50.2	32,692
Owen	248,193	108,212	43.6	22,398
Lawrence	289,508	74,114	25.6	46,033
Morgan	261,847	154,228	58.9	69,874
Jackson	329,074	200,406	60.9	42,184
TOTAL	**1,944,295**	**788,670**	**40.6**	**356,254**

It is important to qualify these numbers. More land may be available for agriculture than is presently indicated by the category, "prime farmland," which is defined by USDA as "prime and important farmable soils, possibly needing some drainage or flood protection in some areas, but not requiring large-scale amendment, preparation, grading, or terracing to be used as highly productive farmland for a large variety of crops."[18] However, an examination of the region's agricultural history paints a different – more productive – picture.

[17] Adapted from U.S. Census of Agriculture, 2007.

Indiana agriculture reached its apex in 1900. In that year, approximately 21.6 million acres of the State's 23 million acres were on farm and Monroe County had 237,500 acres of its land in farms. By 1930, Monroe County farmland had dropped to 191,985 acres due to increased competition from western growers, decline of commodity prices, general economic contraction, and urbanization resulting from economic and social change, with a consequent fall in the rural population. Of the land in production in 1930, 47,842 acres were harvested cropland and 84,748 were pastured land. While data from earlier periods is obscure, we can assume that during Indiana's agricultural height in 1900, the same proportions of total farmland were used in crop and pasture as in 1930: 25 percent in crops, 45 percent in pasture and 30 percent in woodland or other uses (or neglect). Thus, as much as 59,000 acres of Monroe County may at one time have been planted to crops, and as much as 107,000 acres may have been in pasture.

Loss of Prime Farmland

Much prime farmland has been lost to development -- most of it in the 20th century and most of it enabled by the availability of cheap oil.

From 1982-1992, Indiana lost 150,000 acres of farmland to development. Based on population, Monroe County's share of that loss would have been about 2,800 acres.

Development continued Statewide during the 1990s and early 2000s at a similar rate, but has slowed since 2003, and virtually ceased since 2007.

This deduced figure for cropland in 1900 closely matches the 2007 Census data for prime farmland. Land farmed and total value of farm production has fallen steadily in the State and region since 1900, and by as much as 25 percent between 1997 and 2002. A reasonable inference from this is that even within the past decade, significantly more land has been used for farming in the seven-county region than was inventoried in 2007, and that under changed economic conditions, some of that land might be brought into production again.

[18] Soil Survey Staff. "Soil Survey Manual". Soil Conservation Service. U.S. Department of Agriculture Handbook

Can Bloomington Feed Itself? Yes.

In addition to farmland available in the rural areas surrounding the City, there are many spaces to grow food within the City itself. Some of these spaces are held by local government, some by IU and some by private entities. Much productive land is available right in our own backyards. Maximizing the amount of food we produce just within the City has the distinct advantage of reducing the amount of energy it takes to get the food to the people and the people to the food.

The greenspace available within the City limits was mapped by the City's Environmental Commission in 2007.[19] As of the last inventory on July 1, 2007, 6,429 acres of greenspace were available within Bloomington corporate boundaries -- about 3900 square feet per City resident. Of this, 1,222 acres were held by Indiana University, 1,376 acres were controlled by Parks and Recreation, and 3,831 acres were in private hands. In addition, over 3,500 acres of the City are zoned single-family residential. Even if all this residential land is developed—and some is not, then at least 2,500 of the 3,500 residential acres are not covered with buildings or pavement and might be made suitable for gardening—an additional 1,400 square feet per City resident. Therefore, approximately 5,300 square feet of open ground are presently available in Bloomington per City resident.

To place these numbers in perspective, John Jeavons, author of *How to Grow More Vegetables Than You Ever Thought Possible on Less Land Than You Can Imagine*,[20] has documented production of enough food to provide recommended daily allowance levels of nutrition for one adult for one year on 4,000 square feet, which includes the growing of compost crops to maintain soil fertility indefinitely. This research suggests that enough land exists, even within the corporate boundary of Bloomington, to provide a basic, albeit primarily vegetarian diet to all City residents.

18, 1993. http://soils.usda.gov/technical/manual/print_version/complete.html.

[19] City of Bloomington Environmental Commission, *Greenspace Trends in Bloomington, 2003-2007*(2007). http://bloomington.in.gov/media/media.php?media_id=2738

[20] John Jeavons, *How to Grow More Vegetables Than You Ever Thought Possible on Less Land Than You Can Imagine* (Berkeley: Ten Speed Press, rvsd. ed., 1991).

In assessing the present and future capacity of Bloomington to feed itself, many factors must be taken into account. First of all, under conditions of food shortage, people are strongly motivated to consider alternatives to their present modes of eating and sourcing food. The example of Cuba during the *Special Period* of 1991-94 is instructive. During this period, oil supplies plummeted and mechanized agriculture ground to a halt. As a result, residents in Havana and other cities planted just about every available square foot of land and adopted a diet which included approximately 85 percent less meat. The population maintained health, while critical groups (pregnant women and children especially) received extra rations.

Under conditions of food shortage, Bloomingtonians would likely be similarly motivated to increase local food production by gardening, and could be expected to accept significant changes to dietary habits. A modified American diet (see below) that eliminated most caloric sweeteners (substituting smaller amounts of honey, maple syrup, and sorghum syrup—all locally sourced sugars), reduced by 60 percent the amount of fats and oils eaten, while doubling the volume of nuts and seeds, a diet which reduced dairy consumption about one-third from present levels, and provided only two-fifths of the meat consumed today, and which added about seven times as many beans and legumes, and about 50 percent more grain, flour, and cereals, would serve about 87 percent of the weight of food of the present diet, and would more than meet World Health Organization average daily nutritional needs while requiring substantially less land—about 1.85 acres per person. This assumes no change in farming practices or land intensity of production, though under such constraints, these would likely also shift.

It is reasonable to conclude that the land base of the seven-county region surrounding Bloomington is more than adequate to produce the amount of food needed to sustain the present population of the area in a state of health. Indeed, a reduction in fats, caloric sweeteners, red meat, and the substitution of whole grains and flours for denatured cereal, plus the substituting of smaller amounts of wild game and other locally harvested wild foods such as mushrooms for ocean fish now eaten would likely improve health.

A Locally-Grown Diet

The diet suggested above and detailed below—one that is based on familiar foods and roughly the same volume and calories per person as current average consumption -- is shown in the table below. The table depicts average per person projections of various food groups and types eaten in pounds per year and the land required to grow them.

LAND REQUIRED TO PROVIDE FOR AVERAGE PER CAPITA PER YEAR CONSUMPTION			
FOOD TYPE	**POUNDS**	**SQUARE FEET/POUND**	**ACRES**
Vegetables	500	22	0.25
Dairy Products	400	100E	0.91
Grain, Flour, and Cereals	300	14E	0.10
Fruits	275	22	0.14
Beans & Legumes	60	35E	0.05
Red Meats	55	150	0.19
Eggs	40	60	0.05
Poultry	35	100	0.08
Fats & Oils	35	44E	0.04
Misc vegetable foods	35	22	0.02
Nuts & Seeds	20	22	0.01
Caloric Sweeteners	15	9E	0.00
Fish (aquaculture & wild local)	10	44	0.01
Game	5	0	0.00
TOTAL	**1,785**		**1.85**

Of concern in making the above estimates is the nature of the agricultural system itself. What would be its sources of fertility in the absence of most chemical nitrates and phosphates? Leguminous and other cover crops would need to be grown in rotations, especially in shoulder and cold seasons to the extent possible. A larger population of livestock would be needed to exploit available pasture land and to provide adequate meat even for a lower-calorie diet. Composted offal and animal remains from local

slaughterhouses, plus human and other animal manures would need to be recaptured for fertility inputs, and yields of surplus biomass would need to be harvested from non-croplands throughout the region. Assuming that most of the 60 percent of the region's land area not in prime farmland is wooded or could be sown to compost crops, it is likely that a regenerative agricultural system for the region could be designed and implemented given sufficient cooperation and willingness. Of course, the best innovative techniques for soil fertility management and intensive production should be recommended. Yet, even without these potential improvements to productivity, it seems likely that the region could feed itself if other factors of production could be mobilized. Feeding ourselves is a critical goal. As we saw in the summer of 2008, food prices tend to follow in lock step with oil prices. As discussed previously, we expect oil prices to increase again. As they do so, some disruptions to the current distribution of food and other goods are likely.

Potatoes at the Bloomington Community Farmers' Market. Source: Daniel Orr

Factors Which Moderate Food Supply

While we've determined that the agricultural land base of Bloomington's seven-county region is sufficient to provide Bloomington and its neighbors with a healthy diet, we've come to this conclusion on in light of the following factors which tend to moderate local food demand.

1. Many students at Indiana University and other area colleges and universities depart

the region for travel, study, or to return home to family during the summer break and for significant periods in the winter and spring, reducing by several percentage points the food requirements of the area. In the event of food shortages emerging as a chronic social condition, the resident population may be reduced as some students seek refuge with their families in other parts of the state or the nation.

2. The American diet is widely acknowledged to be excessive, and most people could live better and longer on somewhat less food. Sugars and bad fats could be reduced with an expected increase in health, and perhaps less hunger, as these empty calories often strip the body of nutrients and leave it craving even more food.

3. Much less meat and dairy in the diet could be anticipated in the event of extreme conditions. Price increases for these energy- and land-intensive foods will tend to reduce consumption, even absent shortages. This change alone would dramatically reduce the amount of land required to feed the regional population of 350,000.

4. Conventional American agriculture uses little labor but much land, energy and capital. Home gardening produces 2-7 times as much food per acre as commercial farming. Jeavons' French Intensive gardening methods produce 11 times the fruits and vegetables per unit area of land as conventional American agriculture. Indeed, using Jeavons' method, Jules Dervaes and his family raise 6,000 lbs. of food annually on one-fifth of an acre in Pasadena, California.[21]

   Arable land available within the City of Bloomington alone (as much as 8,000 acres, or upwards of 5,000 square feet per resident) is potentially sufficient to meet most of the vegetable, fruit, egg, and some poultry requirements of city residents were it to be cultivated to the maximum extent possible using the most productive and intensive garden-scale methods.

[21] http://www.pathtofreedom.com/about/urbanhomestead.shtml

MITIGATION GOALS & STRATEGIES : PLANTING SEEDS

Bloomington is a long way from achieving self-reliance in food, and may never be required to produce 100 percent of its food needs locally, but it should begin now to increase all forms of food production and food processing and storage within the City and the surrounding region to build resilience in the face of likely food shortages and severe price increases over the coming decade.

The short-term goals presented here aim to mobilize the community to begin self-provisioning, to change attitudes so as to make legitimate and preferable the notion of a locally-centered food system, and to set in place infrastructure and launch initiatives that will make possible a rapid expansion of local capacity in the medium term. In 30 years, the aim of these recommendations is to realize a level of local self-reliance for the Bloomington region in food and related industries, thereby ensuring the well-being and food security of the citizenry.

These initiatives and infrastructure should be understood as innovative, experimental, and aimed at preparing the ground for a much larger effort to follow. Empirical feedback and rapid incorporation of new learning must be integral to the work. This learning and technology transfer process will depend to a great deal on the transparency and support of the public sector and on the willingness of private citizens to share their knowledge and discoveries. The community as a whole -- and City government and elected officials especially -- can aid this process by exhortation and encouragement. The rewards are potentially substantial: improved nutrition, increased health, a more beautiful and productive environment, less waste, enhanced food security and a new basis for local industry and commerce. We can reasonably hope for an increase in sociability and prosperity in our neighborhoods, and for stronger households and families.

Broadly, the recommendations which follow, track the below strategy:

1) Enlist private sector cooperation;
2) Advocate for local food production and increase access to relevant

information to support food production and processing;

3) Remove or reduce legal, institutional, and cultural barriers to farming within and around the city, and open institutional markets to local food;
4) Reserve open land for agriculture and make additional land available for food production;
5) Create and expand local food processing and distribution systems;
6) Organize direct support by the city and other public agencies to address infrastructure needs for water supply, fertility collection and distribution, food processing, storage, and marketing; and
7) Create specific forms of support for new farmers, including training, land access, low-cost start-up loans, and property tax abatements or land rent offsets.

SHORT-TERM STRATEGIES (1-5 Years)

In the interest of increasing all forms of food production within and around the City: gardening, arable cropping, animal husbandry, aquaculture, wild harvesting, and silviculture such that the City achieves 20 percent self-provision in vegetables, fruits, nuts, seeds, and small animal proteins.[22]

1. **Work closely with the private sector and Indiana University to outline a detailed plan for community food security, using this *Report* as guidance**.

2. **The City should plant edible landscapes on public property**.
   The City of Bloomington's Parks and Recreation Department already does a great job of fostering a few community gardens and a burgeoning orchard through it Community Garden Program. The City should expand these efforts substantially and plant edible public landscapes along streets, in parks, and surrounding public buildings, especially City Hall.

3. **Organize City-led horticultural services to include organic waste collection, processing, and distribution.**
   - Create a City nursery to supply edible perennials to the City's Parks and Recreation and Street department. .
   - Work to establish perennial food forests on public land, by grafting and planting fruit and nut trees.
   - Institute an urban forestry and composting program to harvest the carbon flow through the City and compost it for growers. (e.g., cardboard, hair from salons, food waste (pre- & post-consumer), brush trimmings)
   - Promote home-scale composting of kitchen wastes.
   - Create a City arboretum of economic species
   - Establish additional seed banking facilities in Bloomington.

4. **Expand water storage within the City to support agriculture (See following *Water* section).**

5. **Subsidize the cost of materials and education for building resilient infrastructure.**
   - Farm stands/agricultural parks at Activity Nodes [See Map p. __]
   - Food storage systems at schools

[22] Based on the modified diet discussed above, this would comprise about 200 lbs./person of food—or about 14 million pounds in the aggregate, per year.

- Make grants available to neighborhood associations for
  Rainwater catchment tanks
  Root cellars
  Neighborhood-based food businesses

6. Adopt a Food Security resolution.
The resolution should affirm that "Everyone has the right to adequate, healthful, nourishing food appropriate to their cultural and physical requirements."

7. Establish Bloomington as a Slow Food City

8. Food Security should figure prominently in the City's new *Sustainable City Initiative*.
The City should use the Initiative's website to anchor a web presence for information related to local food production, processing and marketing.[23]

9. Through education and funding, work to increase food storage in Bloomington household and community pantries to three months supply for all residents—about 18,000 tons aggregate.

10. Train and deploy 300 new urban garden farmers.
- Toward this end, the City should:
  intensify its practical food production arts classes via People's University;
- Work with Ivy Tech for vocational training in small-scale organic farming
- Lend City support to efforts at Monroe County School Corporation (MCCSC) schools to launch gardening programs.
- Request Monroe Co. Public Library to increase its holdings of relevant literature and media.
- The City should work with the State and other stakeholders to create specific forms of support for new farmers, including training, land access, low-cost start-up loans, and property tax abatements or land rent offsets.

11. Remove or reduce legal, institutional, and cultural barriers to farming within and around the City, and open institutional markets to local food.
- Amend the City's Unified Development Ordinance to allow garden farming, animal husbandry, front yard gardening, and growing in street lawns.
- Increase the number and scale of community garden plots.
- Promote "locally grown" food to MCCSC, Bloomington Hospital, Ivy Tech, and IU.
- Make solar access for passive energy capture and food production a limited

[23] http://bloomington.in.gov/documents/viewDocument.php?document_id=2121

right of all city homeowners.

- Change the basis of administration of the chicken ordinance to address actual problems of noise, odor, or nuisance only after they arise, eliminate the permit fee, and expand coverage to other livestock not presently permitted. If necessary, put the administration of this onto a public commission or appropriate citizen advisory panel.

12. The City and other stakeholders should work to establish food-business incubator programs with access to community kitchens.

13. The City should dedicate at least 200 acres of public land to intensive gardening and farming within city limits and to bring it into production, and to identify, acquire, and prepare an additional 500 acres for future production.

14. The City should work to increase the area available for year-round growing to 200,000 square feet (just under 5 acres).

15. In the interest of increasing ten-fold local food marketing and processing within the community from an estimated 1-2 percent of local consumption to between 10-20 percent, the City should create and expand food processing and distribution systems. Toward that end, the City should:

a) Identify and zone appropriately a food processing and distribution hub in each of the City's 55 districts (*See* Map E, p.); and

b) Permit transitional uses in these districts to bring these hubs into existence. For example, these hubs could be outdoors initially, then covered and then eventually add indoor space. The hubs could also begin with buying clubs with buying clubs, neighborhood-run food co-ops, evolve to storefront commercial operations;

c) Inventory commercial-rated kitchens within the city and identify unused capacity;

d) Work toward a Year-Round Regional Farmers' Market.
Begin working to bring about a regional farmers' market/food hub that provides year-round facilities for covered stall and indoor stall sales by local and regional producers, that has adequate public access and facilities for receipt and processing of farm-scale loads of produce, and which is on a scale at least ten times larger than the present Showers Plaza market. The regional market should include indoor market space and shop space for food brokerage, processing, and other related businesses. The City and community partners should:

- Identify an appropriate location.
- Seek state support and other funding (private, county, charitable).
- Consider creating a tax-funding district to channel revenues.

e) Launch at least one food-processing business incubator.
f) Acquire and make available to local animal raisers at least two mobile abbatoirs for safe and economic local processing of poultry and other meat animals.

16. Map a strategy to harvest, compost or otherwise process, and recycle to soil 100 percent of the City's organic waste.

17. Integrate locally grown food and locally-based cuisine into the Lotus Festival and at least one other public showcase event or location, preferably in connection with IU.

18. In cooperation with other stakeholders, the City should work to recruit or establish a local land trust for the banking of farmland and the acquisition and holding of development rights to preserve open space for future farm development, and to coordinate a program of placing new farmers on such land.

19. Reserve open land for agriculture and make additional land available for food production. Specifically the community should:

a) Inventory existing (farmable) land within the City, County, and region;
b) Ban suburban-type development within the City's corporate boundary;
c) Shift development focus to brownfield sites and increase density in areas with good services and transit such as the urban core (See further discussion of TIF districts in the *Land Use* chapter);
d) Re-zone planned greenfield developments to include or be replaced by larger scale agriculture;
e) Require that estate-zoning include mini-farms;
f) Support the establishment or direction of regional land trust(s) to hold farmland for long-term lease and usufruct; and
e) Ban the conversion of golf courses, sports fields, or other large tracts of open land to development, rather reserve them for future food production.

MEDIUM-TERM STRATEGIES (5-15 Years)

1. Establish an agricultural park in every neighborhood district of the City with community gardens, year-round production under greenhouses, limited processing, and food storage facilities.

2. Create a year-round food market for local produce and supplementary foods in every city neighborhood (55 districts).

3. Provide 100 percent organic and local or regional food to students in the MCCSC schools.

4. Provide 50 percent local or regionally sourced food to institutional kitchens at IU, Ivy Tech, and Bloomington Hospital.

5. Implement a community service requirement for *all* IU undergraduates.

6. Establish region-wide farm training programs at local institutions and to train and deploy 10,000 new farmers in the region.

7. Design and build five million square feet of greenhouse space for year round growing of integrated aquaponics.

8. Establish or expand local creamery and livestock butchering facilities.

9. Create a local, publically controlled seedbank and arboretum of food and useful plant species for propagation and sale within the region, and as insurance for the community food system.

10. Inventory, document, and disseminate information to the public about the local flora and fauna of the Bloomington region, including native and adapted species, economic crops, other useful plants, and so-called "weed" species, as well as their ecological relationships.

11. Establish a credible local financing facility for the acquisition and development of farmland into small (0.5 to 20 acres), intensive integrated polyculture farmsteads.

12. Ensure that Kelley School of Business offers at least an M.A. in local business design and that SPEA offers a degree in applied environmental design.

13. Work with the County to identify agriculturally suitable, publicly owned parcels within and near the City to be zoned and brought into use as small farm allotments.

LONG-TERM STRATEGIES (15+ Years)

1. **Bank at least 100,000 acres within the seven-county region for small-farm leaseholds (in usufruct).**

2. **Train and deploy 50,000 additional farmers in the area.**

3. **Create 50,000 new jobs in food, fiber, and organic goods processing and related services within the region.**

4. **Realize the goal of being able to feed all 120,000+ people in Monroe County primarily from the resources of the region (@ 2 acres per person).**

5. **Extend the local food production system to other central and southern Indiana communities within our region and to support the expansion of similar systems within the state and the Midwest.**

WATER: A HOUSEHOLDER'S PERPECTIVE

Water is an essential element of sustenance—one we take for granted almost completely, but the provision of which most people are utterly dependent on centralized systems. Water supply, like most of the institutions of modern life, is tightly integrated with the fossil-fuel driven, industrial production system that is now threatened by the decline in cheap oil production. While by any historical standard, the public water supply—of which Bloomington's is a good example—is a miracle of civic order and technical prowess, it comes with a cost. And its centrality to life, health, and the economy makes the community vulnerable to disruption from conditions that are now foreseeable.

The chapter on *Municipal Services* has covered much of the technical material related to the City of Bloomington's Utility Department (CBU) operations as well as vulnerabilities of the CBU system to grid failures. Here we will look at the water situation from the perspective of households and of local food production to see how the present centralized water system can be supplemented and the community made more water-secure.

The City of Bloomington and ten rural and suburban water districts that buy from it are supplied by surface water runoff held in Lake Monroe with a capacity of 159,900 acre-feet at normal pool level of 538 feet above mean sea level. This is about 52 billion gallons. All water supplied through City mains and surrounding private water districts is pumped by electric pumps with diesel backup. The average volume supplied by the CBU treatment plant is 14 million gallons per day, or 5.1 billion gallons each year, about 60% of which is used by residences. The remainder goes to Indiana University and other institutional, commercial, and industrial users. Bloomington households use about 85 gallons per person per day for indoor purposes, while the national average ranges from 80-100 gallons/day.

(NOTE TO EDITORS: I am following Dave and SJ's lead from Municipal Services, but I find these numbers on consumption exceedingly squirrelly. How much is actually being used by residential customers? How many residential students are supplied through the

University? How many county residents are supplied via the 10 rural water districts? Are commercial and industrial users really taking a quarter? A third? And where did the figures for domestic use locally and nationally come from anyway? FROM sj: INQUIRY submitted to Utilities)

Water use rises in May and peaks about August at 40% above the cool-season baseline. This is presumably attributable to irrigation of lawns and gardens and to the use of swimming pools, plus additional bathing. This period also sees declining surface inflows and lower levels of rainfall recharging the lake.[1]

Existing outdoor water uses already add about 5 million gallons per day of demand to the City's water supply each summer, at times pushing against the limits of the treatment facilities and of Bloomington's contractual limits of 24 million gallons/day on withdrawals from the lake. If, as the previous section in this chapter recommends, we are to increase the supply of locally grown food, new sources of water will be needed to ensure reliable production.

MITIGATION GOALS & STRATEGIES

An appropriate program of response to vulnerability would combine supply- and demand-side management. As urban agriculture increases, demand for water will also rise, however, much of this need could be met by a concerted program of small tank construction or installation to collect roofwater. This diversion of runoff would also tend to reduce flooding during rain events. Present household use rates of 60-100 gallons per person could be reduced ten fold or more under pressure of need and by change of habits

[1] The Army Corps of Engineers (ACE), which manages the lake for flood control, downriver navigation, and conservation purposes, maintains the minimum outflow rate at approximately 5300 cfs (57 MG/d). Evaporation also increases in hot summer months, reaching peaks around 485 acre-feet/day (about 160 MG) In most years, drawdown plus evaporation exceeds net inflows during the months of July through October, such that the lake level falls. During the hot, dry summer and fall of 2007, the lake level fell about a foot per month between June and November, losing 3 billion gallons per month, or about 6% of reservoir capacity each month.

over time, without compromising essential services. Demand-side management can be either structural (new plumbing devices and appliances) or behavioral, preferably both. It is by far the cheapest way to increase capacity within the system.

For Households

While the *Municipal Services* chapter addressed the ways that the City can build the resiliency of the municipal water treatment and delivery system, there is much that individuals, households and neighborhoods can do to increase our collective water capacity. Indeed, households can contribute significantly to improved water management and water security. The average non-conserving North American single-family household consumes about 70 gal/capita/day for *indoor* uses, and an additional 30 gpcd for outdoor uses. Of the 70 gallons used indoors, 27% go to flush toilets, 18.5% are used in showers and baths, 16% flow through faucets, and 22% supply washing machines, while 14% are lost to leaks.[2]

1. Smart Flush.

A program of conservation by improved plumbing fixtures has been estimated to reduce indoor water use by 40% to approximately 42 gallons per capita per day (gpcd). The main source of water savings is a reduction in water used to flush toilets (over 10 gpcd), based on the installation of 1.6 gallon/flush units (even more efficient toilets are available today). However, significant savings are also available through the use of low-flow shower and faucet fixtures and from water-efficient laundry and dishwashing machines.

2. Behavioral changes.

Some pretty simply and easy-to-implement behavioral changes at the household level can substantially reduce water use:

- Not rinsing dishes before loading them in a dishwasher can save up to 10 gallons per load, while for hand washing of dishes the use of dishpans can save half the water needed over washing under a running tap;

[2] *Managing Wet Weather with Green Infrastructure: Municipal Handbook – Rainwater Harvesting Policies*, Kloss, EPA-833-F-08-010 (December 2008).

- Toothbrushing or shaving in front of a running tap can waste up to 200 gallons per month of water;
- Keeping a pitcher of water in the refrigerator provides cold water on demand without running the tap until the stream is cool;
- The initial gallons of cold water discharged when running a bath or starting a shower can be collected in a bucket for flushing the toilet;
- Using a stop-valve on the showerhead when soaping and scrubbing conserves dozens of gallons of hot water with measurable cost savings;
- Running laundry machines and dishwashers at full capacity instead of doing small loads saves water on every load; and
- Used bathwater can be "re-used" for hand laundry, and dishwater (held in dishpans) is more than suitable for flushing toilets.

All told, it is possible to bring household water use down to under 10 gallons per capita per day without reducing sanitation or compromising any essential services.

3. New Fixtures

New fixtures improve water use efficiency, providing the same services at lower water cost. Repairs to leaks and changes in behavior—learning the household water cascade and its economies—conserves water that would otherwise be wasted. In a city with many rental units there are unfortunately conflicting incentives around reducing water use. Most multi-unit buildings provide water as a service of rent, so tenants have no economic incentive to conserve. Conversely, in rented single-family housing, old fixtures may waste water paid for by the tenant, while replacement of these is a cost the landlord may seek to avoid. The same problems of course obtain, with even more acute energy impacts, to heating and cooling equipment, insulation, etc. The incentives align, however, for owner-occupied houses. It is recognized that water use increases with affluence, with aridity of climate (ironically), and in older housing stock (because of leaks, older plumbing fixtures and appliances).

4. Collect Rainwater

In addition to measures of conservation and efficiency at the household level, it is possible to increase water supply available for outdoor and non-potable indoor water use by

collecting rainwater from roofs and other runoff. The use of rain barrels is becoming widespread, while in some areas where water supply is already critical (such as Austin, Texas), the construction and use of household cisterns is commonplace today as it was a century ago in southern Indiana. An expected increase in urban gardening and farming with a consequent need for more irrigation water in summer gives focus and purpose to a community-wide program of rainwater catchment.

For City government

There is much that City government can do to help residents conserve water. While some of the strategies cited below are also recommended in the Municipal Services section, they warrant repetition her as these strategies bear directly on both household conservation and the need to increase the local production of food.

SHORT-TERM (1-5 Years)

1. Restructure water rates to support conservation, i.e., set rates to rise rather than fall above a modest threshold. This is the inverse of present policy. Some of the revenue from such a program should be ear-marked to help fund construction of neighborhood cisterns for landscape irrigation.

2. Provide subsidies to consumers to make plumbing changes. As it has done with compact fluorescent light bulbs and compost bins, the City should give away or subsidize water-conserving devices, such as low-flow showerheads and toilets. Similarly, the City should offer citizens rebates for water-conserving appliances, especially washing machines.

3. Educate residents about the household water cascade, water efficiencies, and conservation measures.

4. Create a public demonstration of water conservation by installing composting toilets and roof water collection and use at a high-profile City park:

5. Work with County building officials to authorize composting toilets for residential installation.

6. Authorize small grants through neighborhood associations for construction of household and neighborhood water catchment systems involving "self-help."

7. Fund water tank construction and installation workshops to educate city residents about the use and management of these systems.

8. Implement green roof standards and provide a high-profile example on a City structure, such as the Police Department headquarters or on a City parking garage.

9. Follow the lead of the City's forward-looking *Evergreen* development, and adopt raingarden use City-wide. Specifically, the City shold:
    - Design and build rain gardens in city parks.
    - Mandate raingardens and water tanks in new developments and for apt. complexes.
10. Institute new parking lot ordinances that provide for:
    - Tree cover
    - Permeable paving and infiltration zones and/or raingardens

11. Modify sidewalk requirements to limit paving.
    - Encourage permeable paving for sidewalks where needed.

Medium-Term (5-15 years)

1. Install roofwater collection and storage systems at all major city-owned buildings to supply water for landscaping and other non-potable uses.
2. Install waterless urinals and water-conserving plumbing fixtures in all City-owned buildings where not already present.

3. Create rainwater catchment systems in connection with all City parks and community garden facilities for landscape irrigation. This may require the construction of pavilions, sheds, toilets, or other outbuildings to create catchment surfaces.
4. Build medium-sized catchment reservoirs throughout the City (to 100,000 gallons) supplied by collection from roofs of City and other public buildings and some large commercial or industrial buildings.

Long-Term (15-30 years)

1. Require household level roofwater catchment as a condition of receiving public water service. (This is already routine in Australia.)
2. Work toward replacement of impermeable pavement with permeable surfacing in parking lots, sidewalks, low-traffic streets and paths wherever practicable. Set goals soon with long-term mileposts for implementation.

WASTE: PERSPECTIVE OF LOCAL FOOD PRODUCTION

The City collects mixed household waste and yard waste from city residents. County residents take bagged, mixed household waste to transfer stations. As discussed in the *Municipal Services* chapter, there is no local landfill. Municipal and county mixed waste is trucked to the Vigo County Landfill at Terre Haute for burial. Yard waste and leaves collected by the City Sanitation department are depoted above ground at the site of the county's former landfill. Drains collect mixed blackwater and industrial wastes and deliver this sewage via underground pipes to centralized plants which use aerobic methods of treatment and chemicals for finishing. No methane is captured in this energy-intensive process. The treated water is released into the Clear Creek watershed.

VULNERABILITIES

Like the water delivery system, the City's centralized waste treatment plant is vulnerable to disruptions of the electricity grid. Though most of the sanitary sewer system delivers wastewater to the treatment by gravity, the plant itself depends on a series of pumps to move and aerate the waste. Because of the choice to build an aerobic treatment plant, no methane can be captured from the waste, so no net process energy is available. The cost of mixed waste collection and disposal is vulnerable to price increases in liquid fuels.

However, the City's waste streams, both solid and liquid, are not only a source of vulnerability to disruptions of centralized energy supply, they represent potential resources for the regeneration of agricultural land in the region. While we do not share the U.S. EPA's enthusiasm for the application of sewage sludge to farm fields—because of mixed collection which includes industrial wastes, it is as often a source of toxic contaminants as of fertilty—we do recognize the value of the city's green and woody yard waste, other organic waste materials from food processing and animal management, and the selective diversion of human wastes at source for nourishing soils.

The building of a local food system requires that we redirect local organic nutrients from "disposal" to reuse through composting, chip-and-mulch, and other appropriate processes. There are rich opportunities in this field and the City is well-situated to assist in this conversion process. In addition to City-generated tree and shrub trimmings, grass clippings, and collected yard waste, a great deal of the City's solid waste consists of organic and compostable materials such as food waste, boxboard, and paper. Sources include households, restaurants, and institutional food servers. Hair trimmings from salons and barbershops, stable waste, and cardboard cartons are also available. Because it already collects a large fraction of the community's organic waste materials, the City is in the best position to organize the large-scale chipping and composting of this material to supply soil nutrients to urban farmers and gardeners.

MITIGATION GOALS & STRATEGIES

The main strategy in waste reduction and recycling—which is the only way to limit costs and vulnerabilities in the long-term—is to capture and divert the organic fraction of Bloomington's present waste stream, both to reduce haulage and even more importantly, to supply fertilizer for the local food system.

SHORT TERM (1-5 Years)

1. Establish a centralized composting system for large-volume processing. This can be the initiative of the City, the Solid Waste Management District, Indiana University and/or a private entity.
2. Create a "compost corner" in each of the 55 Natural Neighborhoods where smaller-scale neighborhood composting could go on to supply the community gardens and home gardens in each City district. (*See* Map D).
3. Encourage home composting to divert residential organic waste.
4. Encourage organic source separation by City residents and make the transition to re-equip the Sanitation Department's fleet and/or restructure collections to handle this stream.

5. Work with commercial kitchens, groceries, and institutional food servers to harvest food wastes to supply the compost operation, balancing this nitrogen-rich source with "brown" material in the form of dead plant matter and shredded paper and cardboard.

MEDIUM TERM (5-15 Years)

1. Consider mandating source separation of organics from commercial and institutional sources.
2. Add in non-food organic waste sources as the capacity for materials handling is built up.

HEALTH CARE

The implications of peak oil for the provisioning of health care is a topic of increasing discussion, both among self-organized groups such as the Task Force, but also among and between mainstream health care organizations, such as the American Medical Association and Johns Hopkins.[3] Our neighbors in Marion County, Indiana (Indianapolis) were one of the first county health departments to initiate a task force devoted to examining the implication of peak oil for public health.[4]

Observers generally point out that peak oil will affect our current health care system in at least four ways. Writing in the Journal of the American Medical Association, Dr. Howard Frumkin of the Centers for Disease Control and co-authors write that petroleum scarcity will affect health care in the following ways: through effects on medical supplies and equipment, transportation, energy generation, and food production.[5] Many medications, such as aspirin and antibiotics are made from petroleum derivates and many medical supplies contain oil-derived plastics (bandages, prosthetics, syringes, tubing, etc). Similarly, the current health care system is highly reliant on oil for transport: ambulances, organ transport, workers travelling to work, patients travelling to appointments and the movement of medical equipment. Lastly, as was discussed previously, as current food production is so dependent on petroleum for its production, processing and transport, any reduction in affordable, healthy food has implications for community health.

While we've worked to address ways to shift our food production away from petroleum reliance, early on the Task Force agreed that a protracted examination of the implications of peak oil for local healthcare, was largely beyond the purview of the group. However, the

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[3] Peak oil has been identified as a topic for mitigation by the Johns Hopkins Public Health Preparedness Programs. In March 12, 2009, Johns Hopkins hosted a *Peak Oil and Health* Conference http://www.jhsph.edu/preparedness/Images/PeakOilFinalAgenda.pdf

[4] Mary McKee, *A Local Health Department Plans for Peak Oil*. Paper presented at: 134th Annual Meeting of the American Public Health Association; November 6, 2006; Boston, MA. http://peakoilmedicine.com/2006/11/12/how-local-health-care-authorities-can-prepare-for-peak-oil/

[5] Frumkin, Howard; Jeremy Hess; Stephen Vindigni, "Peak Petroleum and Public Health" *Journal of the American Medical Association* 298, no 14 (2007): 1688-1690.

subject is addressed here in the interest of problematizing peak oil and health care on a local level. We hope local health providers and stakeholders work to examine this more closely.

VULNERABILITIES

Up until this era, health care in the United States has been primarily a private concern and has evolved in an era of cheap energy, one predicated on the assumption that specialized equipment and teams of highly-skilled professionals are the critical elements in health care. While this allopathic model of health-care delivery is superb at dealing with trauma, it is less well-suited to dealing with environmentally-induced or diet-based degenerative illnesses – a hallmark of the current *Zeitgeist*.

Medical care in the U.S. today is among the most energy-dependent sectors of the economy. Costs are spiraling out of control and have contributed significantly to the nation's economic dilemmas. Nor is cost outlay linked to quality of care. The World Health Organization ranks the U.S. 37th in the world in quality of health care.[6] Already excessively dependent on emergency interventions at high cost, the system is likely to lurch further in that direction as energy-based economic contraction leads people to avoid timely and preventive care. A rise in the number of uninsured people poses potential financial burdens. And of course, rising energy costs and shortages of energy-intensive supplies, plus fuel-cost and supply problems related to patient and employee access to services threaten to push the system out of control.

Bloomington Hospital is a substantial employer of people from throughout the region and serves 11 Indiana counties. Currently, the Hospital is situation in Bloomington's downtown and is served by Bloomington Transit. The Hospital has recently merged with a large

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[6] *WHO World Health Report 2000 --- Health Systems, Improving Performance*, http://www.who.int/whr/2000/en/index.html; http://www.photius.com/rankings/healthranks.html

The United States was ranked behind nations like San Martino, Andora, Malta, Singapore, Oman, Iceland, Luxembourg, Netherlands, Colombia, Saudi Arabia, United Arab Emirate, Chile, Dominica, Morocco, Cyprus, and Costa Rica.

Indianapolis-based group of hospitals and has plans afoot to relocate to a campus northwest of, and outside, the City's corporate boundary, ostensibly to better serve the wider region by emphasizing ease of commuting by highway. As mentioned earlier, Bloomington Transit is constrained to serving only within the ambit of the City's corporate boundaries, if Bloomington Hospital were to relocate out of the City center it would make services less accessible to those unable to drive, a portion of the public set to rise substantially over the next decade.

MITIGATION GOALS & STRATEGIES: RE-IMAGINING CARE

While the City has little direct influence or responsibility for the health care of its citizens, it can support, and this *Report* hopes to advance, a new way of thinking about health that may make our increasingly scarce health dollars stretch further and help a vulnerable medical establishment transition to an era of lower energy resources. Beyond just working to substitute other materials for the material, medicine, machinery etc. that is so petroleum dependent, we need a new model of taking care of ourselves and each other. If we can see beyond our present model of medicine the outlines of a new path to health, we may, as a community, help it to come into being sooner and more easily.

Recognition and reversal of the presently upside-side down approach to health care would be the primary hope of maintaining reasonable public health and access to necessary medical resources in the coming era. As with food production and other components of everyday sustenance, peak oil presents with an opportunity to do things better. We will need to re-conceive our present notion of personal responsibility *away* from paying for one's own insurance and medical care *to* better measures of personal care beginning with diet and family health. It is instructive to re-think our system of care as a series of concentric zones, wherein the most frequented systems of care are at the core, and the less-frequented -- but necessary -- components of the system are more distal.

The Core: Individual and Family

Conceiving health care as existing in a set of concentric zones, the individual and the family are properly the center of the health-care system. The most effective care consists of personal and household practices that are healthy including: proper nutrition, exercise, reduction of stress, contact with nature, and protection—both personally and through public action—from environmental toxins. Both government and the medical establishment would better serve public health by educating and regulating with these aims in mind. Health is really only possible when this layer is vigorous, well-informed, and supported by public policy and cultural expectations.

The Second Layer: Community Support and Complementary Modalities

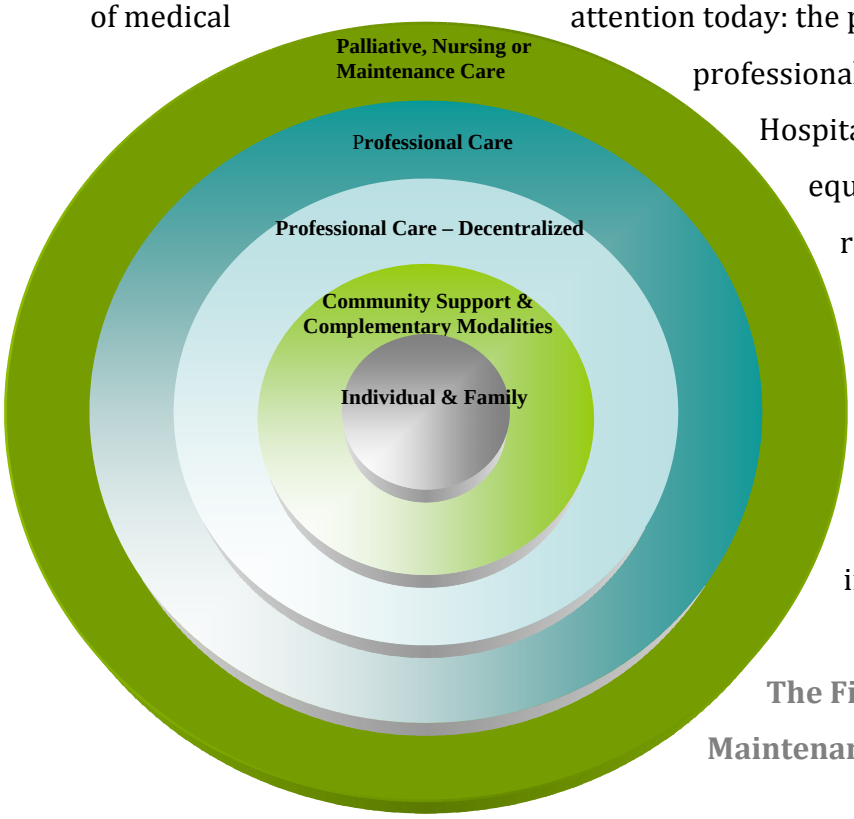
The next layer of care in a restructured system would consist of mutual support from community members and what are sometimes called complementary or alternative modalities. Massage and other body manipulation, acupuncture, chiropractic and cleansing therapies, herbal and botanical medicine, and homeopathics offer non-invasive, accessible, and lower-cost care for a wide variety of conditions. Many millions of Americans already use these methods and systems, but they exist mostly outside the formal structure of insurance, hospitals, and recognized medicine. Indeed, they are often the subject of official denigration and persecution. We exist in a matrix of social and environmental relations and to the extent that these are healthy, individuals can more easily maintain their own health.

The Third Layer: Decentralized Delivery Systems

A third layer of health care provision, and one that is largely absent from the U.S. system but which is present in more advanced countries such as France and Cuba, is local provision of formal medical services. The nationalized French health service provides home visits by physicians to patients as needed, while in Cuba, doctor's offices are located in every neighborhood. As transportation becomes ever more costly, it will be necessary to decentralize medical care and move the provision of services down the scale of energy intensity. Besides physicians' offices, these facilities might include smaller health clinics for outpatient services.

The Fourth Layer: Professional Care in Centralized Locations

The fourth layer of care in a restructured system would consist of what is often the first line of medical attention today: the provision of services by professionals in a centralized hospital or clinic. Hospitals will need to revision their equipment and organization to respond to shortages of disposable supplies and pharmaceuticals (which derive from oil), the inability of employees to commute as frequently, and even to the possibility of regular power interruptions.



The Fifth Layer: Palliative, Nursing & Maintenance Care

And a fifth layer of care, which exists today primarily in the hospice setting, would be an expansion of palliative, nursing, or maintenance care for those individuals at the end of life or whose conditions are either not responsive to medical intervention, or for whom the choice of medical manipulation is unwelcome. It's quite within the realm of imagination that proper medical care, even for patients whose conditions can heal, might lie in providing supportive care and guidance outside either home or hospital, as in a spa or sanitorium, where time and retraining in new personal health practices could result in the reversal or remission of illness.

Some elements of this layered care system exist today, though arguably the first and most important of these is the weakest, and is under constant assault by commercial interests, but a layered approach to health is also most effective when all the elements in it are integrated and mutually respectful. Regrettably, formal medical education, and the

professionals largely in charge of the medical system today are poorly equipped and prepared to bridge between the components of health as conceived above. As citizens, as consumers of medical services, and as individuals and families concerned with our own well-being, we will have to demand more holistic thinking from everyone about the sources and pathways to health. With costs lowered by structural reorganization and new thinking, it might be possible to implement community scale health coverage for all, regardless of what does or does not come about from federal action.

The goals of a healthy post-peak Bloomington should be to:

- Create a resilient health care system which provides care that is more affordable and which minimizes the need for energy-intensive interventions and support systems;
- Increase the flexibility and range of responses available to local health-care providers; and
- Support a concentration of essential medical services to remain in the central city location accessible by public transit and pedestrians.

Mitigation Goals & Strategies

This discussion is offered as guidance and direction for policy and public discussion. Few of them involve action steps for City government in the near term.

1. **Expand and support alternative health care options along the lines set out above;**
2. **Create a mobile medical corps: for both house calls and disaster responses;**
3. **Encourage more nurse practitioners: they can perform many of the same procedures as a doctor, but their training is less expensive and time-consuming. Offices could be sited in more neighborhoods;**
4. **Consider how to create community-level health insurance to include a wide range of therapeutic modalities;**
5. **Bloomington will still need a hospital.**
    a) **Maintain the present downtown location of Bloomington Hospital;**
    b) **Build dormitory facilities for short-term use by hospital employees to mitigate against transportation problems;**
    c) **Expand the re-use of medical equipment: reinstate the use of autoclavable equipment; and**
    d) **Prepare to manage intermittent power situations.**
        - **Increase on-site fuel storage**
        - **Provide employee training in low-energy diagnoses needing only low-tech tools and materials (i.e., old fashioned medicine).**

Opportunities for Citizen Action:
What can YOU do?

"Find you place on the planet. Dig in, and take responsibility from there."
– Gary Snyder

[ADD PICTURES]
There are many simple, easy-to-implement measures we can all take to reduce our reliance on petroleum.

Get Involved!

- Educate yourself on the peak oil issue, and understand the implications
- Educate yourself on how oil shortages will impact you and your community
- Talk to others in your community about it – encourage a dialog
- Get to know your neighbors – now.
- Identify wasteful behavior and be courageous enough to speak up about it
- Pull people along with the idea of conservation rather than push it on them
- Utilize resources of all kinds sensibly, but especially energy
- Think about everything you do in relation to how your life will be affected after oil hits peak production

What should individuals and families be considering now?

Individuals and families should start "powering down" their lifestyles. This will not only save everybody money, but us all prepare for unexpected shortages of goods, services, and energy caused either by sudden fuel shortages or astronomical fuel costs.

Reduce your dependency on the infrastructures that we currently take for granted. Learn to live without them to the extent possible.

"Infrastructure" means any tangible resource that is supplied from a central community service: electricity, water, gas, shipping and transportation, electronic communication, and supplies may be vulnerable to sudden fossil fuel shortages or price spikes. Currently more than 95% of the electricity generated in Indiana is provided by coal, a fossil fuel that is now becoming much harder to obtain and is projected to peak in 2030. Reducing your energy requirements will help extend the runway of available fossil fuels to buy badly needed time for replacement systems to be deployed and it will save you money.

Make a difference by changing your habits

Changing your light bulbs to compact fluorescents, for example, will reduce your electric bill. Even small changes can make a big difference; over the lifetime of each new CF bulb you will save the energy equivalent of 500 pounds of coal as compared to incandescent lighting. A single 100-watt bulb replaced with a 25-watt screw-in compact fluorescent can save you as much as $75 on your power bill over the life of that bulb. If you are off-grid, it can save you up to $400 in photovoltaics. A typical compact fluorescent replacement for a 300-watt halogen light will save approximately $20 per year if used 3 hours per day on average.

Increasing the insulation in your home and using manual machinery instead of electric or gas-powered devices will reduce energy consumption and costs as well. Visit the hardware store. Buy a water-heater blanket, low-flow showerheads, faucet aerators, and compact fluorescents, as needed. Low-flow shower heads reduce the water bill and consumption so that city pump demand is reduced. How much electricity can be saved through efficient use? Most existing houses can be modified to cut their electricity use by half, repaying the retrofitting costs in a few years, and with minimal effort. Planting shrubs, bushes, and vines next to your house creates dead air spaces that insulate your home in both winter and summer. Plant so there will be at least 1 foot (30 centimeters) of space between full-grown plants and your home's wall.

No and Low-Cost Changes Everyone Can Make

Simple changes can make a big difference. The City's Environmental Commission offers some valuable guidance.[1] As the typical household spends $1,900 on utilities[2], BEQI offers that residents can reduce energy costs by 10-50% by implementing relatively simple energy-savings measures. (Please see the chapter on Opportunities for Citizen Action: What Can You Do?) The BEQI Report offers tips such as:[3]

- **Adjust your thermostat**. For every degree that you lower your heat in the 60-70º range, you can save up to 5 percent on heating costs in the winter. Similar savings can be achieved by increasing your thermostat by a few degrees in the summer.
- **Lower your hot water temperature.** Set your water heater to the "normal" or 120º setting.
- **Replace or clean furnace filters once a month.** Dirty filters restrict airflow and increase energy use. Keeping your furnace clean, lubricated and properly adjusted can reduce heating costs by as much as 5 percent.
- **Insulate your water pipes.** Insulating the first five feet of pipe coming out of the top of your water heater can save considerable energy. Pipe insulation is available from your hardware store.
- **Seal air leaks.** Caulk leaks around windows and doors. Look for places where you have pipes, vents or electrical conduits that go through the wall, ceiling or floor. Check the bathroom, underneath the kitchen sink, pipes inside a closet, etc. If you find a gap at the point where the pipe or vents goes through the wall, seal it up. Caulk works best on small gaps. Your hardware store should have products to close the larger gaps.
- **Consider replacing your old gas appliances.** If your gas water heater is over 12 years old, consider replacing it with a newer, more efficient ENERGY STAR model. The best indicator of a water heater's efficiency is the Energy Factor (EF). The higher the EF, the more efficient the water heater. If your furnace is over 15 years old, consider replacing it with an ENERGY STAR rated model that is at least 15 percent more efficient than standard models.
- **Wash only full loads** of dishes and clothes.
- **Air dry dishes** instead of using your dishwasher's drying cycle.
- **Turn off your computer and monitor** when not in use.

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[1] Bloomington Environmental Quality Indicators Report (BEQI Report) *Energy-Saving Tips*. http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

[2] http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

[3] *Ibid*.

- **Use power strips** for your home electronics, such as TVs and DVD players, being sure to turn them off when the equipment is not in use (TVs and DVDs in standby mode still use several watts of power).
- **Buy ENERGY STAR home appliances and products.** ENERGY STAR products meet strict efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
- **Use compact fluorescent light bulbs.**

Other recommendations include

- **Wash clothes in cold water.**
- **Take shorter showers**
- **Turn off unused lights and appliances**
- **Unplugging appliances that use energy in "standby" mode**
- **Hang clothing to dry instead of using a dryer.**

In order for renewable energy options to be most cost effective, residents must first reduce energy use as much as possible. Since solar panels are expensive, it makes no sense to pay for the purchase and installation of panels that will produce energy simply to be wasted. Bloomington is fortunate to have available a community organization, Southern Indiana Renewable Energy Network (SIREN) whose mission is to educate citizens about renewable energy and assist in renewable energy projects.[4]

[4] See www.sirensolar.org for more information

Resources for Homeowners

Building America: Related Links for Homeowners
This site provides links to information regarding energy efficient houses, resources from the US Department of Energy, and other helpful websites concerned with energy efficiency.
http://www1.eere.energy.gov/buildings/building_america/homeowners.html

Build It Solar: Solar Energy Projects for Do-It-Yourselfers
A resource which gives suggestions, advice, and information on hundreds of sustainable projects, "from changing a light bulb to building a solar home."
http://www.builditsolar.com/index.htm

Roof Ray: What's Your Solar Potential?
As their website states, "We are a solar array modeling service and community determined to help consumers evaluate solar for their home or business and to create greater awareness for solar overall."
http://www.roofray.com/

Renewable Energy Policy Project: Efficiency
A source of information regarding a number of energy efficiency issues, such as lowering monthly utility bills and suggestions for improving energy efficiency around the house.
http://www.repp.org/efficiency/index.html

Reduce your dependency on the automobile for transportation

Carpool, walk, ride your bike, use the bus, ride a scooter. Campaign for dramatic increases in public transportation. Light rail is a far more energy efficient means of transportation than the several thousand cars and SUVs such services ultimately replace. If you must use your personal automobile or truck, don't travel during peak traffic periods, and consolidate your trips to reduce fuel consumption. Telecommute if possible. Ask your employer if they would consider a 4-day work week at 10 hours per day instead of a five-day work week. Ask if they will support flexible hours so you aren't driving during rush house. Move closer to work or work closer to home. If you own any vehicle that gets less than 20 miles per gallon, it is time to trade it in on a far more economical means of transportation – now, before such vehicles become too expensive.

Buy Local!

It is now said that the average food item travels more than 1500 miles before it ends up on your kitchen table. Think about the source of your food purchases; name-brand prepared foods, cereals, chips and sauces, seafood, fresh produce that is "out-of-season", and so on. Each consumed product or service that comes from outside the local area creates two significant problems: First is the fuel needed to transport those goods, and the second is that your personal income is being exported to other communities for their use, instead of keeping it local to be used to help make your own community sustainable.

For example, if you pay $5 for a quart of strawberries from New Zealand, your money is going to New Zealand, and all those points in between for the transportation companies and fuel providers. If you pay $5 for a quart of strawberries from Bloomington, Monroe County or the surrounding area, that money is kept in the area and reused locally at least once, perhaps numerous times. Think of the difference 100,000 quarts of strawberries would make over one season. Local spending creates an exponential increase in the value of the local economy and reduces dependency on outside suppliers.

Prepare yourself and your family to weather shortages.

Shortages can take many forms and folks usually don't know about them until it's too late. Gasoline shortages are easy to imagine. But what happens if the local grocery store supply companies can't get enough fuel to power their delivery trucks, or can't afford it? Nobody is going to pay $8 for a single head of lettuce, unless that's the only source of lettuce. The grocery stores in America only stock, on average, a three-day supply of goods. For Bloomington's population of 71,000, that's 213,000 meals a day.

Protect your family against shortages by stocking bulk dry goods like rice, beans, wheat, flour, sugar, powdered milk, frequently used spices, dehydrated fruits and vegetables, and so on. A half-years' supply would be a good start and doesn't take up too much room in the garage or pantry. Bulk foods can be stored in sealed 5-gallon buckets to assure freshness. Make sure these foods are adequately sealed and protected from moisture and insects to prevent spoilage. Become accustomed to rotating these supplies -- use the oldest first and restock the

Plant an edible garden.

Fresh vegetables will be worth their price in gold if trucks can't get to the stores. A home vegetable garden may not provide for all of your food needs but having fresh beans, carrots, onions, tomatoes and herbs available certainly can't hurt. Study bio-intensive organic gardening techniques -- a way of dramatically increasing the yields from your backyard garden. Plant vegetables as landscaping features; a bed of cabbages, onions, broccoli and carrots for example, or corn stalks as a privacy screen, or a pole bean teepee. How about landscaping mounds for potatoes or squash or watermelons? Create a fruit-

bearing hedge of grapes, or a closely pruned hedge combination of peaches, apricots, pears, and figs. Berries add a nice touch to breakfasts and deserts. And don't forget to learn how to save seeds for the next season -- use only non-genetically modified (non-GMO), cross-pollinating, or heirloom seeds -- and create compost out of your kitchen and yard waste. Use drip irrigation to save water.

The local agricultural extension service is a good resource for home gardeners. Basic garden tools include a spade, fork, u-bar, hoes and weeding apparatus, garden shears and scissors, a compost pile, and the book, "How To Grow more Vegetables" by John Jeavons -- describing biointensive approaches to vegetable gardening.

Learn to make simple repairs around your home.

You can learn a large number of home repair skills at free classes offered on Saturday's by Home Depot and Loews and dozens of other locations. Can you repair a break in a water line? Repair weather-stripping? Install or repair rain gutters? Repair a tile floor? Learning to handle these skills with manual tools could be a real security issue, not to mention a potential source of future income. It would certainly be a good idea to have a well stocked tool box on hand as well. Basic house tools include various screwdrivers, a claw hammer, adjustable wrenches, various pliers, a basic hand saw, a hand-drill with bits, a heavy-duty pair of scissors, lots of duct tape, rope, cordage, twine, and a spool of wire.

Get to know your neighbors and become good friends.

Close groups of friends and neighbors, especially in a crisis, tend to be far more helpful to each other than strangers. You never know when that help could mean the difference between success or distress. It is generally unrealistic to assume any individual or family can become skilled in every vocation needed to be completely self sufficient. Getting to know your neighbors helps you to find out what they know how to do. Exchange your services. Pool your resources.

Build a Neighborhood Skills Database

Compile a database of who has what practical skills in your neighborhood. You may be surprised at the talents your neighbors have, from general skills like carpentry and gardening to very specific skills like diesel engine repair and child psychology. A skills database is a great way to start relocalizing your community immediately, because it helps everyone access the resources that are right in their own neighborhood. It can help people buy, barter or donate services within the neighborhood, as well as be a resource for education, community projects, and establishing a local currency.

CONCLUSION

The peaking of production in liquid fuels and other energy sources in the near future will re-shape our everyday lives. This is most critical and affects our community most in the areas of sustenance, transportation, land use, housing and municipal services. We must all begin now to build other, more resilient supports for our common life. These supports will consist of understandings, agreements, and assumptions, physical structures, and cultural practices that will recognize lower energy availability not as a problem, but as both an opportunity and a condition to which we must adapt ourselves individually and collectively.

Many of us need to become part-time farmers and water harvesters, to learn some effective health practices, and to notice and become responsible for collecting and conserving organic matter everywhere. Many of us must learn how to insulate our homes better. Many of us will have to learn how to better navigate public transit. Many of us will ride our bikes to work and carpool with neighbors to the grocery. Many of us will be required to continue on the path of vigilant resource conservation. Similarly, institutional actors, such as the City will intensive its already-active efforts to foster sustainable community well-being by re-thinking the way it provides services to residents.

Some of these forms of adaptation will be familiar or recognizable as recreations or restorations from past eras, and many have never before been applied. In all cases, the answers we need require us to take greater responsibility for self-provision, for thoughtful cooperation with those around us, and for ever greater attention to the resources and possibilities of our homes, our neighborhoods and our community.

APPENDIX I

COAL: NOT AS PLENTIFUL AS WIDELY BELIEVED
Projected Peak: 2030

Of all the non-renewable fuels, coal is widely believed to be the most plentiful and the one whose production will probably peak the last. It is true that the United States is particularly well-placed with regard to coal reserves, with 120 billion tons of oil equivalent (Btoe) as of 2005. This is almost twice the amount of reserves claimed by its closest rival, Russia, with 69 Btoe.[1] However, there is good reason to doubt the conventional wisdom about coal being available in superabundance.

Unfortunately, estimates of the amount of recoverable coal worldwide are subject to good deal of uncertainty because of the poor quality of reserves data. According to a 2007 report by Germany's Energy Watch Group, "the data quality in general is very poor and the reported data cannot be regarded as a realistic assessment of 'proved recoverable coal reserves,'" and "there is probably much less coal left to be burnt than most people think."[2] Lending weight to this conclusion were huge revisions in reserve assessments by the World Energy Council for particular countries over the past two decades. Examples, for bituminous and anthracite, include the following:

- In 1991, the reserve estimate for China was reduced from 152,831 million tons (Mt) to 62,200 Mt and then not subsequently revised despite rapidly rising production/consumption.

- In 2003, the reserve estimate for Germany was reduced from 23,000 Mt to 183 Mt, a reduction of 99%. This is because, as the Energy Watch Group wryly noted, "large reserves formerly seen as *proven* have been reassessed as being *speculative*."

[1] Energy Watch Group, *Coal: Resources and Future Production* (http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Report_Coal_10-07-2007ms.pdf), Mar. 2007, p. 6.
[2] *Ibid.*, p. 24 and p. 4.

- 1998, the reserve estimate for Poland was reduced from 29,100 Mt to 12,113 Mt. In 2001, it was raised to 20,300 Mt. Then, in 2004, it was reduced again, this time to 14,000 Mt.

In general, the trend has been for coal reserve estimates to be downgraded significantly rather than upgraded significantly, although there have been exceptions. One of the most notable exceptions was an upgrade in the reserve estimate for India in 1990 from 12,610 Mt to 60,098 Mt, and then in four additional steps through 2004 to 90,085 Mt.[3] By 2007, however, the World Energy Council was reporting a reserve estimate for Indian bituminous of only 52,240 Mt[4] after India stopped reporting "in situ" coal and started reporting "recoverable" coal.[5]

The World Energy Council's estimate of total recoverable coal in the world as of the end of 2005 was 847,388 Mt (430,896 Mt of anthracite and bituminous, 266,837 Mt of sub-bituminous, and 149,744 Mt of lignite).[6] Prof. David Rutledge of Caltech believes that the actual amount is considerably lower: 662,000 Mt.[7] Statements to the effect that "We have hundreds of years of coal remaining" are suspect and apt to be rather misleading. We should be very careful about taking such statements at face value. The amount of coal (or oil, or natural gas) remaining is often expressed in terms of a reserve-to-production (R/P) ratio – that is, the estimate amount of remaining reserves, divided by the current year's production. Such estimates can be made for the entire world, for a single nation, or for part of a nation. For example, according to the Indiana Geological Survey, Indiana has about 17.54 billion tons of "available coal resources" remaining:

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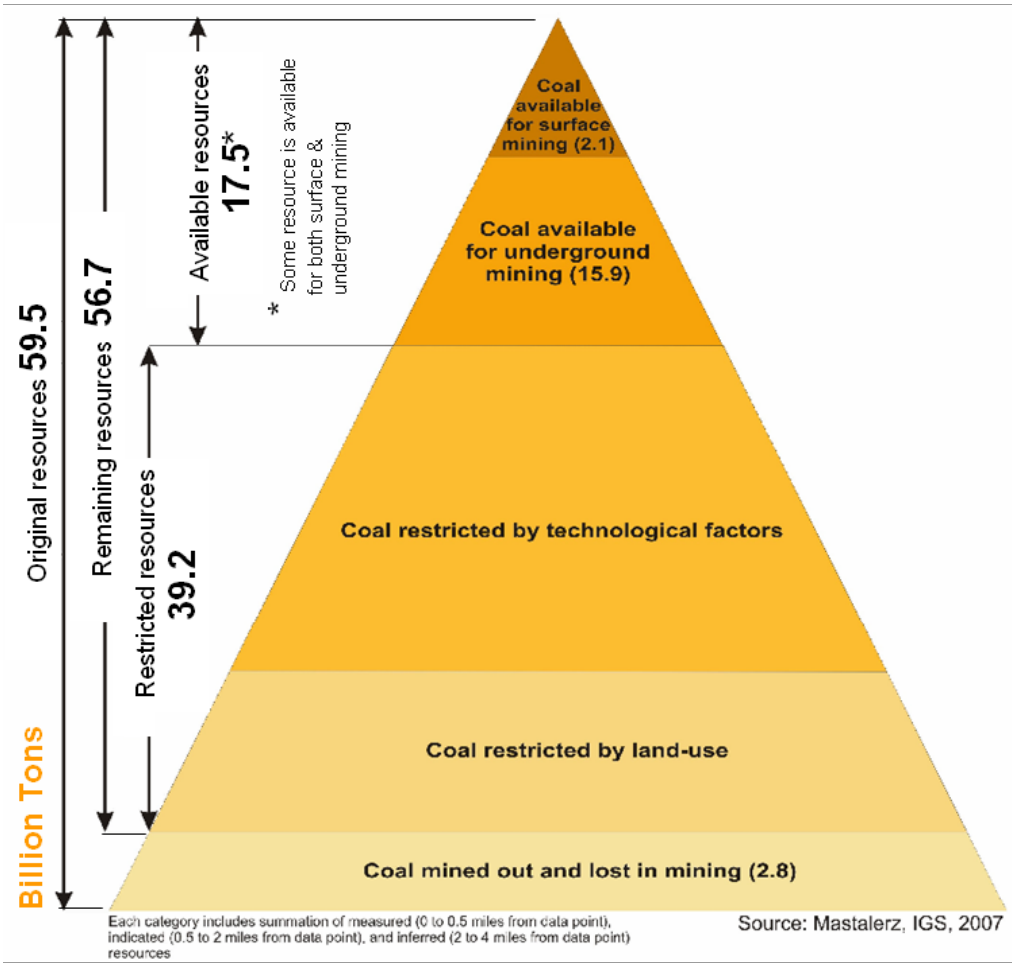
[3] *Ibid*., p. 26.

[4] World Energy Council, *2007 Survey of Energy Resources* (http://www.worldenergy.org/documents/ser2007_final_online_version_1.pdf), p. 10.

[5] *Ibid*., p. 2.

[6] *Ibid*., p. 11.

[7] David Rutledge, *Hubbert's Peak, the Coal Question, and Climate Change*, Watson Lecture at California Institute of Technology, 10/17/2007, http://today.caltech.edu/theater/item?story%5fid=24502



The term "available coal resources" is defined as:

Original coal resources, minus coal mined and lost in mining, minus coal restricted by land use, minus coal restricted by technological factors.[8]

The Indiana Geological Survey states, "Taking into account the current level of coal production in Indiana (approximately 30 million [mln] short tons a year), 17.54 billion tons of coal could last about 585 years."[9] Unfortunately, stated coal R/P ratios are subject to wild fluctuations, depending on revisions in estimates on the

> We have all heard the coal industry's often repeated boast that America is the "Saudi Arabia of coal." The idea that America has 250 years of coal supplies has been repeated so often that has become almost a part of our culture and unfortunately gives policymakers what I believe to be excessive comfort. – Robert A. Hefner, *The GET*, 2009.

[8] Maria Mastalerz *et al.*, *Characterization of Indiana's Co... Physical and Chemical Properties of the Coal, and Present and Potential Uses*, Open-File Study 04-02, Indiana Geological Survey, July 2004, p. 16.
[9] *Ibid*., pp. 23-24.

amount of recoverable coal remaining, and changes in the amount of coal currently being produced. In general, R/P ratios for coal have tended to be adjusted downward rather than upward (in part because, as noted above, there has been a tendency to adjust reserve estimates downward). For example, the earliest R/P ratio estimate for the United States, made in the 1920's, claimed that the U.S. had enough coal to last for over 4000 years,[10] but this calculation was badly flawed, partly because of an exaggerated estimate on the amount of recoverable coal in the country. More recent R/P ratio estimates claim that the U.S. has enough coal to last a little over 200 years. Consider the statement by the Indiana Geological Survey that Indiana coal "could last about 585 years" – a figure reported in the press and taken at face value by the state government -- and examine it carefully. The first thing to note is that it is based on the conclusion by the IGS that Indiana has approximately 17.5 billion tons of "available coal resources." There is a major discrepancy between the 17.5 billion tons of coal reported by the Indiana Geological Survey and the figure currently being reported by the federal Energy Information Administration (EIA): a "demonstrated reserve base" of 9.379 billion tons, and "estimated recoverable reserves" of 4.001 billion tons.[11] Clearly, if the EIA figure is correct, then Indiana's coal would not last 585 years at the current production rate, but considerably less – using a figure of 4.001 billion tons of recoverable reserves, the R/P ratio would point to about 134 years.

When queried about the discrepancy between the Indiana Geological Survey and Energy Information Agency figures regarding Indiana coal reserves, George Warholic of the EIA attributed it to "EIA's current inability to incorporate updated reserve data into [its] existing database" because of lack of funding – an admission that the data provided by the federal agency charged with producing the "official energy statistics from the U.S. government" are perhaps somewhat questionable.

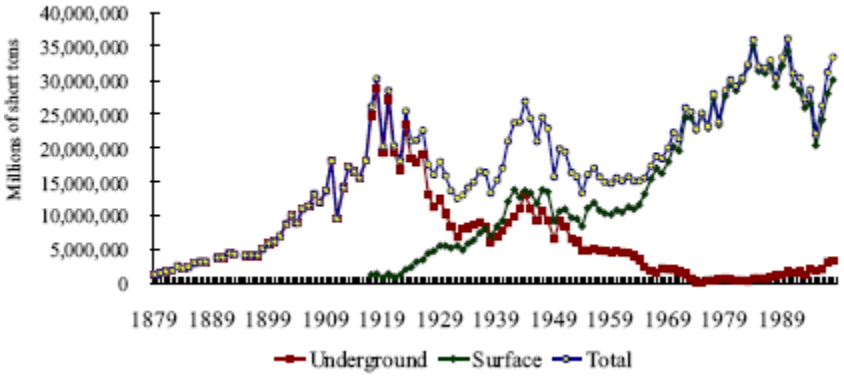
[10] Rutledge, *Hubbert's Peak*….
[11] Energy Information Administration, "Recoverable Coal Reserves at Producing Mines, Estimated Recoverable Reserves, and Demonstrated Reserve Base by Mining Method," Report no. DOE/EIA 0584 (2007), released Sept. 2008 (http://www.eia.doe.gov/cneaf/coal/page/acr/table15.html)

According to Warholic, there was another likely explanation as well: "differences in recoverable reserves definitions." The statement that Indiana has 585 years of coal left at the current production rate comes from a 2004 report by the Indiana Geological Survey entitled *Characterization of Indiana's Coal Resource: Availability of the Reserves, Physical and Chemical Properties of the Coal, and Present and Potential Uses.* Warholic indicated familiarity with this document, and said, "The report does not seem to provide any recovery factors, i.e., the amount of coal recovered from mining the available resources. For Indiana coal production, EIA uses recovery ratios of 41.4 percent for underground and 58.5 percent for surface mines. These recovery factors would substantially deflate the reserve estimate of 17 billion tons."[12] Indeed they would. Assuming that Indiana has 2.0 billion tons of coal "available" for surface mining and 15.5 billion tons "available" for underground mining, then the total amount of coal actually "recoverable" would be, according to the EIA's recovery ratios, 1.17 billion tons from surface mining and 6.417 billion tons from underground mining, or 7.587 billion tons. This is considerably more than the 4.001 billion tons according to the EIA's "official" figures, but considerably less than the 17.5 billion tons according to the Indiana Geological Survey and would point to a R/P ratio that would imply that Indiana has about "254 years" of coal left, not 585 years.

In addition to considering the "reserves" numerator in the R/P ratio somewhat uncertain, we must also note that the "production" divisor, which is subject to change from year to year. Thus, if the production rate goes down, the recoverable coal will last longer, while if the production rate goes up, the recoverable coal will not last as long. Coal production in Indiana has been subject to considerable variation over the past century, rising to one peak during World War I, then falling as production shifted to non-union mines in other states and because of the Great Depression, then rising to a second peak during World War II, then falling into

[12] Personal communication from George Warholic, Energy Information Administration, Dec. 9, 2008.

another trough during the 1950's, and then rising once again to a new and even higher peak, or series of peaks:

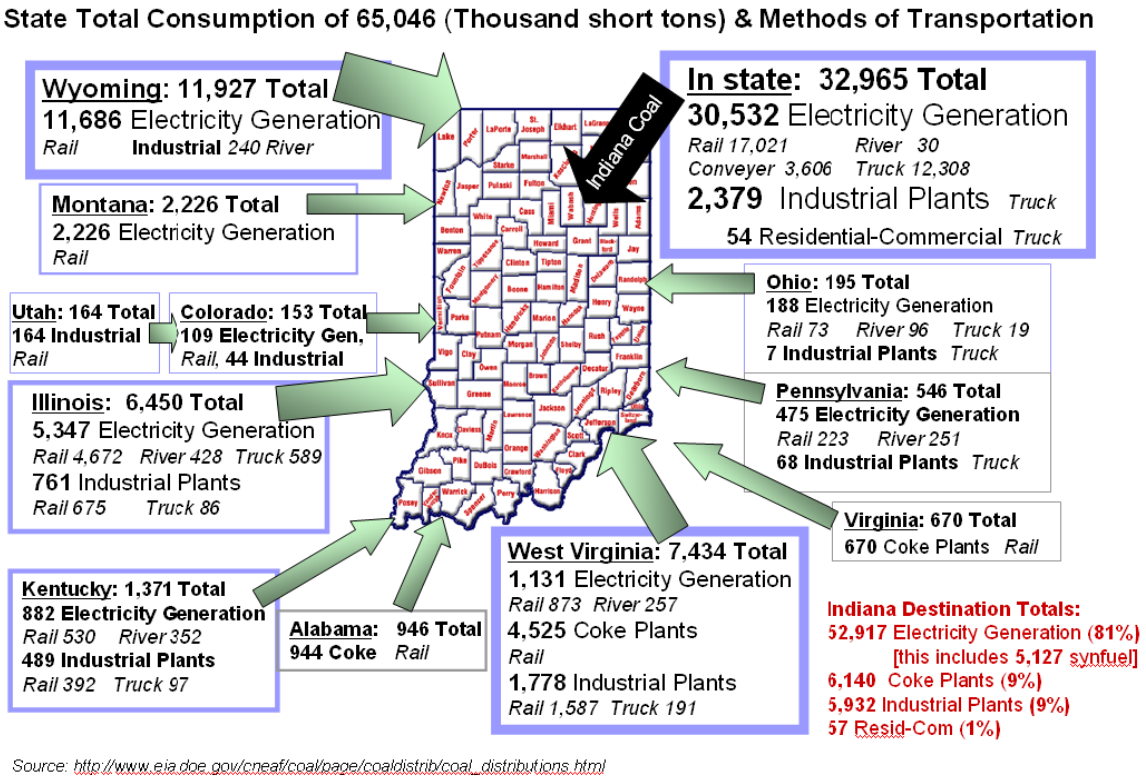


Source: Maria Mastalerz et al., Characterization of Indiana's Coal Resource, 2004, p. 76

After 1990, Indiana coal production took a dip because high-sulfur Illinois Basin coal could not be burned in many power plants due to new federal environmental regulations. Typically, such power plants began using coal from the Powder River Basin of Wyoming instead. This sub-bituminous coal is inferior in heat content to bituminous Illinois Basin coal, but is lower in sulfur. Now, many of the power plants burning Powder River coal have had scrubbers installed to deal with the sulfur problem, and have begun using Illinois Basin coal again. As a result, Indiana coal production is again near an all-time high. In Mar. 2009, Peabody Energy announced that a new mine in Sullivan County that will be the largest surface mine in the eastern United States and will produce 8 million tons of coal per year. This single mine would increase coal production in Indiana by about 25% -- with a corresponding decrease in the amount of time that Indiana's remaining coal can be expected to last.[13]

The statement that "Indiana has 585 of coal remaining at the current rate of production" is apt to be particularly misleading without consideration of the current rate of *consumption*. The fact is that, at least until recently, Indiana has been consuming about twice as much coal as it produces, with most of the "imported" coal coming from the states of Wyoming, West Virginia, and Illinois:

[13] "Indiana Plans Spur to Big Coal Mine," *Trains*, June 2009, p. 13.



Source: http://www.eia.doe.gov/cneaf/coal/page/coaldistrib/coal_distributions.html

If Indiana were required to be self-sufficient in coal, it would (barring a halving of consumption) have to double its coal production, which means that current coal reserves would last only half as long as they would at the present production rate.

Although the prevailing sense is that there is "plenty" of coal left, the Energy Watch Group warns that global production could peak as early as 2020-2025. The EWG is particularly concerned about the supply situation in China, where consumption has been rising especially rapidly over the last decade. It believes that "China will reach maximum production within the next 5-15 years, probably around 2015…. The steep rise in production of the past few years must be followed by a steep decline after 2020."[14] It also believes that "the strongly rising production of China will have a substantial influence on the peak of world coal production. Once China cannot increase its production any more global coal production will peak."[15]

[14] Energy Watch Group, *Coal*…, p.27.
[15] *Ibid*., p. 15.

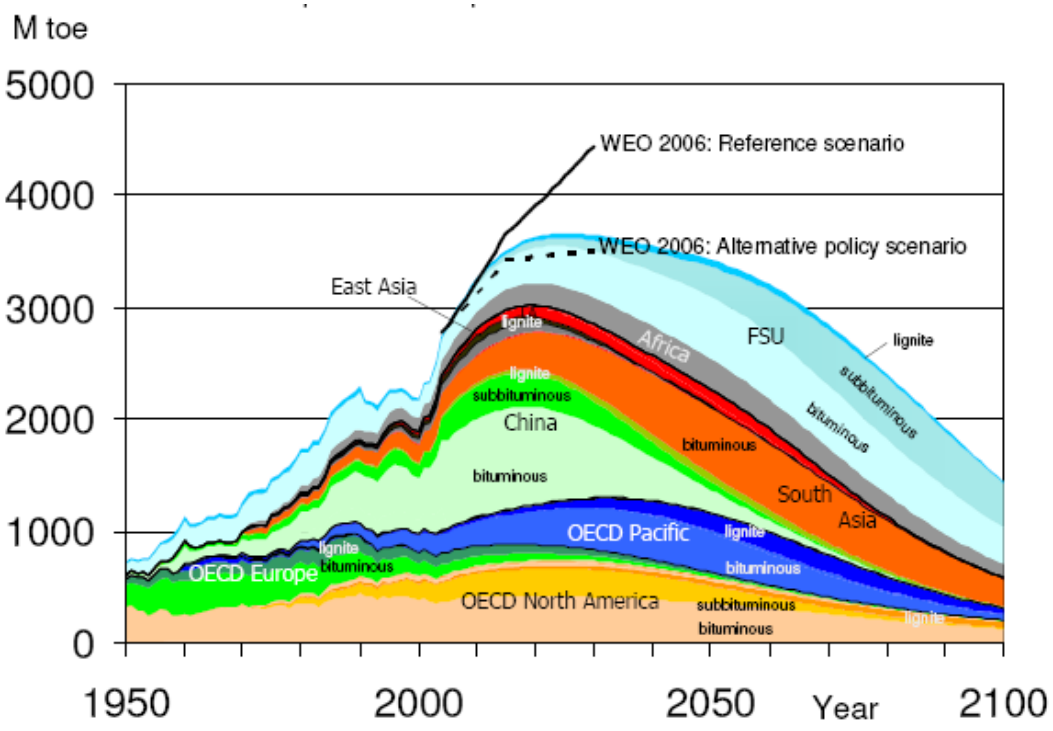
Startling as the conclusion that global coal production will peak by 2020-2025, even more startling is the Energy Watch Group's conclusion that U.S. coal production may *already* have peaked: "Though total production volumes are still increasing due to the

expanding production of subbituminous coal in Wyoming, coal production in terms of energy had already peaked in 1998 at 598 Mtoe [million tons of oil equivalent] compared to 576 Mtoe in 2005."[16] On the other hand, the EWG notes that the U.S. still retains, if the official figures are to be believed, substantial remaining coal reserves in several other states. Its argument that "it is not probable that the huge reserves in Montana, Illinois, Western Kentucky and Ohio will be converted into production"[17] is not entirely convincing. Should global coal production peak early and leave the world hungry for hydrocarbons, it seems unlikely that these reserves would remain untapped. Although the U.S. has ceased to be a net coal exporter and now imports a small amount of coal, it is possible to imagine a scenario in which the U.S. once again becomes a major exporter. For the same reason, although Indiana currently exports only a small amount of coal to power plants in neighboring states, it is possible to imagine a scenario in which Indiana participates in an export boom and significantly increases its production. Should that happen, there would be an increase in the size of the production divisor in the state's R/P ratio, reducing the "number of years" that the state's coal would last. This would especially be the case if demand for coal-generated electricity increases significantly because peak oil causes the world to turn to electric vehicles or coal-to-liquids (CTL) production. On the other hand, the increase in demand could be moderated by rapid penetration of wind- or solar-generated electricity into the marketplace – or, possibly even more likely, as a result of the widespread substitution of natural gas for coal (see below).

A careful recent study of when world coal production will peak is an article by S.H. Mohr and G.M. Evans, "Forecasting Coal Production Until 2100," accepted for

[16] *Loc cit.*
[17] *Ibid*., p. 38.

publication in the journal *Fuel*. According to Mohr and Evans, depending on the actual amount of ultimately recoverable coal in the world, production could "peak between 2010 and 2048 on a mass basis and between 2011 and 2047 on an energy basis. The Best Guess scenario assumed a URR [ultimately recoverable resource] of 1144 Gt and peaks in 2034 on a mass basis, and in 2026 on an energy basis."[18] Given a "best guess" that world coal production will peak in 2026 "on an energy basis," the Task Force feels that it would be prudent to assume that the peak will occur by **2030**. The following projection of future coal production trends by the Energy Watch Group is consistent with the estimate by Mohr and Evans:



Source: Energy Watch Group, *Coal: Resources and Future Production*, Mar. 2007

[18] S.H. Mohr and G.M. Evans, "Forecasting Coal Production Until 2100," http://www.theoildrum/com/node/5256.

APPENDIX II

NATURAL GAS: PLENTIFUL – AT LEAST FOR NOW WHEN WILL IT PEAK?

As recently as 2005, natural gas production levels in North America were stagnant or declining, and it was beginning to appear that its production on this continent had peaked. This was significant because, while natural gas elsewhere in the world, particularly in the Middle East, is still plentiful, transporting it to the United States presents a problem: in its ordinary gaseous state, it cannot not be carried across the ocean in bulk tankers. Transoceanic shipment of natural gas requires that the gas be super-cooled and liquefied, then shipped in special tankers. These tankers require special terminals for loading and unloading. With a potential natural gas shortage in North America looming on the horizon, substantial investments were made to construct liquefied natural gas (LNG) shipping and terminal facilities.

In the past few years, the North American natural gas situation has changed rather dramatically. Instead of going down, production was, until the current recession drastically curtailed demand, actually going up. This development is mainly due to new drilling technologies – horizontal drilling, and hydraulic fracturing ("fracing"). Fracing is a particularly noteworthy development that has made it possible to recover substantial amounts of gas from shale formations previously considered unsuitable for drilling.

A non-profit organization of volunteer experts called the "Potential Gas Committee" (PGC) regularly reviews the U.S. natural situation and issues a biennial assessment of supplies. In June, 2009, the PGC announced its latest report and declared an "unprecedented increase in magnitude of [the] U.S. natural gas resource base" amounting to an increase of over 25% from the previous report. The revised estimate of the "resource base," 1,836 trillion cubic feet (Tcf) is "the highest resource evaluation in the Committee's 44-year history," and the committee pegged

the nation's "total available future supply" at 2,074 Tcf. The committee asserted, "Consequently, our present assessment demonstrates an exceptionally strong and optimistic gas supply picture for the nation."[1]

This announcement was immediately followed by a press release from T. Boone Pickens, who declared,

> Today's report substantiates what I've been saying for years: there's plenty of natural gas in the U.S. I launched the Pickens Plan a year ago to help reduce our dangerous dependence on foreign oil, and using our abundant supply of natural gas as a transition fuel for fleet vehicles and heavy-duty trucks is a key element of that plan. On the same day this report is going out, diesel prices are again on the rise, squeezing the trucking industry. Now more than ever we need to take action to enact energy reform that will immediately reduce oil imports. The 2,074 trillion cubic feet of domestic natural gas reserves cited in the study is the equivalent of nearly 350 billion barrels of oil, about the same as Saudi Arabia's oil reserves.[2]

The famous "Pickens Plan," launched with so much fanfare in July 2008, calls for the substitution of wind energy for natural gas in electricity production so that the natural gas can be diverted for use as a transportation fuel. However, efforts to find financing for Pickens' wind project collapsed along with the credit markets. By January 2009, Pickens declared that "the wind stuff is deader than hell right now."[3]

Where Pickens advocates diverting natural gas from electricity production to transportation, climate change activist (and former Acting Assistant Secretary of Energy for Energy Efficiency and Renewable Energy) Joseph Romm is pushing an almost opposite strategy. Romm wants to use our apparently plentiful gas supply as a "climate action game changer": "Natural gas alone could essentially meet the entire

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[1] "Potential Gas Committee Reports Unprecedented Increase in Magnitude of U.S. Natural Gas Resource Base," http://www.mines.edu/Potential-Gas-Committee-reports-unprecedented-increase-in-magnitude-of-U.S.-natural-gas-resource-base.

[2] "T. Boone Pickens Statement on Surge in Estimated Natural Gas Reserves," http://www.pickensplan.com/news/2009/06/18/t-boone-pickens-statement-on-surge-in-estimated-natural-gas-reserves/.

[3] Neil King, Jr., "Pickens's Windmills Title Against Market Realities," *Wall Street Journal*, Jan. 13, 2009, http://online.wsj.com/article/SB123180966118075887.html?mod=googlenews_wsj.

Waxman- Markey CO_2 target for 2020 – without requiring gobs of new power plants to be sited and built or thousands of miles of new transmission lines. There is simply no doubt that, other than energy efficiency and conservation, the lowest-cost option for achieving large-scale CO_2 reductions by 2020 is simply replacing electricity by burning coal with power generated by burning more natural gas in the vast array of currently underutilized gas fired plants…. Natural gas is the cheapest, low-carbon baseload power around."[4] The Task Force is cautiously optimistic that recent upward revisions in the estimated U.S. natural gas resource base are reasonable, and cautiously hopeful that they are not wildly misleading. While natural gas is certainly not a zero-carbon fuel, compared to petroleum, and certainly compared to coal, it produces far less carbon dioxide.[5] It is less polluting in other ways as well. What is unclear is whether it is now *so* abundant that we could easily use it to phase out most of our coal-fired power plants and at the same time run half our existing auto fleet on it – that is, to pursue Pickens' vision and Romm's vision simultaneously.

While natural gas now appears to be plentiful, no one should be deceived into believing that it will permanently "solve" our energy problem. Oil production is peaking now, and at some point, natural gas production will surely do so as well. However, because of the uncertainty surrounding the extent of the world's natural gas supplies, it is difficult to assign a very precise date to "peak natural gas." In 2006, Jean Laherrere estimated that natural gas production would peak around 2030.[6] Laherrere is a petroleum engineer who, with his colleague Colin Campbell, published the article "The End of Cheap Oil" in *Scientific American* in 1998. This

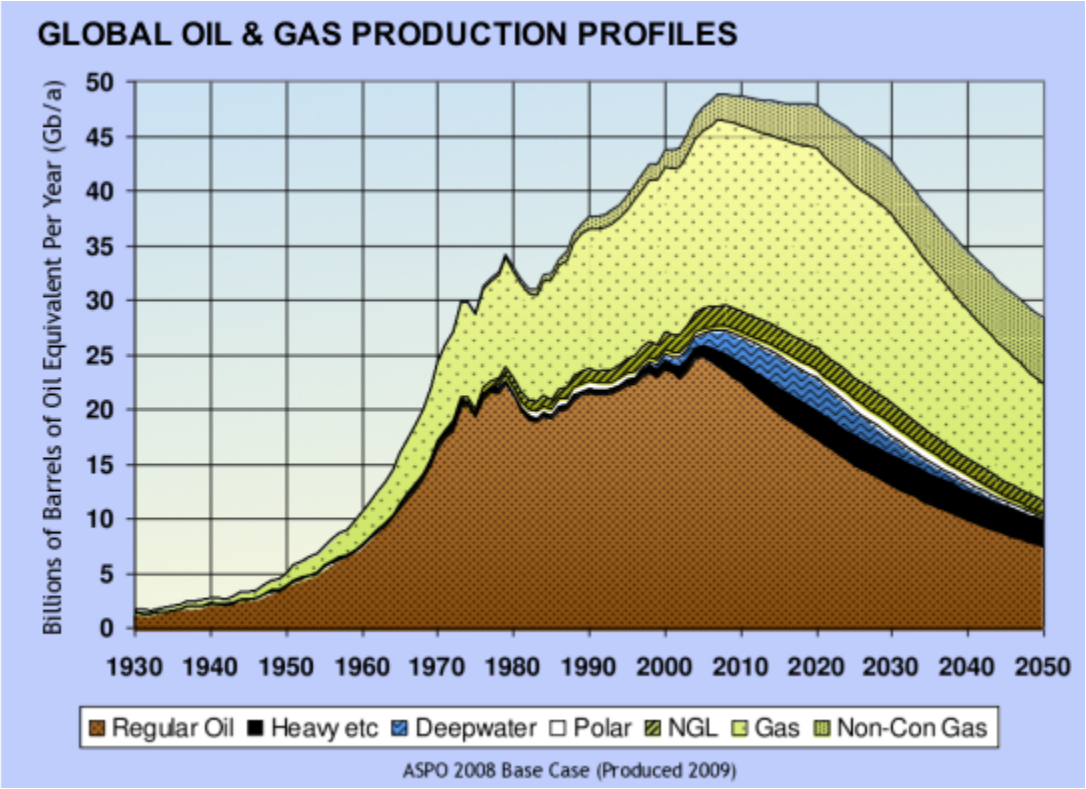
[4] Joseph Romm, "Climate Action Game Changer, Part 1: Is There a Lot More Natural Gas than Previously Thought?" June 3, 2009, http://climateprogress.org/2009/06/03/climate-action-game-changer-unconventional-natural-gas-shale/.

[5] "The best natural gas power plants produce less than half as much carbon dioxide per kWh of electricity as coal fired plants." Craig A. Severance, "Game Changer 3: New Natural Gas Supplies – Great for Low-Cost Climate Action, Bad for Coal," http://climateprogress.org/2009/06/25/game-changer-3-new-natural-gas-supplies-great-news-for-low-cost-climate-action-bad-news-for-coal/.

[6] Jean Laherrere, "Oil and Gas: What Future?" (paper presented at Groningen Annual Energy Convention, Nov. 21, 2006), pp. 22-23.

article signaled the genesis of the subsequent increased attention to the peak oil phenomenon. We consider Laherrere's work to have a considerable degree of credibility, and thus are inclined to accept his date of 2030 for the peak in natural gas production. However, it may not take sufficient account of the potential of non-conventional gas.

The following graph from the Association for the Study of Peak Oil and Gas Ireland shows historical oil and gas production, with a projection for future production through 2050. It appears to be compatible with the Laherrere estimate of peak natural gas around 2030. It shows the world to be on an oil-and-gas plateau sloping very gradually downward until about 2020, when the decline becomes much steeper. It is important to note that the most of the decline is accounted for by falling oil production. The decline in natural gas production is much more modest.



Source: ASPO Ireland

Putting it all together: “peak energy” by 2030?

In summary, we think that the following dates for the peaking of the various fossil fuels are plausible:

- Oil: 2008-2015
- Coal: 2030
- Natural gas: 2030(?)

A question mark is placed after the 2030 projected date of peak natural gas, to allow for the possibility that a peak may occur later if recent optimistic evaluations of the magnitude of the non-conventional gas resource prove correct.

If all of the three fossil fuels peak in production by 2030 (or well before, in the case of petroleum), we think it would be quite difficult for world energy production to grow for very long after that point, even allowing major increases in renewable energy production -- and possibly nuclear energy as well.

APPENDIX III

Vehicle Ownership per Person in Monroe County

Owner-Occupied Houses/Condos				Renter-Occupied Apartments				
		Total				Total		**TOTAL VEHICLES**
no vehicle	762	0		no vehicle	3,001	0		**0**
1 vehicle	6,992	6,992		1 vehicle	10,393	10,393		**17,385**
2 vehicles	11,310	22,620		2 vehicles	5,793	11,586		**34,206**
3 vehicles	4,449	13,347		3 vehicles	1,505	4,515		**17,862**
4 vehicles	1,266	5,064		4 vehicles	656	2,624		**7,688**
5 or more	519	2,595		5 or more	252	1,260		**3,855**
Households	**25,298**			**Households**	**21,600**			**80,996**

Total # of Households		**46,898**
Total # of Households with no vehicle:		**3,763**
Percent of households with no vehicle:		**8.02%**
Population size Monroe County (2000)		**120,563**
Number of Vehicles	**>**	**80,996**
Monroe County Vehicles per person:	**>**	**.6718**
United States -- vehicles per 1000 people		**754**

Source: 2000 U.S. Census