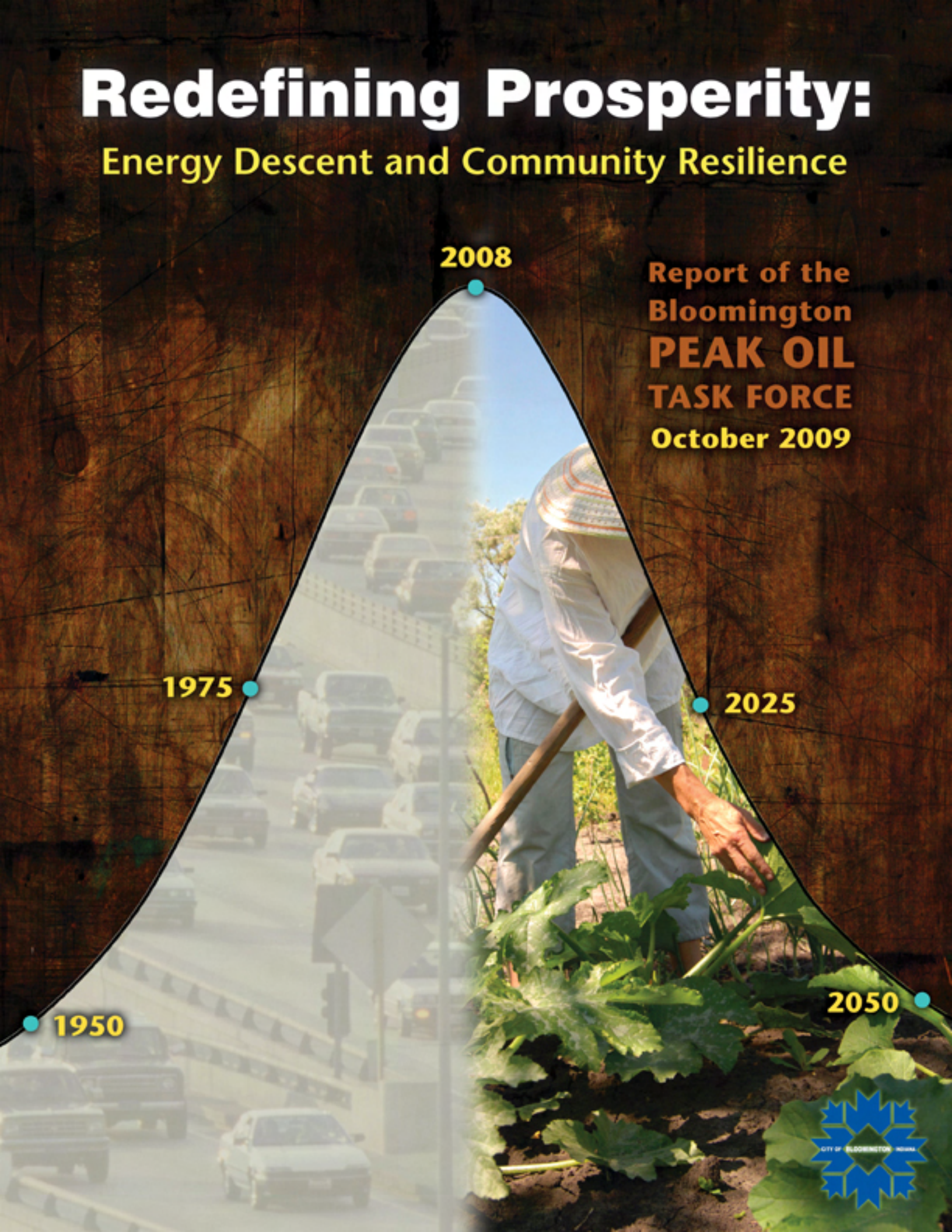
Redefining Prosperity:

Energy Descent and Community Resilience



Report of the Bloomington

PEAK OIL TASK FORCE

October 2009

Redefining Prosperity:
Energy Descent and Community Resilience
Report of the Bloomington Peak Oil Task Force

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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 and 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 ● non-cotton shirts ● 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.*

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* Over 500,000 products use oil or oil by-products as an ingredient in their production. *Source*: Gary L. Stringer, Northeast Louisiana University

This report is dedicated to Colin J. Campbell, whose research and lectures on the coming world oil peak inspired many of us to begin transition planning.

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Preface

Our society is reaching a turning point. Very soon, perhaps already, a key energy and material resource will reach a historic transition. This point, known as "peak oil," will usher in a new age – of declining capacity to supply society with an energy source unmatched in energy density, net energy return, scale, and ease of use.

Peak production has occurred before in fields, regions and nations – the United States offering the most famous example – but now we stand poised to peak globally. Because oil is a finite, non-renewable resource, a worldwide decline in production is inevitable.

Peak oil will necessitate many changes in society. It is difficult to imagine how we can continue a transportation-intensive culture without this key resource. Similarly, most of industrial agriculture relies on fossil fuel inputs. Indeed, oil is a feedstock of a truly massive array of products. And economic growth, entailing ever-greater throughput of materials and increasing consumption, has depended on expanding energy availability.

The consequences of oil production decline are therefore serious. It may be difficult to fully grasp and acknowledge the implications. Can the future be so different than today? Ten years ago, few would have predicted the collapse of a paramount blue chip institution such as General Motors. And few astute political commentators would have predicted the election of an African American President of the United States. The collapse of the former Soviet Union and the rise of global communications via the internet are also testaments to rapid change in a very short time.

The changes implied by peak oil are immense, and thus will require preparation and planning commensurate with the size of the problem.

The transition to a post-peak oil world will likely entail the shortening of commercial and trade supply lines and the relocalization of essential community needs, such as food production. Products that require little oil in their composition and manufacturing will be favored. We will have to develop and employ new technologies that are both environmentally benign and based on renewable resources and energy. There will also be a need for skills that have been neglected in the age of cheap energy, and knowledge thought to be outdated and obsolete. Prosperity may take on new meaning – from a simple metric of accumulated money to a broader meaning of community well being, security, and commonwealth.

On the most basic level, peak oil, climate change, and a host of other environmental crises require that we recognize and live within the limits of our biosphere. This is the challenge and opportunity that we have before us today. We hope that this report contributes to a prosperous and resilient future.

Dave Rollo
Chair, Bloomington Peak Oil Task Force

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Each Task Force member assumed responsibility for drafting a section of the report.

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- Land Use (Gregory Travis)
- Transportation (Christine Glaser)
- Housing (Stephanie Kimball)
- Sustenance (Peter Bane)
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The findings and recommendations herein are solely those of the Task Force and do not necessarily reflect those of any other individual, department, institution, or agency.

Any errors are those of the Task Force.

EXECUTIVE SUMMARY

Oil infuses just about every aspect of our lives. We rely on cheap oil for everyday necessities such as transportation, food, clothing, and electricity. However, oil is a non-renewable resource. It is widely acknowledged that the world has reached, or will soon reach, the point at which oil production is at its maximum, or peak. Once the world reaches peak oil production, we will not run *out* of oil but we will run *short* of oil. At that point, the price of oil will rise and become more volatile. Given the systemic nature of oil, a decline in the availability of cheap oil will have implications for all aspects of society.

The Bloomington Peak Oil Task Force was charged with assessing Bloomington's vulnerability to a decline in cheap oil and developing researched and prudent strategies to protect our community. Since March 2008, the Bloomington Peak Oil Task Force has met bi-weekly to discuss ways in which our community might be made more resilient in the face of peak oil. Specifically, the Task Force examined the following community systems: municipal services, transportation, land use, housing, sustenance, and the economic context.

The Task Force envisions a post-peak Bloomington wherein most residents live within walking distance of daily needs; most of the food required to feed residents is grown within Monroe County; residents can easily and conveniently get where they need to go on bike, foot or public transit; most of the community's housing stock is retrofit for energy efficiency; and local government provides high-quality services to its residents while using less fossil fuel energy.

While peak oil presents our community with serious challenges, it also presents us with an opportunity to make a great community even better.

The following is a representative, but not exhaustive, review of vulnerabilities and strategies identified by the Task Force:

Economic Context. Bloomington and Monroe County are clearly part of both national and global economies and our reliance on a steady supply of inexpensive goods from as far away as half-way around the world makes us vulnerable to a decline in inexpensive oil.
Mitigation:

- Promote economic relocalization through "Buy Local!" initiatives; encourage a Local Exchange Trading System and cooperate with *Transition Bloomington*.
- Examine sector dependence on oil.
- Develop and deploy sustainable forms of energy.
- Develop and promote green jobs.

Municipal Services. As the price of oil both becomes more volatile and more expensive, so too 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. Similarly, the City will also experience a general increase in cost of just about anything that relies on energy to produce and transport it.
Mitigation:

- Explore hybrid energy (hydroelectric-solar) generation to complement existing power at the water treatment plant.
- Encourage more rainwater capture by residents and the City.
- Offer energy efficiency and water conservation incentives to residents.
- Expand water storage capacity.
- Transition all back-up generators to renewable sources of energy.
- Develop a community compost program.
- Establish waste reduction goals -- *Zero Waste Bloomington* by 2040.
- Explore sludge-to-biogas energy generation at the wastewater treatment plant.
- Develop a fuel allocation plan wherein, in the event of a fuel shortage, the Police and Fire Departments are given greatest priority.
- Replace patrol cars with electric vehicles.
- Investigate police pursuit vehicles that do not rely on fossil fuels and transition over to such vehicles as this technology improves.
- Explore alternatives to asphalt.
- Offer carpooling incentives to employees.
- Reduce the size of the City fleet though partnerships with car sharing groups.

Transportation. Of all sectors, transportation is the most petroleum dependent and the most vulnerable to a disruption resulting from declining world petroleum supplies. Ninety-seven percent of transportation energy is reliant on fossil fuel. In Monroe County, we drive approximately 2.8 million miles *per day*. That's like driving one car around the Earth at the equator 112 times in one day.

Mitigation:

- Bring daily necessities closer to where people live.
- Establish ride and car sharing programs.
- Increase connectivity & the number of planned "lengthy corridors" for bicyclists.
- Make bus transportation faster and more attractive.
- Seek funding improvements for Bloomington Transit.
- Encourage Bloomington Transit to transition its bus fleet from one relying on diesel fuel to one relying on locally-produced biogas.
- Work toward a regional Comprehensive Land Use and Transportation Plan involving the City of Bloomington, Monroe County, and Indiana University that fosters bicycle, pedestrian, and transit-friendly changes in land use.
- Encourage commuter rail between Bloomington and other cities.
- Encourage bus service between Bloomington and downtown Indianapolis.

Land Use. When it comes to land use, the physical separation of where we live from where we carry out the activities of everyday life – work, food, school, health care, and community – is by far the biggest threat posed by the end of cheap oil.

Mitigation:

- Through zoning and other land management tools, encourage the redistribution of land to bring about denser living arrangements, and a closer integration of residential and commercial activity, thus reducing the total amount of intra-city transportation required. We must restructure our community to provide high-density, multi-use arrangements friendly to transit, bicycles, and pedestrians.
- Update the City's land use documents with an eye to peak oil.
- Target public transit routes to help shape neighborhood development**.**

Housing. An aging grid, paired with the likelihood that more and more people will turn to electricity to power their cars, means that the grid will be increasingly taxed. In Indiana, the grid is powered by coal-generated energy. Coal relies on oil for extraction and transportation. Absent efficiency improvements, it will be ever-more expensive to heat our homes.

Mitigation:

- Engage in outreach to reduce energy demand through conservation.
- Work to retrofit 5% of homes for energy efficiency per year.
- Explore the possibility of local power generation from renewable sources.
- Establish loans and incentives for installation of renewable energy.
- Create incentives to make rental units more energy efficient.

Sustenance can be understood as the maintenance and nurturance of health and life. The elements of sustenance include: food, water, waste handling, and health care. At present, these elements are provided by private companies, government, and publicly-owned corporations and are entirely dependent on petroleum. Indeed, less than 2 percent of the food consumed by city residents is produced within the city, its surrounding region or the state.

Mitigation:

- Work closely with the private sector and Indiana University to outline a detailed plan for community food security. Adopt a *Food Security Resolution*.
- Plant edible landscapes on public property.
- Organize City-led horticultural services to include the collection, processing, and distribution of organic waste.
- Increase local food storage.
- Train and deploy more urban farmers.
- Remove or reduce legal, institutional, and cultural barriers to farming within and around the city, and open institutional markets to local food.
- Establish food-business incubator programs with access to community kitchens.
- Dedicate public land to intensive gardening and farming.
- Work toward a year-round regional farmers' market.
- Work toward the establishment of a local land trust for the banking of farmland.
- Work toward providing more local or regional organic food to Monroe County Community School Corporation, Indiana University, Ivy Tech, and Bloomington Hospital.
- Create a local, publicly-controlled seedbank.
- Encourage water conservation through outreach and incentives.
- Create community composting sites.
- While the City has little direct influence over health care, it can work with stakeholders to advocate for a health care system that is resilient even in the face of peak oil. Specifically, as a community we should: encourage a mobile medical corps for house calls; encourage more neighborhood health clinics and doctors' offices; and support a concentration of essential medical services to remain in the central city location accessible by public transit and pedestrians.

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 often invisible, component of our everyday lives.

Cheap oil has allowed us to achieve great economic benefit, enabling us to enjoy inexpensive 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. Ninety-five percent of our transportation infrastructure relies on petroleum.

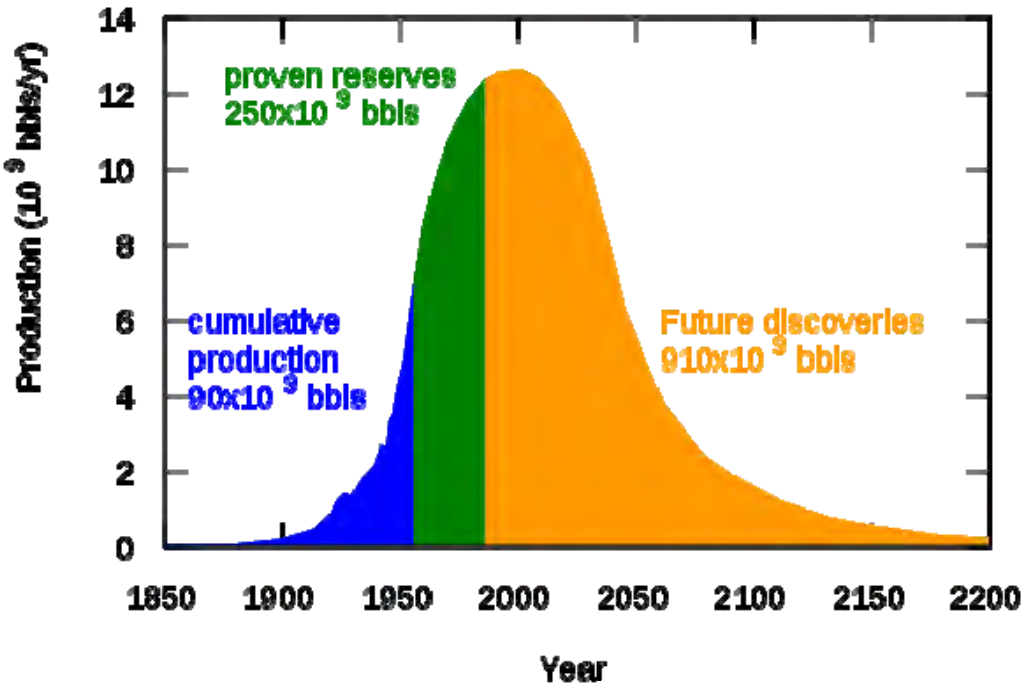
However, oil is also finite. Most of the oil the world now consumes consists of biological material deposited at the bottom of ancient shallow seas between 90 million and 150 million years ago. While nature can and eventually will produce more oil, it will do so only very slowly and on a time scale that 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.

WHAT IS "PEAK OIL"?

Given the finite nature of oil, 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. Attributed to 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 the oil runs out, the difficulty and cost of extraction will have risen so far that it will no longer be possible to increase the rate of production. Instead of increasing, 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 such as oil does not proceed in this way.

In reality, what happens is that the oil which is high quality, easy to find and readily processed is used 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 a peak and then transitions into decline. During the decline phase, oil production continues to fall as the remaining sources become more and more difficult to extract. M. King 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 – world oil production did not actually peak quite as early as 2000 – but he was remarkably close.



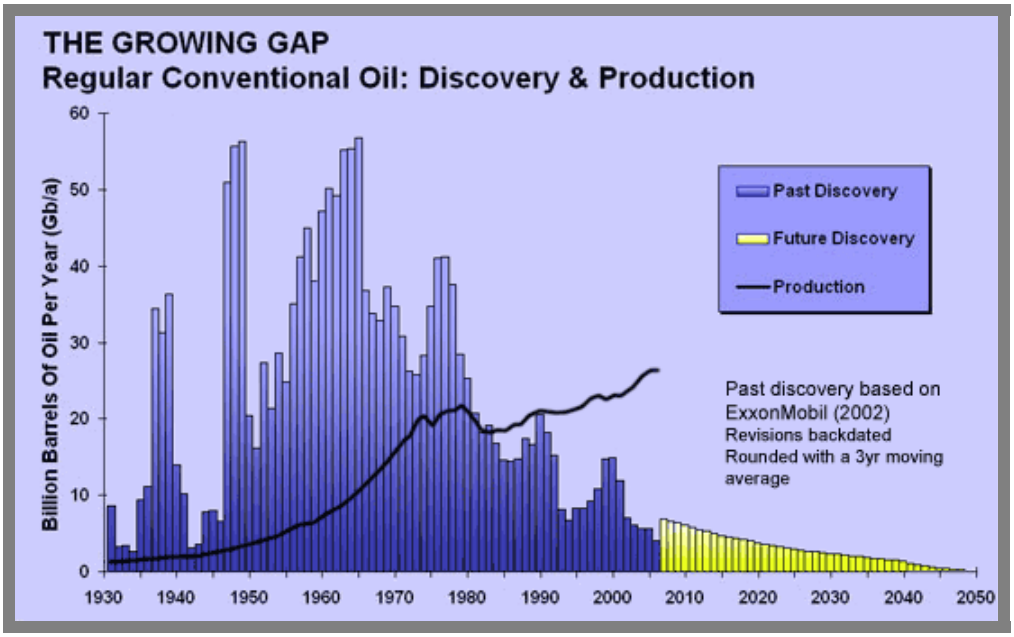
The "Hubbert Curve." Decades ago, Hubbert predicted oil production would peak in 2000. It turns out Hubbert was not exactly right, but pretty close. Source: Wikimedia Commons

When this Task Force began its work in March 2008, there was a sense that the peak might still be a few years away. However, it is now clear that peak may have arrived while we went about our 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 through 2008, despite a record oil price of $147 a barrel recorded in July. That month, 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*. In fact, oil production is down significantly. The Organization of Petroleum Exporting Countries (OPEC) in particular has reduced its output in an attempt to set a bottom limit to the price. In the meantime, exploration for new oil fields and much 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 will 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 now discovering less and less new oil. Indeed, the rate of production has been outrunning the rate of new discovery 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. Many 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 output – 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]

[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.

Other observers believe that peak oil might not 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]

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

- Charlie Maxwell, energy expert from *Barron's* magazine, 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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[2] Tom Nicholls, "The Peak is Nigh" [interview with Kjell Aleklett], *Petroleum Economist*, April 2008, 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," February 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 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 to 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] US General Accounting Office, *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 agrees that the date of peak will turn out to be somewhere between 2008 and 2015 – most likely 2008. It is clear that peak oil is either here or right around the corner. Now is the time to collectively implement measures to reduce our reliance on petroleum.

RATE OF OIL DEPLETION

So what happens after production peaks? Production obviously declines 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.[10] The rate at which the world has been burning through oil is sobering. Although oil production began as far back as 1859, by 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.
- 37% of all the oil that had ever been produced had been produced since 1990.[11]

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[7] Allianz, *Energy Future: A Significant Period of Discomfort, Interview with Robert Hirsch*, June 2008. http://knowledge.allianz.com/en/globalissues/safety_security/energy_security/hirsch_peak_oil_production.html

[9] *The Oil Depletion Protocol*, http://www.oildepletionprotocol.org/. Please see *Appendix I* for a discussion of factors that affect global decline rate.

[10] Nicholls, *loc. cit*.

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

Given the enormous rate at which the world has been burning its way through oil 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 oil in the world will be consumed over the course of the next few decades. If the downslope of the global oil production curve resembles the upslope, 90% of the world's remaining recoverable oil will be gone within 50 years of the peak – in other words, within roughly 50 years of the present.

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 re-think our individual and community habits to radically reduce our reliance on oil.

STRATEGIES THAT WILL NOT SOLVE THE PROBLEM

As the discourse on "peak oil" intensifies, 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 reasons explained below, the Task Force considers some of the most popular proposals – drilling in the Arctic National Wildlife Refuge, mining oil shale and biofuels – as intrinsically limited and flawed.

Arctic National Wildlife Refuge (ANWR)

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 years to bring it into production.

What's more, it is highly unlikely that ANWR could produce anywhere 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 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, 186.

By the time ANWR oil came into production, it is likely that world production will already be in steep decline. The additional 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, becomes depleted.

[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

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

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. 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. However, unless the "Law of Receding Horizons" is somehow repealed, no oil will be produced in commercial quantities from U.S. oil shale, ever.

[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*, February 2007 (http://www.gao.gov/new.items/d07283.pdf), 55.

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 been, up to this point, largely 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 due 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 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 viewed 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 potential. 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]

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

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

[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), 10.

[18] Robert M. Boddey *et al.*, "Bio-Ethanol Production in Brazil," in Pimentel, ed., *Biofuels, Solar and Wind*, 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*, 361.

One of the major problems associated with the production of ethanol from corn is that it drives up the price of corn and the price of food for consumers. In fact, 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] Furthermore, because industrial agriculture relies so heavily upon petroleum inputs, we are likely to experience lower grain productivity post peak.

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

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 peak in the near future, likely within a couple of decades. As more and more people switch to electricity to power their cars and heat their homes, the peaking of both coal and natural gas will also affect the way we go about our individual and collective lives. In Indiana, most of our electricity is generated by coal-burning power plants. The Task Force took a very close look at coal and projects that world coal production might peak around 2030, and that world natural gas might also peak at about the same time. Both of these issues are discussed in detail in *Appendices II and III*.

[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.

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 the community's vulnerability to changing energy markets and to develop researched and prudent mitigation strategies. The *Resolution* called for the Task Force to document its findings in a report for approval by the Mayor and City Council.

Beginning in March 2008, the seven members of the Task Force met bi-weekly to work through vulnerabilities and possible solutions. Early on, the Task Force decided to parse its work into the following subjects: The Economic Context, Municipal Services, Land Use, Transportation, Housing, and Sustenance. Each Task Force member assumed responsibility for a particular subject-matter area. The Task Force approached each of these subject areas with a three-pronged analysis. First, the group collected 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.

The Task Force has aimed to make its work as transparent as possible. Members of the Bloomington community frequently attended our meetings. For those unable to attend, Task Force meetings were broadcast via our local Cable Access Television Service since August 2008. Members of the Task Force have also given several public talks.

GUIDING PRINCIPLES

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

- **SUSTAINABILITY**. Recommendations should be sustainable. That is, they should foster environmental integrity, equity, and economic health. They should also be more than mere short-term fixes. Recommendations should work indefinitely, or at least for a very long time.

- **ACTIONABILITY**. 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 explore change immediately, understanding that it may take years to fully implement a recommendation.

- **A FOCUS ON CONSERVATION**. While the Task Force's recommendations call for greater efficiencies and, occasionally, new energy sources, most of the recommendations focus on reducing oil consumption. The Task Force maintains that a lot of the oil we use is wasted. We do not need to use all the oil we do to have happy, prosperous, and fulfilling lives. To the extent that much of our current oil consumption is frivolous, initial steps at conservation should be immediately actionable.

ENDORSEMENT 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 endorsed 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] The intent of the *Protocol* is to reduce competition among nations for scare resources and to help communities prepare for oil price shocks and shortages. Notably, the Bloomington Common Council supported the adoption of a global oil depletion protocol in 2006 with *Resolution 06-07: Recognizing the Peak of World Oil Production.*

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 an achievable goal. Not only will reducing petroleum consumption make the community healthier and more sustainable, it will save us all money.

[21] See *Oil Depletion Protocol*. supra note 9.

VISION

The recommendations herein are intended to envision a *resilient* and *prosperous* community while we collectively descend the peak of energy production. In so doing, the Task Force uses terms that might be new to some, and uses other terms in ways that are a little different from conventional understandings. We define these key terms as follows:

ENERGY DESCENT: The irreversible decline of net energy available and the accompanying transition from a high to a low fossil fuel use community. [22]

RESILIENCE: The ability of an ecosystem – from an individual to a whole community – to maintain its integrity and ability to function in the face of change and shocks from the outside. Resilient systems can roll with external changes and adapt as needed.

PROSPERITY: Our ability to flourish as individuals and as a community under energy constraints and within ecological limits of the planet. "Prosperity is about things going well for us – in accordance with (*pro*-in the Latin) our hopes and expectations (*speres*)… But prosperity is not synonymous with income or wealth."[23]

This *Report* is intended to be a guiding document; it is advisory in nature. The Task Force makes no claim that our recommendations provide all the answers; indeed, we hope and expect that the community will have numerous innovative ideas to add. However, we do think that the ideas we propose here provide a good start.

Certainly, preparing for peak oil presents our community with unprecedented challenges. However, it also presents us with unprecedented opportunity. While the recommendations that follow are primarily aimed at "powering down" our energy consumption, they also promise non-energy benefits such as reduced environmental impacts, greater savings for residents, improved quality of life and greater interaction among community members. Indeed, while individual preparation for peak oil is certainly important, the greatest way to prepare for peak is to work together toward a community solution. Peak oil presents us with an opportunity to make a great community even better.

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

[23] Tim Jackson, *Prosperity Without Growth? The Transition to a Sustainable Economy* (*s.l.*: [U.K.] Sustainable Development Commission, Mar. 2009), http://www.sd-commission.org.uk/publications/downloads/prosperity_without_growth_report.pdf, 16

NEXT STEPS

This *Report* outlines a number of recommendations that call upon the City to act. Some recommendations are relatively simple and can be implemented in the near term; others are considerably more complex and call upon the City to explore the issue further in the interest of realizing a long-term goal. Many of the suggestions call for action by City departments and require the expertise of City staff. A team of City staff should be charged with addressing the Task Force's proposals. The team might wish to delegate some ideas to City entities whose missions align, in part, with those of the Task Force, such as the City of Bloomington Commission on Sustainability (BCOS), the City's new Sustainability Director, the Environmental Commission, and Team Process. We leave it up to the best judgment of the City Administration (with feedback from the City Council) how to build such a team.

AN EXAMINATION OF COMMUNITY SYSTEMS

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.

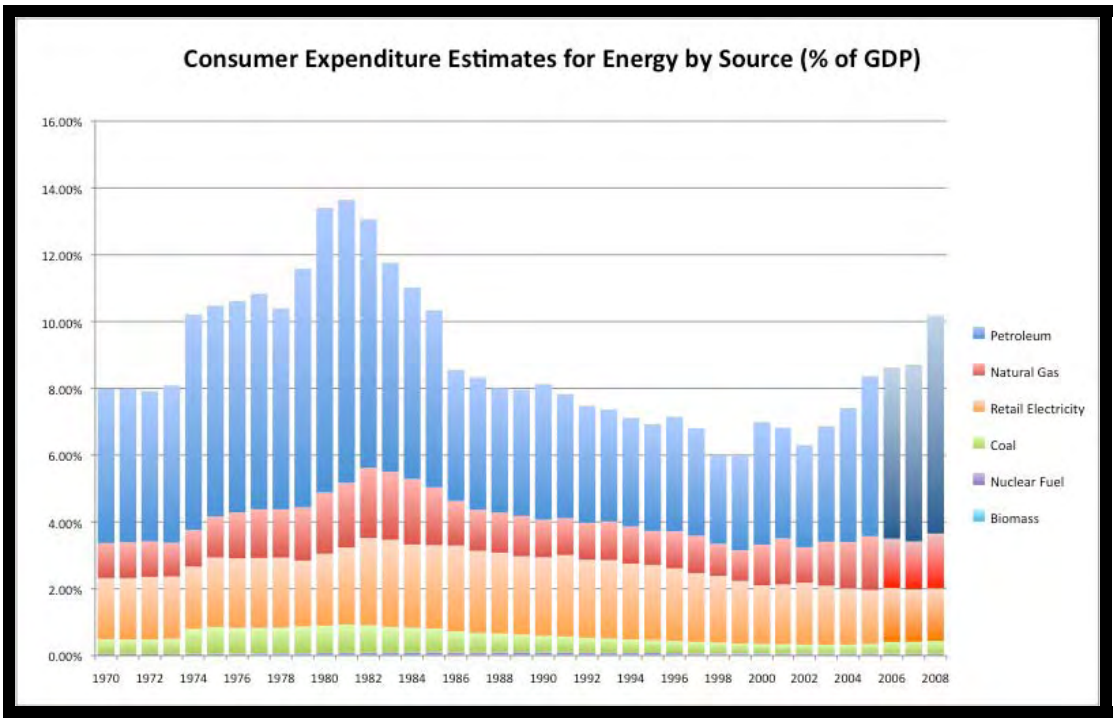
– Charles A.S. Hall, Robert Powers and William Schoenberg [24]

As this *Report* is being written, the most serious global recession since World War II has been under way for over a year. While the severity and duration of the recession may include 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.

[24] 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), 110.

Indeed, this run-up occasioned energy prices to occupy a percentage of the Gross Domestic Product (GDP) not seen since 1985:



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.[25]

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

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 would be to cause inflation. The primary cause of inflation in such an environment would be an increase in the price of oil.

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 (plastics, aspirin and clothing, to name a few) are reliant on oil as a key input. Second, as Bloomington imports most of the products it consumes, 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 November 1978, Iranian oil workers reduced output from 6 million barrels per day to 1.5 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, GDP 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. Wild oscillations in demand could result in 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, 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.[26] Six months after the December low, oil was once again inching its way above $70/barrel. In the teeth of the worst postwar recession on record, this doubling of oil prices in only six months is truly remarkable. 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.[27]

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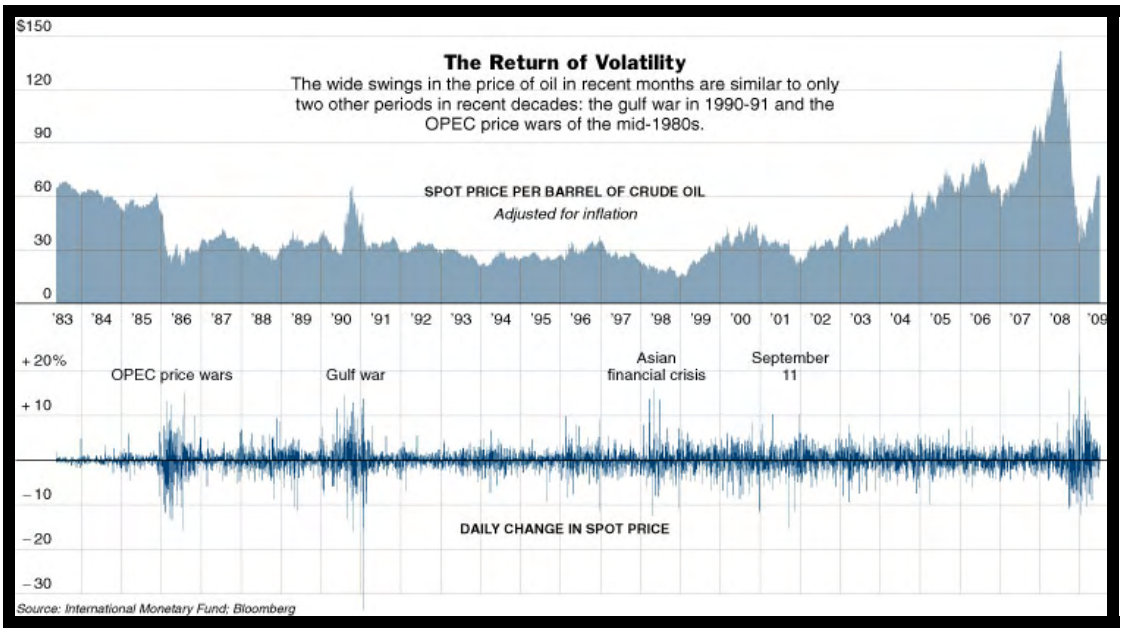
[26] Jad Mouawad, "One Year After Oil's Price Peak: Volatility," *New York Times*, July 10, 2009, Green Inc. http://greeninc.blogs.nytimes.com/2009/07/10/one-year-after-oils-price-peak-volatility/?scp=1&sq=one%20year%20after%20oil's%20price%20peak&st=cse

[27] "Crude Oil: Uncertainty about Future Oil Supply Makes It 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



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.[28]

Some observers might see the rapid fall of oil prices in the latter half of 2008 as proof that the theory of peak oil has been falsified, but we believe they are wrong. It is hard to know how long the current recession will last. However, if the recession begins to lift soon, 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. However, if the recession is prolonged (for, say, another five or even ten years), then oil production could fall below even that required to meet depressed demand. In that case, rising oil prices could prolong the recession still further. At that point, if not before, the world will probably begin to sit up and take notice that the Age of Oil is coming 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.

[28] *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 vulnerable to a decline in cheap oil.

2. New competitors for energy resources.

When the United States was on the upward slope of Hubbert's Curve, there were many populous countries in the world that consumed relatively little petroleum per capita. Now some of those countries – particularly China and India – are developing and motorizing rapidly. As a result, on the downward slope of the curve, Americans will have formidable new competitors for the world's remaining supplies of petroleum and other fossil fuels.

3. Financial chaos.

The current financial crisis will continue to make it difficult to mobilize the resources necessary either to maintain the current level of oil production or to continue the migration to a post-petroleum economy. The development of new oil fields, which are often in challenging environments and therefore very costly, has been slowed or postponed. The development of major renewable energy projects has likewise been delayed or postponed.

4. A finite Earth cannot support infinite growth.

This is a point that seems simple enough to grasp, but it tends to get lost in our well-intended efforts to produce and consume more. This point is also one long championed by ecological economists, specifically Herman Daly. Daly struggled to communicate the idea of ecological constraint to the World Bank, where he worked in the late 1980s and early 1990s.

Daly 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. [29]

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 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, U.S. GDP has grown by 3.4 percent per year.[30] Even if we replace petroleum reliance with 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 in energy consumption 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,

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[29] 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

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

and it is clear that it 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 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 percent. In that case, we would need to consume 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 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. However, in order for economic growth to continue in perpetuity, it would have to be the case that growth and energy consumption can be *absolutely* decoupled. This seems wildly implausible.

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 energy will call into the idea that quality of life and economic health are necessarily tied to *more*. A "growth economy" is typically characterized by an increasing GDP. However, a growing GDP does not necessarily imply a comparable improvement in 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. It is possible to have a "prosperous" economy which is not based on perpetually rising production and 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."[31]

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 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."[32]

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.[33] Toward this end, we echo the resolution of the Bloomington Environmental Commission:

> 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.[34]

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[31] 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).

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

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

[34] *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 Global Problems to Homegrown Solutions

The Bloomington economy is clearly woven into the fabric of both the national and global economies. The food we eat, the clothes we wear, and 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 the emergence of certain local economic threats. On the other hand, our community's position as a college-driven metro area 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.

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. Bloomington businesses that buy or sell in national and global markets will have to contend with higher shipping costs. They may have to adopt new business strategies or may have to lay off employees to compensate for higher costs.

Less Discretionary Income

If households have to spend more on energy, they will have less to spend on discretionary goods and services. Businesses such as restaurants and entertainment venues which rely on the discretionary spending of local residents or out-of-town visitors will be squeezed.

Fuel Rationing

As we collectively slide down the peak oil curve, motor fuels will become more scarce. As a result, fuel will be rationed. Rationing will either be imposed by the market in the form of higher prices that drive out marginal consumers, or by the government by fiat. A combination of both forms of rationing is plausible.

Gasoline rationing was considered during the Second Oil Shock of 1978-1979. Ration coupons were 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 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 over rationing, we should anticipate that rationing may happen.

Population growth and shifting demographics

The population of Bloomington might grow 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.

Economic hardship could cause an increase in enrollment at Indiana University if residents lose their jobs and elect to return to school. On the other hand, hardship might instead 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.[35] As globalization is an energy-intensive system of exchange and production, it is extremely vulnerable to high energy costs and shortages. Economic relocalization should be considered necessary for community economic security.

[35] 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.

- **Economic incentives.**

  The City should leverage economic development incentives, such as a Business Incentive Loan Fund and tax abatements to further encourage the relocalization of goods and services, especially those essential to daily life.[36]

- **Foster a "buy local" campaign.**

  Local government can help foster and expedite relocalization by actively promoting 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 Trading System (LETS).**

  In thinking through ways to encourage more people to buy locally, the Task Force examined 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. This 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) was unsuccessful. BloomingHOURS was introduced in August 1999; however, within a year the currency had gone out of circulation. Merchants were left with a stockpile of currency that they could spend neither inside nor outside of the community. For a local currency to be successful in Bloomington, it would be important for government and other large institutions 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 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 – exchange local goods and services.[37]

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

[37] See further, *LETS Program: A Sustainable Local Economy*, Relocalize.net http://www.relocalize.net/node/2194. However, a similar problem can occur with a LETS system as that which contributed to the demise of BloomingHOURS -- some people may accumulate a lot of credits but have no way to spend them.

- **Local government should collaborate with *Transition Bloomington***

  Relocalization promises resilience and is gaining increasing momentum thanks to the growing "Transition Movement." This movement seeks to equip communities for the twin challenges of climate change and peak oil. It aims to prepare cities and towns for a shift from oil dependence to local resilience.[38] Central to the Transition Movement is the idea that life without oil could be happier and more rewarding than a current oil-dependent society. [39] Indeed, a recent *New York Times* article on the Transition Movement exclaimed, "The End is Near! (Yay!)"[40] 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."[41]

  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;
  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; and
  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.[42]

  A local Transition group has recently formed in our own community – *Transition Bloomington*.[43] The local government should partner with *Transition Bloomington* to work toward a cooperative post-carbon future.

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

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

[40] 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

[41] *Ibid*.

[42] *Ibid.*, 172

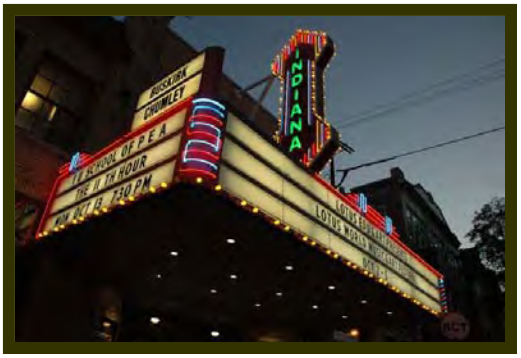
[43] http://transitionus.ning.com/group/transitionbloomington

2. 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 committed to improving 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 health care 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;
- Suppliers of raw materials and semi-processed goods; and
- Embodied energy required for products and services.

3. Prepare the tourism industry for peak oil.



Bloomington has positioned 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 tourist destinations close to home could become more popular, and Bloomington's tourism industry could benefit from a relocalization of travel. There are three major population centers (Indianapolis, Louisville, and Evansville) near Bloomington. Having bus or rail transportation links to those centers would further enhance the position of Bloomington as a tourist destination. Having improved local

transit and pedestrian and biking facilities would help also. However, the possibility also exists that in an oil-short world, people will be reluctant or unable to travel even to nearby tourist attractions.

4. Commit to a steady state economy.

A steady state economy is one in which the level of production and consumption remains relatively constant. It is one in which the goal of having more stuff is replaced by the goal of having an improved quality of life.

The notion of a steady state economy is likely to be resisted by many people. However, a debate over whether such an economy is "good" or "bad" would be pointless. We do not take the position that a steady state economy is preferable to a growth economy. Rather, we take the position that a growth economy will soon simply no longer be possible. Considering the two remaining alternatives – a steady state economy, or an economy in a continual state of crisis and collapse – the steady state is clearly preferable.

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 take immediate steps to manage it. Because peak energy will occur as a result of production constraints of various non-renewable sources of energy, attempting to solve the problem of peak energy by substituting some forms of non-renewable energy (e.g. natural gas) for others (e.g. petroleum) is a temporary but not a permanent solution. While a detailed examination of possible forms of alternative energy is beyond the scope of this *Report*, local government should work with public, private entities, and other stakeholders to encourage and provide incentives for sustainable forms of energy.[44]

Source: www.globalwarming.house.gov

[44] 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.

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."[45] While it is difficult to predict exactly what the post-peak employment environment will look like, we can anticipate that we will experience a "greening" of employment as the economy becomes less dependent on fossil fuels and more dependent on renewable energy. Local government should partner with the public and private sectors to aggressively promote and provide incentives for business start-ups and existing employers in sectors facilitating the transition from non-renewable to renewable energy. It is at least equally important to promote those facilitating reductions in energy demand through conservation.

The change in the employment profile presented by peak oil represents both challenges and opportunities. Unfortunately, it is somewhat difficult to predict what the eventual employment mix might be, and even more difficult to predict the timing of any shift from one job mix to another. 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. Thus, some jobs could go unfilled even as unemployment rises.

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

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[45] City of Bloomington, Indiana, *Strategic Plan 2009-2010*, 8. See, http://bloomington.in.gov/strategicplan

On the other hand, there is probably considerable potential for new employment in "green jobs," especially those related to the manufacture, installation, and maintenance of solar electric and solar thermal systems.

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

- **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; and
- **Welders** for solar power manufacturing.[46]

To this list, we would add home and business energy efficiency specialists, appliance repair specialists, and farmers and agricultural workers. In the long run, should fuel shortages cause a breakdown in mechanized agriculture, a significant amount of additional labor could be required for food production.

Green-collar jobs require some new skills and some new thinking about old skills. The economic development community, in cooperation with local employers, Workforce Development, and local educational institutions, should identify specific skills called for to meet the demands of our economy during the period of energy descent, and should develop educational and training programs to teach those skills. Some of green jobs will be entirely local because they are in the service sector; while solar panels can be manufactured in China, we can't ship our houses to China to have the panels installed there. Green manufacturing jobs will have to compete in a marketplace that will remain theoretically global, but the rising cost of transportation may give local producers a competitive advantage that they currently lack. Green jobs 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.

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[46] *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 .

MUNICIPAL SERVICES

Identifying and mitigating community vulnerabilities is probably one of the more important – if often unwritten – expectations we have of our local governments.[47]
– 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.[48] 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 oil dependencies and match each dependency with greater conservation, greater efficiency, and 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 *Sustainable 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;"[49]
- 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 the 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). The City has partnered with the local grocery cooperative Bloomingfoods to distribute over 40,000 bulbs, with a total estimated savings of $2.0 million over the life of these bulbs;

[47] Lerch, Daniel. *Post Carbon Cities: Planning for Energy and Climate Uncertainty. A Guidebook on Peak Oil and Global Warming for Local Governments* (Sebastopol: Post Carbon Press 2007), 4.

[48] *Ibid.* at v.

[49] http://bloomington.in.gov/sustainablecity

- all City traffic signals have been retrofitted with light-emitting diode (LED) technology;
- the City recently passed a Green Building Ordinance calling for all occupiable City structures to 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. In addition, a number of naturalized lawn projects have been implemented 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; [50]
- 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, 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 the ways we use and produce energy.

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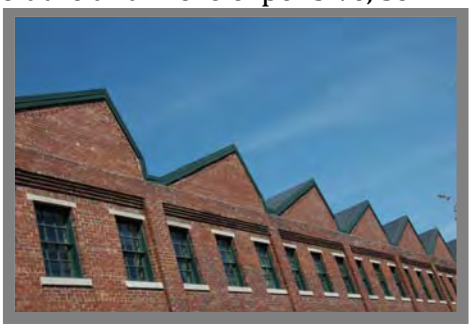
[50] City of Bloomington Environmental Commission & City of Bloomington Commission on Sustainability, *Greenhouse Gas Inventory for the City of Bloomington, Indiana: Footprint, Projections, and Recommendations* (May 2009) https://bloomington.in.gov/media/media/application/pdf/5047.pdf; City of Bloomington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

VULNERABILITIES

Of the 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. These services are energy intensive. 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.



City Hall

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 the cost of products in which oil and oil by-products are used. 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 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.[51]

These vulnerabilities call for a plan that seeks to build resiliency into the City infrastructure. The aim of this chapter is to map out an "energy descent" plan 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 staff and residents will have even more ideas about how to plan for peak oil. The intent of this chapter is to get the conversation started.

[51] These three vulnerabilities are borrowed, in part, from those outlined by the Sebastopol Ad Hoc Citizens Advisory Group on Energy Vulnerability, *Charting a Path for a New Energy Future for Sebastopol* (2007).

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, 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 or diesel fuel, the City will experience a significant reduction or suspension of water treatment services.

That our current electrical grid is both aging and overloaded is well documented. Indeed, the U.S. National Power Grid received a "D+" by the American Society of Civil Engineers in 2009.[52] 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 extraction. 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.[53] The grid might also experience more stress if people perceive electricity as bearing a significantly smaller carbon footprint than petroleum. However, fully 95 percent of Indiana's electricity is generated by coal, while 5 percent is generated by natural gas.[54] The finite supply of Indiana's coal is discussed in *Appendix II*.

[52] American Society of Civil Engineers, *2009 Report Card for America's Infrastructure,* http://www.infrastructurereportcard.org/sites/default/files/RC2009_full_report.pdf. It is also important to that the Society gave the U.S. Drinking Water Supply a grade of "D-," Wastewater a grade of "D-," and Dams a grade of "D."

[53] See *Appendix III* for a discussion of the peaking of natural gas.

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

Water Supply

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) provides for the treatment and distribution of the community's water supply.

Lake Monroe Dam and Control Tower, Source: U.S. ACE

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 used for water supply, flood control, and recreation. Between the silt pool elevation of 515 feet (ft) above 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.[55]

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 16.1 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 withdrawal of 24 million gallons per day.[56] The City has frequently come close to this maximum withdrawal. 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.[57]

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[55] 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.

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

[57] The Order advised that a failure to implement any proposed improvements "is cause for imposing a connection ban on your system."

Water Treatment

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 seven to eight miles from the plant to the City. In the event of a complete loss of electrical power, the City can produce potable water at a rate of 12 million gallons per day provided that No. 2 diesel fuel can be replaced in the tanks for the standby engine generators. 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."[58]

The City maintains two back-up diesel generators: one at the Low Service Pump Station (on the shore of Lake Monroe) and one at the Monroe Water Treatment Plant (about one half mile the Lake). Each generator has a 1,000 gallon fuel tank. The engine of each is rated to consume 57.8 gallons per hour under full load operating conditions. Therefore, 2,000 gallons of fuel would be consumed in 17.3 hours if both engine generators were operating at full load conditions.

The City currently maintains seven active water storage tanks and is requesting an additional tank. Under normal usage conditions, the seven active tanks provide approximately eight hours of capacity. A combined liquid fuels shortage and protracted grid failure would leave little buffer for City water users.

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

VULNERABILITIES

Production of Bloomington's water is energy intensive 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. This usage translates into a price tag of almost $60,000 per month. [59]

Grid vulnerability 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.[60]

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.[61] In the U.S., typical domestic indoor per capita water use is 80-100 gallons per capita per day;[62] outdoor water use can increase that rate to as much as 165 gallons per day.[63] Meanwhile, the average (western, industrialized) European uses an average of 53 gallons per day.[64]

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[59] This energy is 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.

[60] 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

[61] Black & Veatch, *Water Supply*.

[62] U.S. E.P.A., National Performance Track, *Water* http://www.epa.gov/performancetrack/tools/wateruse.htm

[63] Christopher Kloss, U.S. E.P.A., *Managing Wet Weather with Green Infrastructure: Municipal Handbook – Rainwater Harvesting Policies*, EPA-833-F-08-010 (December 2008).

[64] *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. Explore hybrid energy generation.

While the Monroe Water Treatment plant enjoys some flexibility to scale down production, it does not have the capacity to run without power. Water production and treatment requires a continual input of power. The plant cannot be frequently completely shut down and then turned on again without negative consequences.

Given the precarious state of the grid and the need for continuous power at the plant, the City should explore alternative energy options to supplement the water treatment plant's energy supply. Specifically, the City should explore the possibility of installing a second layer of pumps powered by a combination of both solar energy and hydroelectricity from the Monroe Dam.

At the request of the City's Environmental Commission and some members of the City Council, the Utilities Department sent Black and Veatch a list of general questions concerning the possible use of alternative energy sources to power the water treatment plant. In October 2008, lead engineer Donnie Ginn, P.E., responded to these questions via a memorandum.[65] Ginn's memorandum advised that *completely* transitioning the facilities to either hydroelectric power or solar power is significantly constrained by space, season, and cost. For example, hydroelectric power generated at the dam would have to be transferred about 10 miles over difficult terrain to the water treatment intake facility. Furthermore, the facility could only be operated for a few months in the late spring. Meanwhile,

[65] Memo from Donnie Ginn of Black and Veatch to Patrick Murphy, Director of City of Bloomington Utilities Department, *Monroe Water Treatment Plant Alternative Energy Sources* (October 21, 2008).

transitioning the entire plant over to solar power would call for clearing between 16 to 40 acres of land for solar cells.[66]

Instead of completely shifting the treatment and intake facility over to *either* solar or hydroelectric power, the City should explore a hybrid configuration of *both* to complement (not replace) the facility's primary source of power. Such a hybrid configuration should be designed to produce enough power to run the plant at 10-15% treatment capacity in order to provide residents a basic level of water sufficient for drinking, cooking, and basic sanitation. Hydroelectric power could be leveraged during the Indiana spring rains, when substantial cloud cover reduces the feasibility for solar but there is a great deal of untapped energy flowing over the dam. Solar power could be leveraged during the summer months and sunny winter months.[67] Used as part of a hybrid system to complement existing power sources, solar panels would require less than an acre of cleared land (estimated).

In the interest of the community's water security, the City should more closely examine hybrid energy generation at the water treatment plant. Any study should take into consideration the amount of water needed to provide minimal drinking and cooking water to residents. Further study should include a cost-benefit that takes into account the weaknesses of the electrical grid and the grid's ultimate reliance on oil.

[66] *Ibid*.

[67] Cities receiving less solar radiation than Bloomington, such as Newark, New Jersey have successfully transitioned their water and wastewater treatment to solar power. Boulder, Colorado has a level of radiation similar to Bloomington and has transitioned its water and wastewater treatment facilities to solar power.

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

The Mayor has expressed an interest in pursuing a rate structure to encourage water conservation.[68] The proposal must be approved by the Indiana Regulatory Commission.[69] A tiered-rate structure would mean that the unit price of consumption would increase after usage exceeds a predetermined basic monthly amount. 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. In Athens-Clarke County, Georgia – an oft-cited college town comparable to Bloomington – rates are based on each customer's winter average. Officials in that community estimate that this rate structure will save approximately one million gallons of water per day in the summer when use is at its peak.[70]

3. Encourage rainwater capture.

Outdoor water use can comprise 25% to 58% of overall domestic water demand.[71] Rainwater harvesting has significant potential to reduce stormwater runoff while conserving potable water. Rainwater capture offers a number of advantages:[72]

- 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.

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

[69] 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.

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

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

[72] 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).

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:

Commercially sized cistern at the Chicago Center for Green Technology. Source: Abby Hall, EPA.

- Provide rain barrels to community members at a reduced cost, much the way it did when it offered compost bins at a reduced rate (in cooperation with the Center for Sustainable Living). It is estimated that a 55 gallon rain barrel can save approximately 1,300 gallons of water in peak summer months;[73]

- Implement a rain barrel rebate program;[74]

- Require greywater and roofwater catchment for new development as part of the City's Unified Development Ordinance (UDO). Currently, the UDO provides incentives for the use of greywater, but does not require it.[75] The City might look to Tucson, Arizona – the first city in the US to require rainwater harvesting for landscaping use. In Tucson, 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;[76]

- Require bio-swales and/or permeable paving for any new development; and

- The City should lead by example by installing cisterns and rain barrels to provide for its own landscaping needs.

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[73] U.S. E.P.A., *What is a Rain Barrel?* http://www.epa.gov/Region3/p2/what-is-rainbarrel.pdf

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

[75] §20.05.049, Bloomington Municipal Code. http://bloomington.in.gov/green-building-incentives

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

4. Offer other efficiency incentives.

The City should implement incentives to encourage water conservation such as:

- subsidies for low-flush toilets and low-flow shower heads, toilet displacement devices, and faucet aerators; and
- rebates for energy-efficient appliances, such as washing machines; and

(See *Sustenance* chapter for other possible incentives.)

5. Expand storage capacity.

Expanding water 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:

> 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.[77]

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

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 or biogas.

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

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 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. Utilities currently has "What to do if" emergency guides for each physical location, but they are limited to identifying hazards and suggesting notification and evacuation scenarios. The guides are not up to date. Utilities 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 identify consumption in more detail than a conventional meter and would communicate that information back via a network to CBU for monitoring and billing purposes. This would 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[78] and was recently instituted throughout Britain.[79]

Source: Associated Press

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

LONG-TERM (15-30 years)

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

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

While harvested rainwater could be used as potable water, the required on-site treatment and perceived public health concerns represent cultural hurdles. These hurdles will take a long time to address, but a long-term goal is to transition to more use of neighborhood cisterns.

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

[79] James Kanter, "Britain Announces Broad Smart-Metering Plan," *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

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

The Lake Griffy Treatment Facility was decommissioned in 1996. 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 was determined that these sources should not be considered due to higher costs associated with capital improvement projects, water quality concerns, and concerns about sufficient yields from these sources.[80]

At approximately 3.23 miles from the city center, Lake Griffy is significantly closer to Bloomington residents than is Lake Monroe, which is at least seven miles away. 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.

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

WASTE DISPOSAL: THE DETRITUS OF CONSUMPTION

Waste is a systemic and inevitable aspect of our community. Yet, our ever-increasing consumption of goods and their easy disposal has led to a very energy-intensive waste disposal infrastructure. Re-thinking our consumption and disposal habits with peak oil in mind 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.[81] 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. However, 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 Division collects residential solid waste, yard waste, and recyclable material from approximately 8,000 households within City limits. The City collects neither trash nor recyclables from residences of more than four 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 collects leaves and yard waste. The City's Sanitation Division picks up yard waste from early March to early January and takes it to Good Earth Compost and Mulch, LLC for mulching. Both the City's Sanitation Division and Street Division provide leaf pick-up services.

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

From early November to late December, residents are afforded three options to 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; and
- The Street Division 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 for composting, the leaves collected by the Street division are taken to a decommissioned City wastewater plant contaminated by PCBs where the leaves are used for fill.

The City's Sanitation Division owns approximately 17 vehicles. In 2008, the Division consumed 1,584.84 gallons of unleaded and 24,475.79 gallons of diesel. The Sanitation Division has gone to a condensed work week of four 10-hour work days and has cut its unleaded fuel costs by 37%. 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 was operated by the Monroe County Solid Waste Management District. However, the landfill suspended operations during the summer of 2004 after it erupted into flames. It was 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.[82] Based on U.S. Census figures, Bloomington residents constitute about 56% of the Monroe County population. [83] Therefore, we might estimate that Bloomington residents generated about

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

[83] U.S. Census Bureau; Indiana Business Research Center

89,582 tons of garbage in 2007.[84] 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.[85]

VULNERABILITIES

1. The collection of waste and recyclables is essentially a trucking function, wholly reliant on liquid fuel for operation.

While the City's Sanitation Division 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 Division would have to reduce all collection services and possibly eliminate its appliance collection service and/or pass on the 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, rising costs of such shipping due to fuel scarcity would likely be passed on to residents with the aforementioned consequences.

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

[85] US EPA, *Municipal Solid Waste in the United States: 2007 Facts and Figures*, EPA530-R-08-010, 134; See further, Elizabeth Royte, *Garbage Land: On the Secret Trail of Trash*, 275 (2005).

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

The U.S. Environmental Protection Agency (EPA) estimates that yard trimmings and food residuals together constitute 24 percent of the U.S. municipal solid waste stream.[86]

In 2008, the Sanitation Division collected 470 truck loads of yard waste. In 2008, the Division 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, 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 provide for compostable food residuals. That's a lot of waste to send to landfills when it could become useful and environmentally beneficial compost instead.[87] Not only does the collection and transport of such material remove a lot of potential compost, but such organic matter produces significant greenhouse gas emissions when landfilled.

[86] U.S. E.P.A. *Wastes - Resource Conservation - Reduce, Reuse, Recycle – Composting*. http://www.epa.gov/waste/conserve/rrr/composting/basic.htm

[87] *Ibid*.

MITIGATION GOALS & STRATEGIES

SHORT-TERM STRATEGIES (1-5 years)

1. Residents should be encouraged to buy less stuff – especially non-local stuff.

According to the E.P.A., "source reduction" is one of the most effective ways to reduce 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.[88]

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 *Economic Context*), it will reduce the volume of material we send to the landfill and promote economic resilience through relocalization.

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 trimmings and food scraps can help decrease the amount of solid waste that must be sent to a landfill, thereby reducing disposal costs. According to the E.P.A., food waste alone comprises about 12 percent of what a typical US American throws away every day; yet, only 2 percent of that is composted.[89] 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.

Shovel digging in compost. Source: U.S. EPA

[88] U.S. E.P.A. *Wastes - Resource Conservation - Reduce, Reuse, Recycle – Reduce and Reuse.* http://www.epa.gov/wastes/conserve/rrr/reduce.htm

[89] *Supra* note 86.

3. The City should establish a neighborhood compost collection program. It 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 economically-vulnerable populations. Programs for growing food within the city will need to be expanded. The City should begin to identify sites for neighborhood composts.

4. The City should work toward encouraging existing apartment complexes to provide recycling services to their tenants and should require any new apartment development to do so.

Currently, the City picks up waste and recycling only from residences which contain four or fewer units. Buildings of five or more units may or may not provide recycling services to their tenants. The City should work toward encouraging existing apartment complexes to provide recycling and should require any new apartment development to do so.

5. The City should support the establishment of a community materials recovery facility.

The Monroe County Solid Waste District currently outsources the processing of paper, cardboard, aluminum, glass and plastic. Currently, these recyclables are taken to Indianapolis for processing. From 2005-2008, the District outsourced processing for 11,575 tons of paper, cardboard, aluminum and plastics. Those items were valued at more than $1.25 million, but the District only received about $275,000 in rebates. A local recovery facility would likely not only generate revenue, but would keep such processing local, obviating the need to transport the community's recyclables 50+ miles. Should such transport become cost-prohibitive, localizing this service makes our community more resilient. The City should work with other community stakeholders to support this effort.

Similarly, as the City works to promote composting, it should consider the establishment of a community organic materials recovery facility. See further the *Sustenance* chapter.

MEDIUM-TERM STRATEGIES (5-15 years)

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

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.[90] 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 services 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 made from 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. A similar program in Bloomington would foster energy independence by providing alternate fuel for the City fleet, while at the same time providing businesses and residents with a cheaper and cleaner option for waste disposal.[91]

[90] 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

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

LONG-TERM STRATEGIES (15-30 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 in 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 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.[92]

Landfill gas should not be released and allowed 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 or liquefied natural gas.).[93]

Landfill biogas-to-energy systems are not uncommon. As of 2008, the E.P.A. reports that there were approximately 480 such energy projects in the U.S. and 520 landfills that were good candidates. At least three landfills in Indiana are generating energy.[94]

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

[93] *Ibid*.

[94] Logansport, Liberty and Clark & Floyd counties. A description of the Logansport and Liberty projects at: "Two Indiana Landfills now generating electricity," *The Chicago Tribune* (October 20, 2008). 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 relocalization 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 wastewater consumes approximately 1,141,000 KWh per month. 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 (1-5 years)

1. Encourage greater water conservation

The vulnerabilities inherent in the treatment of wastewater are similar to those associated with water treatment and distribution. Perhaps the most immediate and decidedly low-tech solution to a vulnerable wastewater system is to reduce the amount of 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 and in the *Sustenance* chapter.

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 or biogas.

3. Make better use of biosolids.

At present, the Utilities Department deposits all treated sewage sludge – biosolids – at its Dillman Road Treatment biomass landfill. It is expected that the landfill will be at capacity in four to five years. 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.[95] The City should consider using this for fertilization of non-food plants, such as those grown for biofuels or feedstock. However, as is required by the EPA, it is imperative that any biomass spread on local fields be free of harmful contaminants.

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

LONG-TERM (15-30 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 phosphorus.[96] Indeed, research has demonstrated that sewage actually contains 10 times the energy needed to treat it.[97] A number of widely-tested energy recovery technologies have emerged to recover this energy.

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 very costly 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.[98]

Furthermore, elements like phosphorus 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 phosphorus recovery.

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[96] 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. US EPA, *Phosphorus Recovery from Sewage* (2005) http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/7345/report/F; See further, Woods, et al, "Phosphorus Recovery Technology Modeling and Feasibility Evaluation for Municipal Wastewater Treatment Plants," *Environmental Technology* 20(7)(1999): 663-679.

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

[98] *Ibid.*

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 potential social unrest due to fuel shortages and economic disruptions.

POLICE DEPARTMENT

The City of Bloomington Police Department (BPD) 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. The Department is a very visible one and such visibility helps keep crime low in our community.

The BPD maintains 45 vehicles. Over the last three years, the Department has used an average of about 5,360 gallons of gas a month. That keeps about 12 police cars on the street patrolling and responding to calls. BPD is one of the City's most fuel-intensive departments. In 2008, the Department used 64,109 gallons of unleaded fuel and 84 gallons of diesel – about 3,613 gallons less fuel than it used in 2007. Despite this reduction, its fuel expenditures increased from $164,040 in 2007 to $196,640 in 2008. $230,300 has been budgeted for fuel in 2009.

Bloomington police Lt. Jimmy Ratcliff stands on a Segway along the B-Line Trail. Property of the Herald-Times, David Snodgress.

Where it can, BPD is working to use vehicles that consume less energy. The Department has added a few motorcycles, 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 engines when vehicles are not being driven.

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 107 full-time firefighters and maintains five fire stations. It has 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 significantly 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. [99]

[99] National Biodiesel Board, *Biodiesel Basics*, 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 prices, 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* chapter, 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 tend to increase.[100] Observers point out that every recession since the late 1950s has been marked by an increase in crime, particularly property crime and robbery.[101] The Police Executive Research Forum recently conducted a survey of 233 police agencies and found that 44 percent reported a rise in certain types of crime 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. [102]

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.[103] This will put increased pressure on the Police Department to keep the city safe and on the Fire Department to provide 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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[100] Alfred Blumstein and Richard Rosenfeld, "Factors Contributing to U.S. Crime Trends," *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," *The New York Times*, May 10, 2009. http://www.nytimes.com/2009/05/10/weekinreview/10streitfeld.html?scp=14&sq=recession%20violence&st=cse

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

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

[103] 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.

It is likely that as oil becomes more and more expensive, some residents might try to hoard gasoline – a practice that presents serious 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. Gasoline hoarding and heating with 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 are 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 Police Department should continue to invest in bicycles, neighborhood electric vehicles, etc. and should consider the use of horse patrols where appropriate.**

6. **Anticipating more fuel hoarding and non-conventional home heating practices, the Fire Department should provide community outreach on the dangers of hoarding and how to practice safe home heating using biomass.**

7. **The Fire Department should investigate to what extent the fire trucks 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.[104]**

[104] 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

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 pursuit cars that are not reliant on fossil fuels. While we've described why biodiesel 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 full-spec pursuit car that can run on biodiesel.

2. The Police Department should 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 Monroe County 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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elastomer degradation and no changes are 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.

LONG-TERM (15-30 years)

1. Implement neighborhood police stations rather than one, centralized station.

Neighborhood police stations have the potential not only to decrease the response time for emergency and non-emergency calls, but also would enable local residents to become more involved. Cities where neighborhood-sited police stations have been successfully implemented include Oakland, Chicago, and Boston.[105]

2. Electric fire engines are still largely in development. However, as they are perfected and become affordable, the City should explore this option.

[105] 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 emergency services are provided by the Monroe County Emergency Management Agency (MCEMA). 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*.[106]

As spelled out in its "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.[107] These are the hazards anticipated in emergency planning, which assumes:

- 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. Because our reliance on petroleum is systemic, planning for peak oil is planning for a *long emergency*.[108] Reliance on fossil fuel for back-up generators for vital communications and other functions would be a long-term vulnerability. The County Emergency Management Agency should plan for supply interruptions and shortages.

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[106] *Monroe County Comprehensive Emergency Management Plan*, Basic Plan, (2003).

[107] *Ibid,* 4.

[108] The term "long emergency" is borrowed from the book 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 MCEMA 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 powered 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. The City's Fleet and Street Divisions 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[109](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.[110] Since 2005, the City has abided by a biodiesel-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 for taking care of the city's water and wastewater needs.

The City's all-electric GEM car

[109] City Fleet advises that only 25 cars are flex-fuel capable; the rest of the fleet cannot be "retrofitted" for flex-fuel capacity.

[110] 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 Information & Technology Services (2).

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 2,000 gallons. As these tanks can only be filled to 90% capacity, the City has storage capacity for approximately 27,000 gallons of unleaded fuel and 19,800 of diesel fuel. Fleet purchases an average of 8,500 gallons of unleaded fuel and 7,500 gallons of biodiesel each month. The City has contracts with three providers for unleaded fuel and two providers 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 even though 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%.[111]

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, the amount budgeted for fuel in 2009 increased by almost 20%, from $679,091 to $810,791. Meanwhile, the percentage of the overall City budget claimed 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.

[111] In 2005 the City began buying only biodiesel to power its diesel vehicles and equipment. Note that Fleet does not currently track the total number of miles driven.

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, most enforcement departments have greatly consolidated their trips (now most inspection is based on location rather than inspecting a complaint as soon as it is lodged), departments encourage carpooling, the acreage of turf mowed in City parks has been reduced, experiments with "low-mow" or "no-mow" grasses have been conducted, and energy-efficient maintenance equipment has been purchased. 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 each department was asked 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. Vehicle 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 the enforcement of parking rules becomes more expensive and as residents increasingly are unable to drive nearly as much, the City will likely experience a marked decrease in this source of revenue.

4. The City currently employs 692 full-time employees and 200 temporary employees. 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 an emergency fuel reserve to prepare for a fuel shortage.

The City should shift its practices to maintain an emergency reserve of fuel (beyond that which it already maintains for daily use) 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 eliminated and how we might maximize fuel efficiency in the short term. In the long term, the City should transition its 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 electric cars in code enforcement, where feasible.

5. Establish a City bicycle fleet

Institute a City bicycle fleet so that City employees have the option to ride a City bicycle rather than drive a City vehicle. Currently, the City's Parking Enforcement Division owns two bicycles for use by two of its nine enforcement officers. Each employee using such a program would likely have to have her/his own helmet. While liability concerns may arise from such a proposal, it should be noted both that employees already often walk or ride their own bikes for City business where appropriate and that many other municipalities

successfully maintain a bicycle fleet for employees and have addressed liability concerns.[112] 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 to achieve 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, bonuses 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 under which higher wage earners pay more to park. This should be a progressive measure, not one that burdens low-earning employees. Money collected from this program could be used to pay for the carpooling incentives mentioned above or for other employee rewards for sustainable practices.

9. The City should implement one-day-a-week telecommuting options for non-manual work employees where appropriate.

As discussed in the *Transportation* chapter, 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

[112] 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%.[113]

The City should seriously examine a telecommuting policy wherein employees are encouraged to work from home once a week, if appropriate to their duties. A number of municipalities have already implemented such policies.[114] 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 and reduces greenhouse gas emissions while improving employee morale and retention.[115]

10. The City should explore a four-day work week.

Both the City's Sanitation Division 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, this promises to substantially reduce employee drive time.

11. Seek assistance with park maintenance from 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 *Adopt-a-Park* trial runs to assess how such volunteer provisioning would best work.

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[113] 2000 US Census.

[114] Examples include San Francisco, San Diego, Portland, OR; Atlanta; Virginia Beach, VA; and Denver, CO. 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

[115] Ravi S. Gajendran and Harrison, David A, "The Good, the Bad, and the Unknown about Telecommuting: Meta-analysis of Psychological Mediators and Individual Consequences," *Journal of Applied Psychology*, 92(6) (November 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.

Many communities have successfully implemented such programs. For example, the City of Philadelphia has a municipal fleet of approximately 6,000 vehicles and joined with the PhillyCarShare[116], the community's non-profit car sharing service in 2004.[117] 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. See the *Transportation* chapter for more details on car sharing.

2. Implement a pilot *Grease-to-Biofuel Program* whereby the City offers local restaurants free vegetable oil collection for processing into biodiesel to fuel the City fleet.

Communities such as San Francisco[118] and Seattle have started to leverage restaurant grease to fuel municipal vehicles as concern over the environmental harm of soy biodiesel mounts.[119] As discussed elsewhere, this would divert harmful fats, oil, and grease away from the City's sewer system.

LONG-TERM GOAL (15-30 years)

1. Realize a Model City Fleet.

All City vehicles, especially emergency vehicles, should be transitioned away from fossil-fuel reliance.

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[116] http://www.phillycarshare.org/.

[117] 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

[118] San Francisco's initiative can be found here: http://www.sfgreasecycle.org/thedish.shtml. Converting grease into biofuel requires 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.

[119] 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. Chris Grygiel, "City of Seattle Halts Biodiesel Purchases, Looks for Greener Fuel," *Seattle Post-Intelligencer*, June 19, 2009.

MAINTAINING CITY STREETS

Everything we do relies on oil.[120]
– Bobby Chestnut, Street Commissioner, City of Bloomington Street Division

The City's Street Division provides maintenance and repair for Bloomington's 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. In 2009, it is scheduled to pave a little over 1 million square feet.

The Street Division 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 consist of 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, the price of liquid asphalt has increased 250% during the past five years. This price increase has led to a doubling of total asphalt paving costs. [121]

[120] 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.

[121] http://www.bls.gov/

The City has been adversely affected by 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.[122] In 2008, the Street Division used 20,000 tons of asphalt. Bloomington has one asphalt plant.

The Street Division has worked to extend the life of existing 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 Division has made impressive efforts to reduce its consumption of asphalt by recycling the asphalt on projects where the City mills existing road, the Division is nevertheless very exposed to volatile and increasing asphalt prices.

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.** [123]
3. **Explore the use of brick or stone pavement, where appropriate.**
4. **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 repaving plan will be necessary.**

[122] Asphalt is bid out at the beginning of the year for that year's paving season.

[123] http://www.gtkp.com/uploads/public/documents/Knowledge/Eco-road%20Technologies%20Review-a.pdf; http://www.sspco.org/naturalpavexl/naturalpave_OV.html

MEDIUM TERM (5-15 Years)

1. **Reduce road width where appropriate (See *Transportation* chapter).**

LONG TERM (15-30 Years)

1. **Low-use roads might safely be transitioned to gravel, dirt, or other non-fossil fuel materials.**

CITY BUILDINGS

VULNERABILITY

Buildings account for 72 percent of all electricity consumption and 39 percent of all energy consumption.[124] This *Report* has already discussed the grid's age and its reliance on oil. The City has done much to make its buildings more efficient – upgrading the HVAC system in City Hall to use 15% less energy, installing LED traffic lights, installing low-flow sensored water faucets, and passing the City's 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. **All back-up generators for all City buildings should be transitioned away from diesel fossil fuel reliance, with the Police and Fire Departments to receive priority.**

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 can meet 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.

[124] U.S. Green Building Council, Green Building Research, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718

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.[125]

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 include insulation, efficient windows, weather stripping, natural ventilation, passive solar, and the planting of deciduous foliage on the south and west sides of buildings. Such measures not only save energy and money, but continue to work even in the event of power outages or rolling black- and brownouts.

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

CITY REVENUE

As has been documented elsewhere in this *Report*, high gas prices have translated into reduced demand. With demand destruction comes lower gasoline tax revenue. Indiana is one of eight states with a gas tax in addition to the federal gas tax.[126] 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 experienced a steady decline in revenue from these pooled "gas tax" sources from 2004-2008. In 2004, the City received $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 of approximately $292,000.

VULNERABILITIES

When the price of gasoline begins to rise again, we can expect a further decrease in demand. 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 percent 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.

[126] Currently, Indiana's gas tax stands at 29.2 cents/gallon.

MITIGATION GOALS & STRATEGIES

SHORT TERM (1-5 Years)

1. **The City should consider the 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 price "lows" wisely by using current and any future price reductions (which will likely only be temporary) to redirect already budgeted higher fuel expenses into a special emergency fund** (See *Transportation* chapter).

THE BUILT ENVIRONMENT

Energy consumption and the built environment are closely linked. Energy use shapes the way our communities are laid out, how we get from one place to another, and how we build our homes. In the U.S., the ubiquity of the personal automobile has reshaped our everyday lives such that we can live a considerable distance from work, the grocery store, the hardware store, and other necessities of life. Similarly, cheap energy has shaped the form and function of our homes: in general, we tend to live in houses that are too big and pretty inefficient. This section examines peak oil and the built environment through three lenses: land use, transportation, and housing. A decline in cheap oil will require that we rethink how we use our land, how we get from one place to another, and how we use energy in our homes. However, a resilient built environment promises to save both energy and money while enhancing individual and collective quality of life.

LAND USE

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 Human Scale

Historically, our communities have been shaped by the mode of travel available to us. While horse, rail, and the street car allowed us to go further and faster than ever before, for most of human history we have lived our lives on a scale that was within walking distance. That is, we were able to meet our needs of daily life by walking to the grocery, to work, the hardware store, school, and other activities. This ambit wherein we meet most of our essential daily needs can be understood as the "human scale."

The Automotive Age

The human scale was completely redefined with the advent of the personal automobile. Thanks to technological advances, the personal auto became much more commonplace after WWII. After the war, just about everyone owned a car. As the personal auto became the norm, it dramatically reconfigured the geographic space we could traverse in a day: people could easily live in one place, work in another, while shopping, schooling, and conducting all of the other aspects of daily life in equally distant places.[127] In turn, the ever-increasing distances between home and the rest of life radically reshaped land use patterns.

[127] Real-estate interests reacted quickly and predictably, introducing the legal concept of zoning in order to place legal restrictions on what land use activities were allowed or prohibited. Originally sold to the public on the basis that these rules 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 and a vast increase of the human scale. Over time, as suburbs exploded around city cores, they drained those cores of residents. Inner cities became little more than employment centers or depressed quarters for those unable, financially, to escape them. Meanwhile, the suburbs developed a new, and heretofore unique, arrangement whereby zoning forced land use into specialized pods such as residential, employment, or retail. These pods were separated by large distances and 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.

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

The automobile-enabled diaspora's effects are felt most acutely by lower-income earners. Without access to low-cost transportation, such as pedestrian travel or public transit, lower-income workers are forced to either take on the expense of automotive ownership ($5,000 a year for an average automobile[128]) or restrict their employment opportunities. Because lower-income workers are more likely to own older and less fuel efficient vehicles, the effects of fuel prices are particularly problematic for these workers. If a worker must make a twenty mile round-trip commute from her place of residence to her place of employment and her vehicle averages twenty miles per gallon, then paying for gasoline alone will consume a significant portion of her income. At $5,000 a year for vehicle ownership, a laborer working a typical 2,000 hours/year must earn $2.50 an hour

[128] According to the American Automobile Association.

just to cover the cost of vehicle maintenance, or 35 percent of the new minimum wage of $7.25 an hour.[129]

In areas of the community developed prior to WWII, 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 newer areas.

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

Macro-level changes in the community have stripped 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 (0.38 per capita of total elementary student school population).[130] Today there are 16 elementary schools (0.25 per capita of total elementary school population)[131] and only 9% of elementary students travel to school by foot.[132] Likewise the neighborhood grocery has given over to the supermarket, and everything from hardware supplies to pharmacies has decamped from the older neighborhoods to the shopping centers and strip malls on the community's periphery.

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

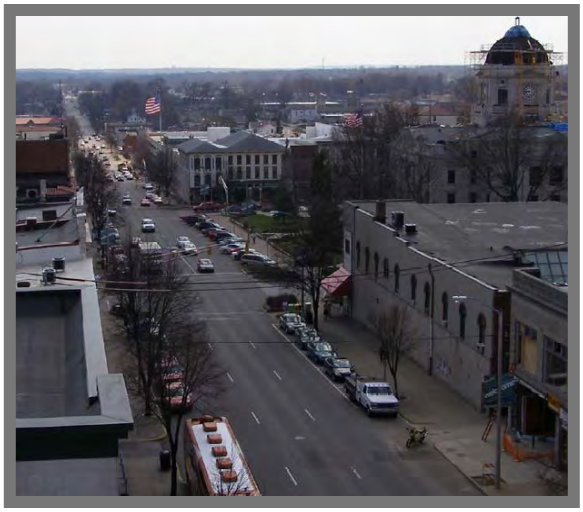
[130] Based on 1960 US Census data.

[131] Based on 2000 US Census data. Total elementary school population in 1967 estimated to be 6,028; total elementary school population between both Monroe County School Corporation (MCCSC) and Richland-Bean Blossom School Corporation(R-BB) is 6,518.

[132] This figure only reflects elementary students within the MCCSC; it does not include students in the more rural R-BB. 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? It will be, in a word, relocalization. Instead of dispersed 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."[133] However, relocalizing the community will require us to re-think our built environment.



Downtown Bloomington

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

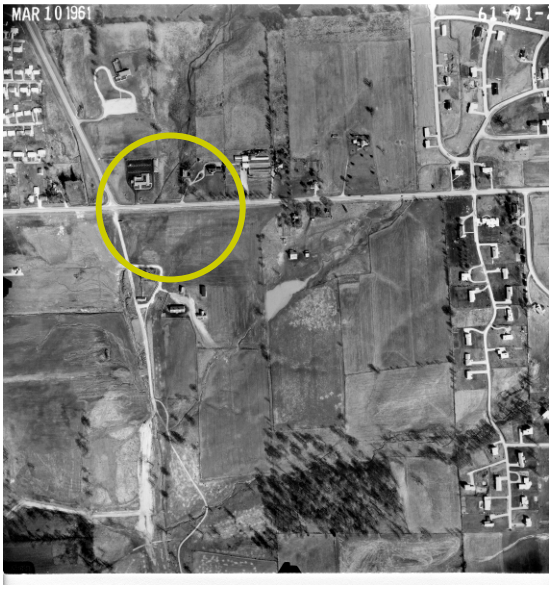
The growth of an expansive road network has had a transformative effect on Bloomington's built environment for the past two decades. An aphorism attributed to industrial designer Norman Bel Geddes, who designed General Motor's *Futurama* exhibit for the 1931 World's Fair, stated "the highway should not impress upon the city, nor should the city impress upon the highway." The traditional practice of running connecting pikes and roads through the centers of the communities they connected was deemed to be no longer appropriate because 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. Therefore, it was thought best to allow it to pass by communities rather than through them.

Bloomington was not immune from this bypass logic. State Road 37 used to come through Bloomington by way of Cascades Park. The park was a Depression-era project of considerable civic utility. Community 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. However, 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.

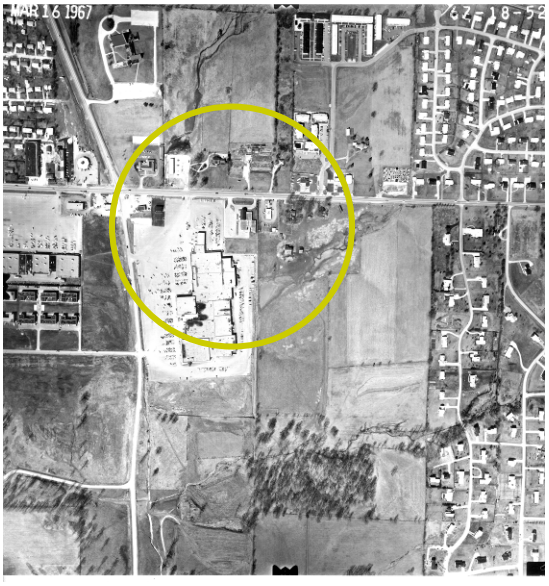
Simultaneously, the State of Indiana wished to increase opportunities for tourism and economic development around the recently-completed Lake Monroe. Large numbers of day-trippers from the communities to Bloomington's north, especially Indianapolis, were expected to use the lake for summertime recreation, and preparations for traffic management were made. These preparations included the provision of a second bypass around the city, connecting State Road 37 on the city's north to a new highway down to the lake outside the eastern edge of the city. Neither bypass remained rural for very long. The first to sprout was the "College Mall" area, established on formerly agricultural land in 1965 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 which entered a long, but not particularly sharp decline cushioned by the presence of Indiana University's urban campus.

The Machine in the Garden
The First Sprout: College Mall

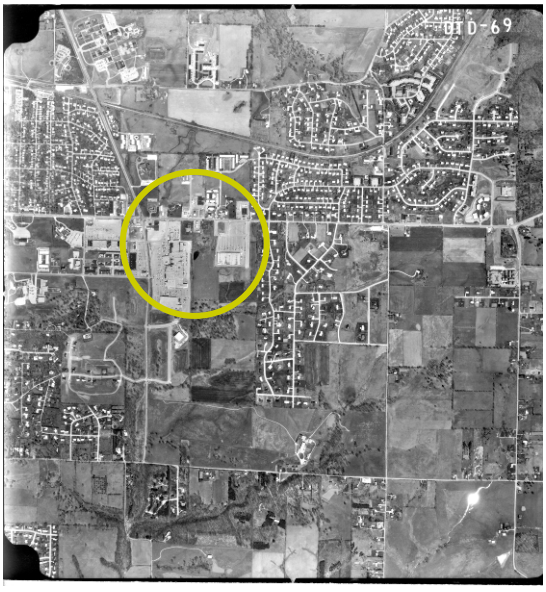
College Mall Area – 1949



College Mall Area – 1961



College Mall -- 1967



College Mall -- 1972

In the late 1980s, commercial activity began along the State Road 37 bypass to the west of the city as well as the area between Second Street/Bloomfield Road. 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. 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 essential amenities (such as grocery stores, retail shopping, pharmacies, schools, etc.) and the more dependent it is on the automobile to reach those amenities. Consequently, 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 a post-peak world, it will be important for people to live close to services critical to everyday life. In an effort to understand just how close or far residents currently live from key services, the Task Force mapped those services and compared the location of key services (areas of "activity nodes") against a map of population density.

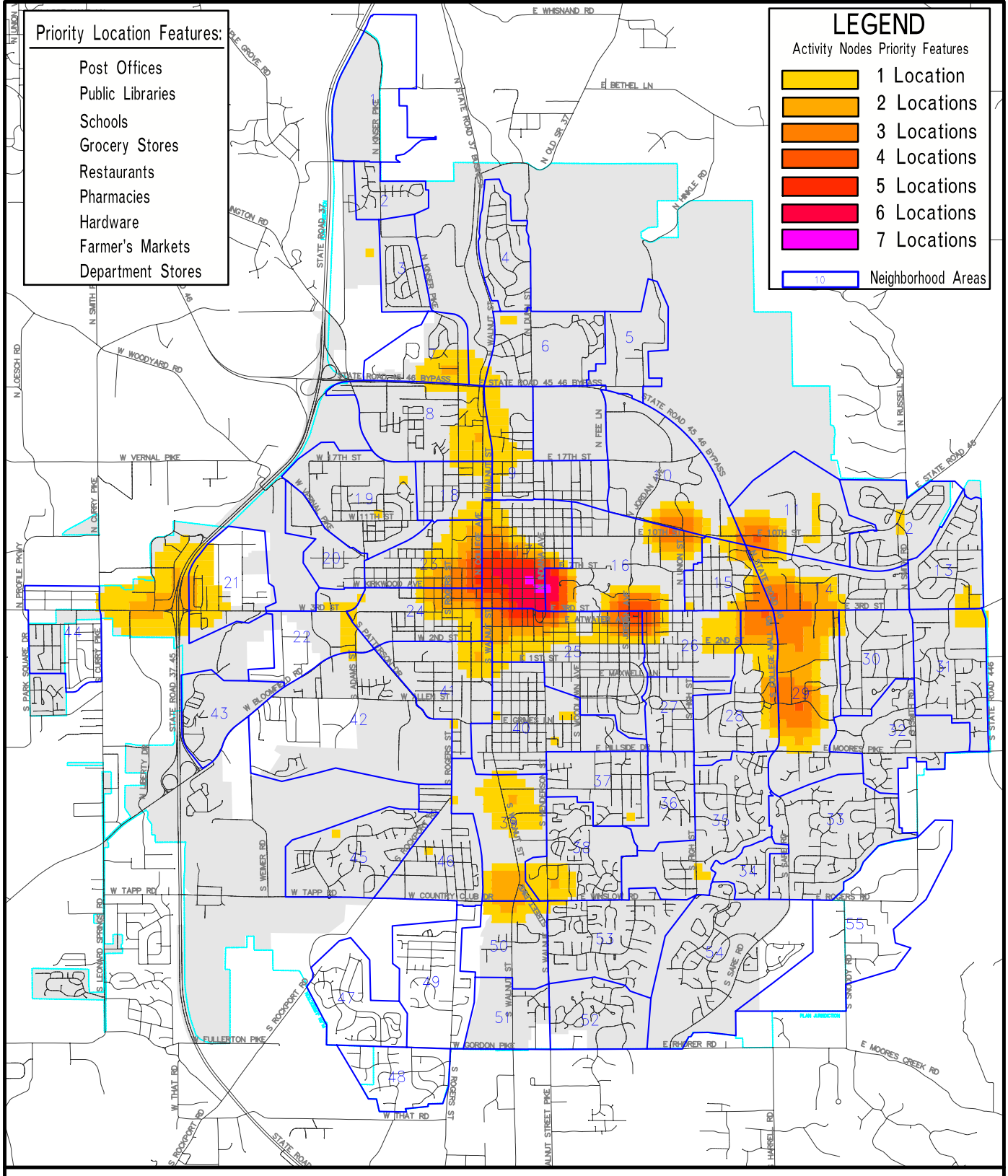
The following *Activity Nodes* map tracks the location of nine key services and the density of these services within a 300-foot by 300-foot block: grocery stores, schools, pharmacies, post offices, public libraries, restaurants, hardware stores, department stores and farmers' markets. The areas of the city with the highest concentration of these services (seven or more) are noted in bright pink; those with five to six locations are marked in red; those with four and three destinations are marked in dark and light orange respectively while those with one or two locations are indicated by yellow.

While the current picture of activity nodes points to three distinct nodes, an ideal configuration would place people closer to the nodes or the nodes closer to the people. Map B outlines areas of population density. When we lay the services map on top of the population map to examine the ways they align, it is clear that daily necessities cluster around major thoroughfares and do not necessarily track population density (Map C).

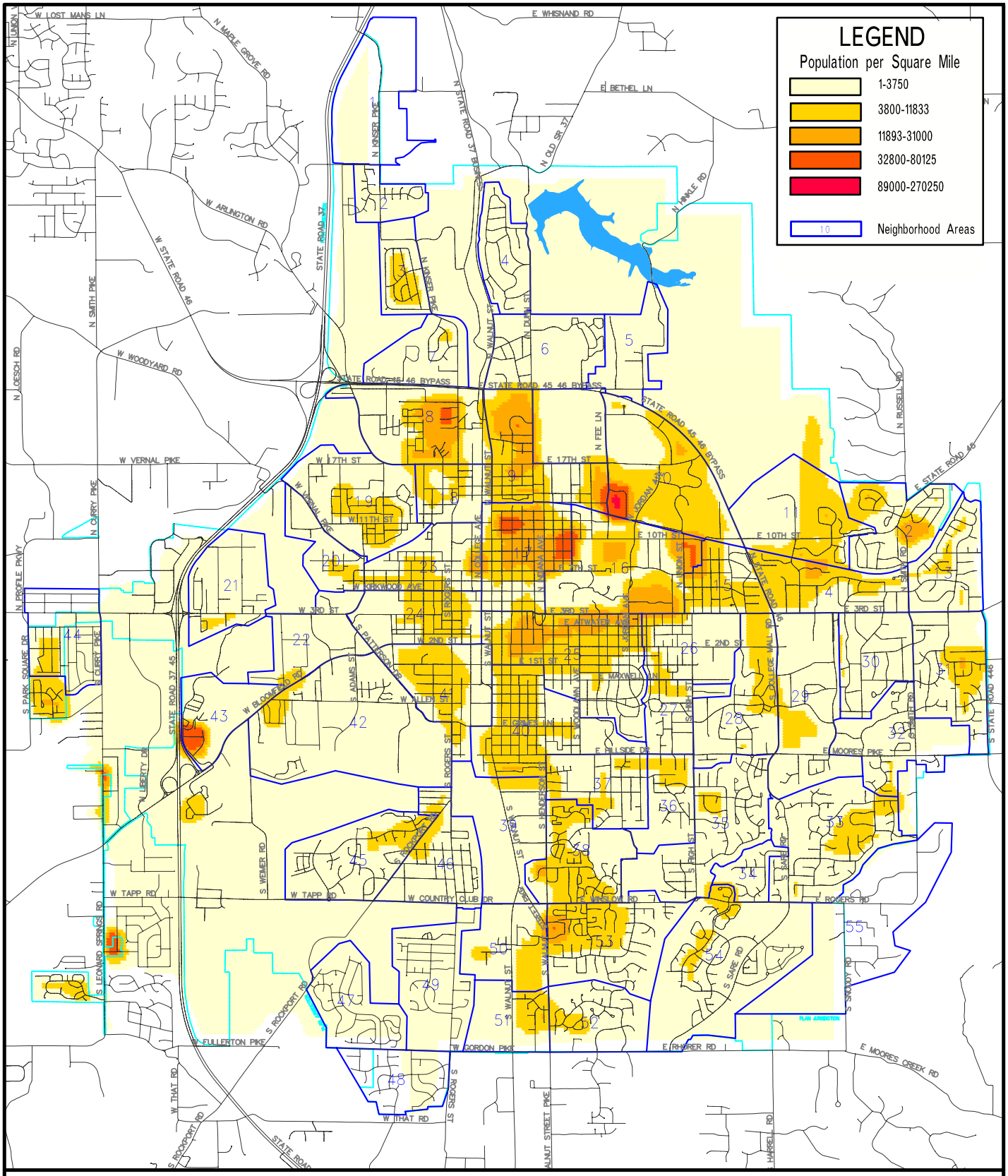
The idea of activity nodes is anticipated in the City's 2002 *Growth Policies Plan* (GPP). The GPP outlines the idea of a "Neighborhood Activity Center" (NAC). A NAC is a "mixed commercial node that serves as the central focus of each neighborhood" that should be easily accessible by pedestrians and minimize auto traffic while providing "small-scale retail and business services within the context of neighborhoods" [134] However, the GPP identified just a handful of NACs, only a few of which map onto the critical nodes identified by the Task Force. [135] For the most part, the NACs identified by the GPP do not align with critical services, nor are they located in areas of significant population density.

[134] GPP, 33.

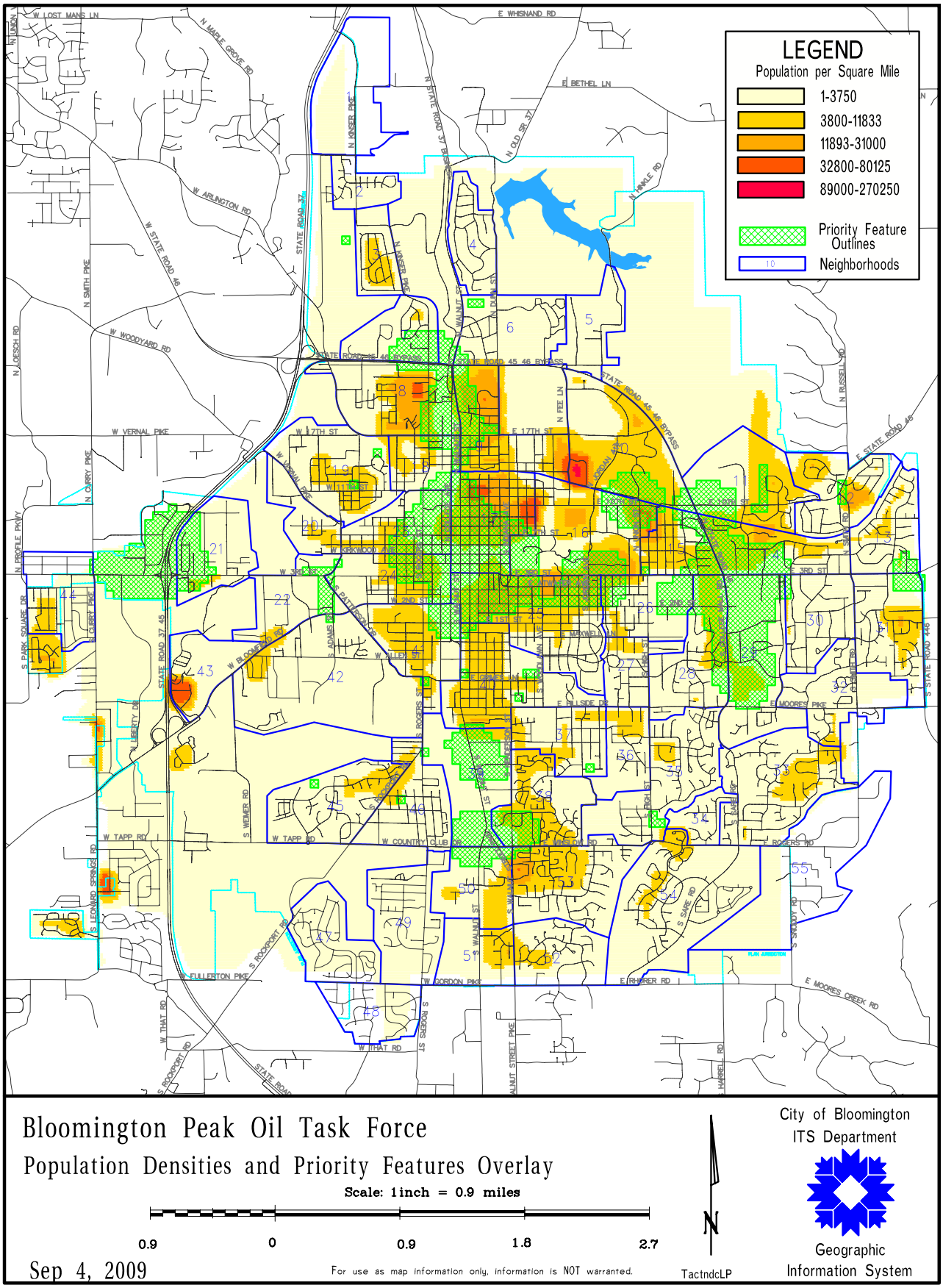
[135] *Ibid*.



MAP A: Activity Nodes



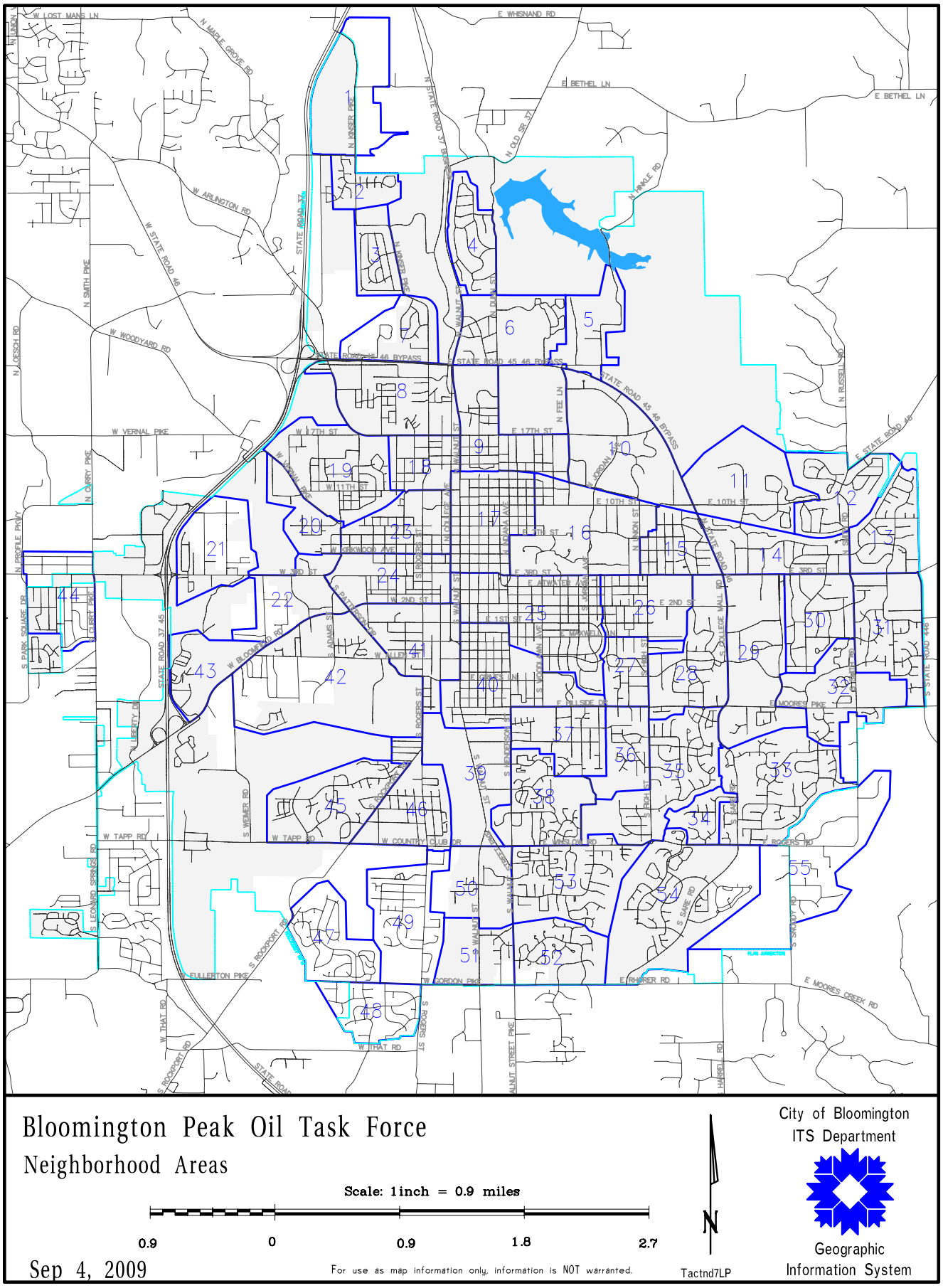
MAP B: Population Density



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 as many residences as possible. 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 a city matrix of 55 "Natural Neighborhoods." Collectively, these neighborhoods defined a basemap for the Task Force on top of which are overlaid the other maps that follow in this *Report*: activity nodes, walkability, population density, and proximity to bus stops.



MAP D: 55 Natural Neighborhoods

VULNERABILITIES

1. When it comes to land use, the physical separation of where we live from where we carry out the activities of everyday life – work, food, school, health care, and community – is by the biggest threat posed by the end of cheap oil.

As fuel prices rise and/or fuel disruptions occur with greater frequency, neighborhoods without access to necessary services will become less livable and could even be abandoned unless efforts are made to transform them into self-sufficient communities either by adding missing amenities or by developing alternative transportation options. [136] Increasing fuel prices and other costs associated with transportation will provide incentives to develop land within the city core and in neighborhoods that provide key goods and services. Available land for housing in the city core and in core neighborhoods could include areas previously used for parking, vacant lots, and lots occupied by single-story buildings. Because of their proximity to necessary amenities, these areas will draw residents from the city's suburban and exurban fringes.

> *[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.

[136] Lack of access to neighborhood services has the effect of driving down property values in those areas, making investment in them problematic at best and nonsensical at worst. In that case the City may find itself, as Youngstown, Ohio does today, in the position of having to abandon those areas to function without municipal services and shrinking the municipal boundary. *Youngstown 2010*. http://www.youngstown2010.com/

MITIGATION GOALS & STRATEGIES

SHORT-TERM (1-5 years)

1. Include planning for peak oil in the Growth Policies Plan (GPP).

The GPP was drafted when 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.[137] 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 future of energy descent, it is recommended that the City greatly increase the number of Activity Centers to bring people within walking distance of essential services in all 55 *Natural Neighborhoods* (Map D). The goal should be to promote small, self-contained neighborhoods with a clearly-defined center providing essential services, ideally no further than a quarter mile from the edge.

Most of the neighborhood activity centers 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. [138] 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 and appropriate locations have been identified." [139]

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

[138] 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.

[139] *Ibid*, 33.

3. Include plans for peak oil in the Unified Development Ordinance.

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.

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 actually be 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:

- **Remove any residual impediments to micro-agriculture.**
  As is detailed in the *Sustenance* chapter, local food production will be a critical component of post-peak resiliency. The City Council took an important step forward in fostering urban agriculture with its recent amendment to the UDO, but the City can do more to make land use within the city more farm friendly. Please see *Sustenance* chapter for detailed recommendations.

- **Encourage form-based rather than use-based development.**
  Use-based development is essentially post WWII suburban development where permitted land uses (residential, retail, employment) are the defining characteristic of the zoning code. This encourages, indeed mandates, separation of use, which in turns promotes dependence on the automobile. 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 providing all neighborhoods with essential services within walking distance, 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 commercial core so that essential services are within walking distance;
- Parks and other public and private open spaces within walking distance; and
- A mix of housing types and residential densities.

5. 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: Indiana University, Monroe County, and the City of Bloomington all draft and implement their plans independent of each other. Without coordinated planning, there is little hope for a comprehensive vision to guide development as transportation fuels become more expensive and are not as readily available. However, such cooperation is precisely what is called for in the City's GPP. The GPP 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."[140]

[140] *2002 Growth Policies Plan*, Implementation Measure ACC-3, p. 22. https://bloomington.in.gov/media/media/application/pdf/49.pdf

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.

A form-based code would both outline the design of the built environment (for example building height, where buildings should be placed on a lot, density of buildings, and street outlay) and provide for a wide range of compatible, neighborhood scale uses, as was the case before automobiles and cheap oil started to pervade our lives. On West 6th Street, for example, a neighborhood that was developed in the late 19th /early 20th century, several of the houses now used exclusively as residences had neighborhood grocery stores on the ground floor sometime in the past, when neighborhoods still provided more of what people needed on a daily basis.

2. 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 provided as a tool to spur the redevelopment of urban brownfields. [141] TIF came to Indiana in 1987 and in the years since, has greatly expanded as local governments have employed it as an alternative financing model for infrastructure and economic development.

Unfortunately, this has taken the use of TIF beyond its original purpose 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.[142] 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*

> ***North Park:*** *an arterial scar of land some 400-plus acres, owned by a developer whom the State of Indiana paid to build the arterial highway in the first place. An open greenspace, 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.*

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

[142] *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 for development of medical offices, warehousing, and suburban retail. The City has established seven TIF districts covering the immediate downtown and 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 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 Bloomington. Co-operation between the two redevelopment commissions along with concessions between the City and County to help move in the direction of urban redevelopment as opposed to suburban greenfield development would go a long way towards slowing or even reversing the building out of suburban infrastructure. A regional (county-wide or even 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 decisions that support the original intent of "redevelopment."

3. 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 were consolidated in a single larger facility. The purpose of consolidation was to 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 dispersed schools.

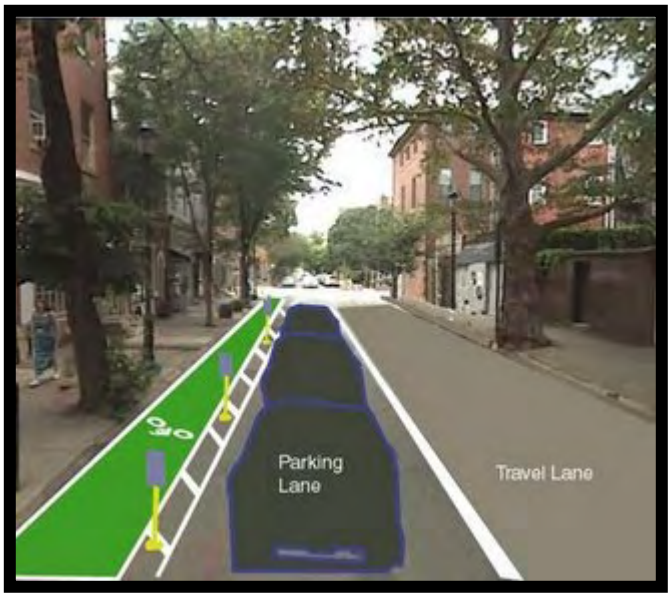
The promise of cost-savings accruing from consolidation is a source of controversy. In any case, there are transportation costs associated with consolidation. With gasoline in the $2-$3/gallon range, the Monroe County School Corporation is expending about 10% of its total budget operating its bus system, outsourcing some of that to private contractors. 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-Bean Blossom and Monroe County Community Schools) should be conducted and those results contrasted against greater fuel and other transportation costs associated with de-consolidation.

4. Target public transit routes to help shape neighborhood development.

Transit routes affect development patterns. The City should work with Bloomington Transit (BT) to shape the quality and form of residential and commercial development by targeting bus routes and schedules both to foster neighborhood identity by naming routes or stops for neighborhoods. However, routes should only be expanded if and as BT achieves fuel efficiency greater than the current 29 passenger miles per gallon, which is actually worse than that of many fuel efficient private automobiles with a typical occupancy load. Better advertising, higher public awareness, and, above all, higher fuel prices will all probably result in increased transit ridership, which should, in turn, lead to better per-rider fuel economy for the transit fleet. A discussion of public transit is more fully treated in the following chapter, *Transportation*.

5. Build in physical separation buffers along streets and roadways.

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 that allow 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 be used to protect bicycle lanes.



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

Bloomington designates bicycle lanes with on-road graphics but there are no physical barriers 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.

6. Discourage widening arterial streets where possible.

Arterial streets are designed to provide a high degree of mobility and generally serve longer vehicle trips to, from, and within urban areas. 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. While the practice of building arterials has largely been discarded by both the City and developers, the City still engages in the widening of existing arterials.

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.

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). In this way, the amount of roadway that must be crossed by a pedestrian at any one time can be minimized.

LONG-TERM (15-30 years)

1. Within 30 years, the City should complete its transition of all 55 *Natural Neighborhoods* to activity nodes that provide for essential services and transit within walking distance.

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. Ninety-seven percent of transportation energy is reliant on fossil fuel. Of that figure, fully 95 percent comes from petroleum.[143] For decades, low global petroleum prices prevailed, shaping the way people and goods move.

Low oil prices fostered personal automobile ownership and a road network that allowed us to live substantial distances from where we work, shop, and go to school. Cheap oil also fostered air travel and long-distance trade among nations. As a result, cities like Bloomington have become dependent on other regions for almost everything needed in daily life, from food, clothing, water, transportation fuel, shelter and medicines to big screen televisions, 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, irrigation systems, fuel, containers, hoop houses, etc. that have been produced elsewhere and transported to Monroe County over long distances. Because of our reliance on automobiles, trucks, container ships, and airplanes for moving goods and/or people, a disruption in the supply of petroleum could affect 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 our community's vulnerability is a function of how easy or hard it is for people, businesses, and institutions to respond to increasing fuel prices by reducing petroleum consumption *without* compromising the basic human needs of shelter, food, water, health care, and transportation. A key aspect of community resiliency will be strengthening our

[143] 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*.

local transportation system.

How vulnerable or resilient we are will be influenced by:

- The quality and costs of transportation alternatives (walking, biking, public transit, rail, car shares, 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: VMT & 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 (the highest in the world until recently).[144] As with 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.[145] See *Appendix IV*.

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*.[146] 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 at the equator 112 times in one day.
- Driving one car from the Earth to the Moon 12 times in one day.

[144] Organization for Economic Co-operation and Development. *See*, William Pentland, "The World's Top Car-Owning Countries," *Forbes*, July 30, 2008.

[145] Based on 2000 U.S. Census figures.

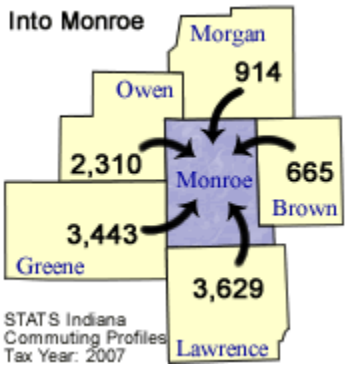
[146] Bloomington Environmental Commission, *Bloomington Environmental Quality Indicators Report*, http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

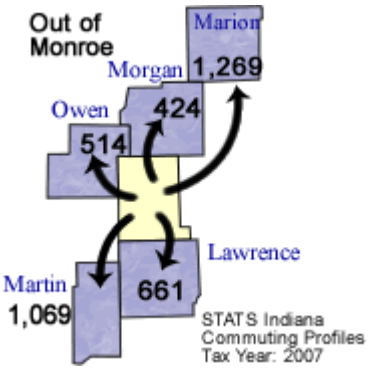
The 2.8 million miles we drive each day translate into 22.8 miles per capita for Monroe County residents. While Monroe County VMT is lower than many other communities in Indiana, the figure is substantially higher than for comparable college communities such as Washtenaw County, MI (Ann Arbor) whose 11 VMT is roughly half that of Monroe County.

According to the 2000 U.S. Census, approximately 67 percent of Bloomington workers commuted to work in single-occupancy vehicles, 14.5 percent walked to work, 9.2 carpooled, 2.8 percent used public transportation, and 2.7 percent used bicycles.[147] These figures 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. Of those, 15,859 (almost 19 percent) commuted into Monroe County from neighboring counties. These commuters predominantly reside in Owen, Green, and Lawrence Counties. 5,952 residents of Monroe County work in other counties.[148]





[147] 2000 U.S. Census.

[148] 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

People with lower incomes and those travelling great distances are the most vulnerable to a decline in cheap oil. Subtracting out the large student population, the poverty rate of Monroe County hovers somewhere around 26 percent.[149] The poverty rate for the nation as a whole is 12.5 percent while Indiana's rate is 12.3 percent.

In an effort to better understand 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),[150] 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**[151]	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%
Fuel expenses as % yearly per capita income **$6,000** [152]	13.67%	20.81%	27.74%	34.68%	67.96%

[149] 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. According to Todd Lare, Executive Director of the South Central Community Action Program, even if you lowered the 41.6 percent figure by 15 percent to account for the student population, it would leave more than a 26 percent poverty figure among non-university residents. 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.

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

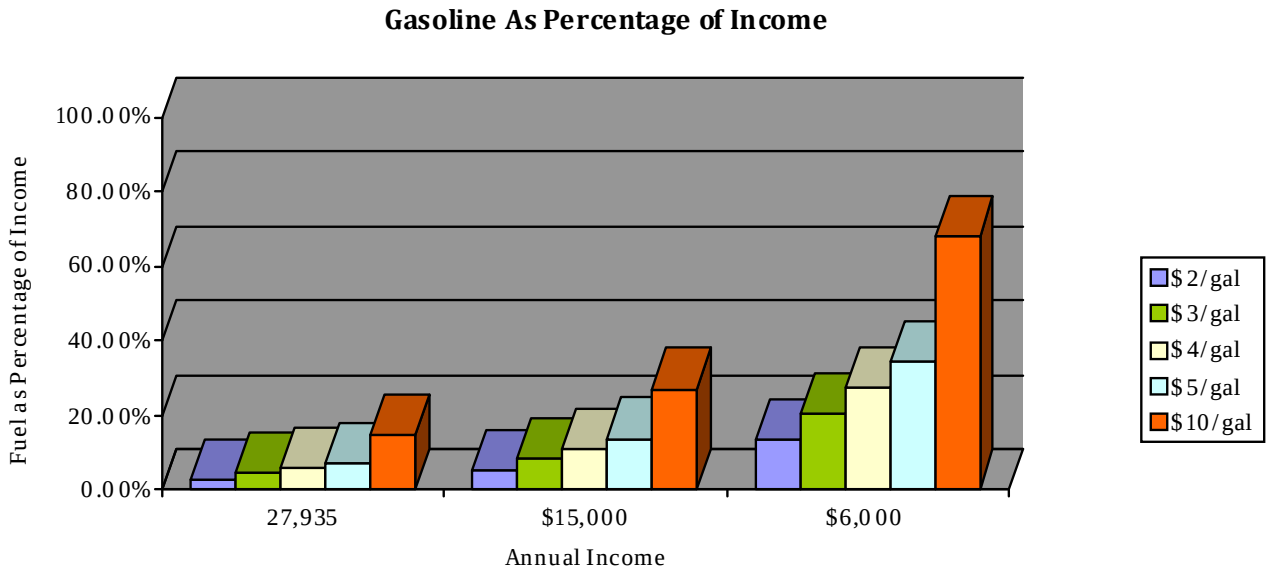
[151] Monroe County 2006 personal per capita income.

[152] Poverty level for household of three.

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 per gallon and 22.8 VMT, fuel constitutes roughly the following proportion of per capita income: 2.9 percent of $27,035/year; 5.47 of $15,000/year, and 13.7 percent of $6,000/year. 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 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 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 with lower incomes 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 with higher incomes 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 burden lower-income residents.**

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

REVIEW OF CURRENT SITUATION: WALKING AND BIKING

The City of Bloomington has made a considerable effort 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*.[153] Indeed, the City is one of 108 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 (MPO) adopted a *Complete Streets Policy*. The guidelines outlined in the policy ensure that local roadways which are federally funded safely accommodate all users of a corridor, including pedestrians, bicyclists, users of mass transit, and motorists.

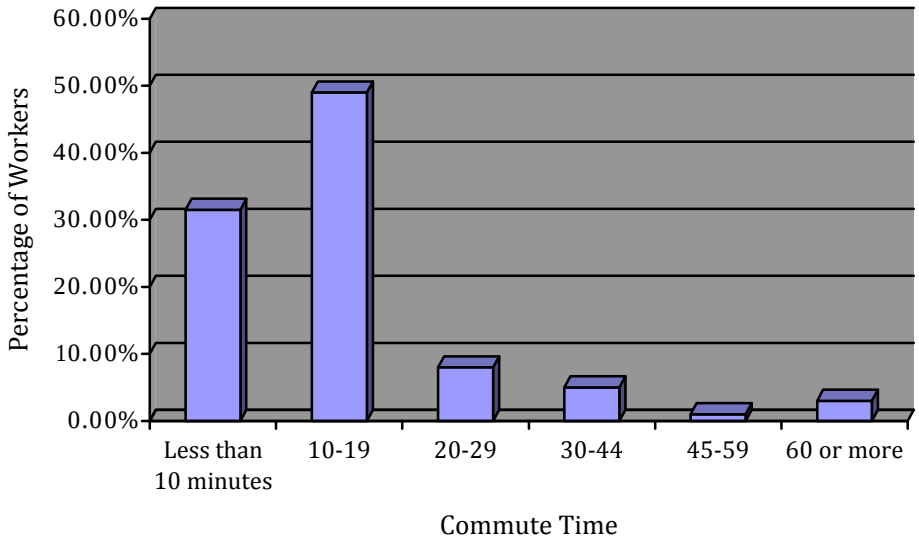
Whether increasing fuel prices can be offset by turning to walking and biking depends on many factors, including the distance residents need to travel and the safety of the bicycle or pedestrian route. If the typical Bloomington resident has an average 19-minute commute by car, how feasible is it for the typical resident to bike to work? What about biking or walking to other necessary destinations such as the grocery store, school, the doctor's office, etc.?

[153] *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. A car driving at an average speed of 20 miles per hour travels about 3.3 miles in 10 minutes. At a pace of three miles per hour, it would take a person on foot over an hour to cover the same distance. It would take a non-athlete biker rider about 22 minutes. The following graph shows average work commute times for Bloomington residents in 2000.

Bloomington Commute Time -- 2000 Census



In 2000, about 32 percent of all commutes by Bloomington residents took less than ten minutes, and about 50 percent 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 replaced by a roughly 45 minute walk or a bike ride of 20 minutes or less.

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 currently enjoys a five-mile 16-minute commute by car, walking the same distance would take over an hour and a half, while biking would take

about 35 minutes.

In other words, if around 67 percent 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 will require a change in habits. For Monroe County residents commuting into Bloomington, walking is almost certainly out of the question and biking would be 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 such as schools, shopping centers, workplaces, day care centers, garden supply stores, hardware stores, theaters, 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. However, for most people, the current land use patterns are major impediments to biking and walking. In some instances, residential areas are physically adjacent to shopping areas and other land uses, but no direct road connections exist 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 determine this, the Task Force calculated the "WalkScore™" of each of the pre-defined 55 *Natural Neighborhoods* (Map D, p. 101).[154] WalkScore measures 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:

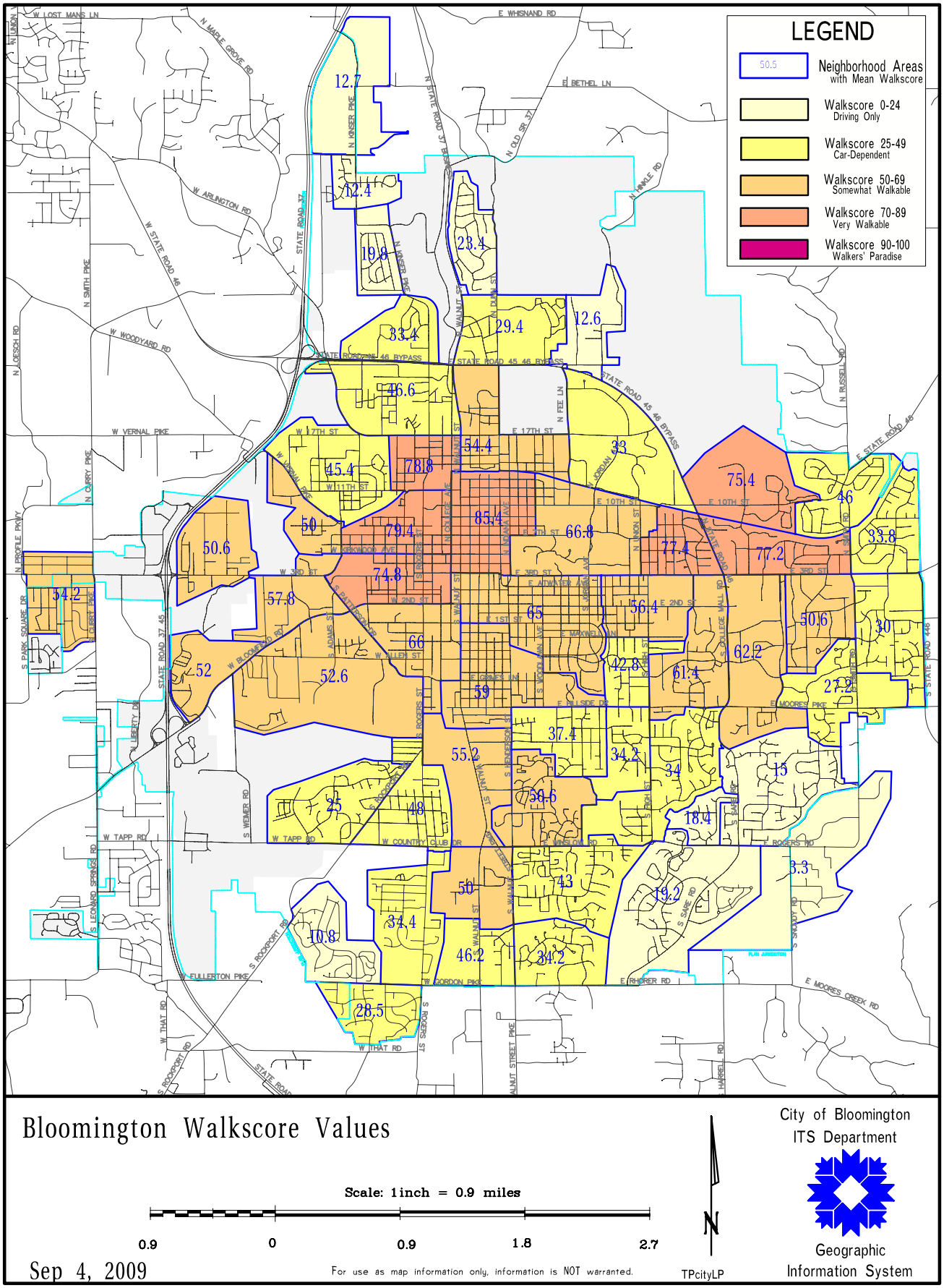
- **90–100 = Walkers' Paradise:** Most errands can be accomplished on foot and many people get by without owning a car.
- **70–89 = Very Walkable:** It's possible to get by without owning a car.
- **50–69 = Somewhat Walkable:** Some stores and amenities are within walking distance, but many everyday 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. Unfortunately, our "walkability" analysis of the city reveals that no neighborhood is considered a "Walker's Paradise" and only seven 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:

[154] www.walkscore.com

grocery stores, taverns, coffee shops, and nail salons are considered equally valuable destinations as grocery stores and doctors' offices. 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 tool 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. However, as pointed out in the Bloomington/Monroe County Metropolitan Planning Organization'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.[155]

Peak oil provides us with an additional rationale for working toward retrofitting these arterials with safer facilities for bicycles and pedestrians.

VULNERABILITIES: BICYCLE & PEDESTRIAN

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

1. **Most destinations are located far from residences.**

2. **Major arterial streets in the city lack adequate bicycle facilities.**

[155] Bloomington/Monroe County Metropolitan Planning Organization, *2030 Long-Range Transportation Plan*, 68.

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 any form of passenger rail connection to surrounding communities.

Bloomington Transit and Indiana University Campus Bus System

Bloomington Transit (BT) 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; and semi-annual passes are $150. There are free transfers to other BT and Rural Transit routes. Bloomington Transit operates two routes on Sundays. Reduced service is offered on Saturdays. All fleet buses are equipped with bike racks and wheelchair ramps or lifts. 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.[156] This increase resulted partly from an increase in the IU student population and partly from an increase in 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."[157] Bloomington had the highest per capita ridership of any city in Indiana with over 40 passengers per capita using transit in 2008.[158]

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[156] 2,363,526 in 2006; 2,570,117 in 2007; 2,829,950 in 2008 (via Lew May, BT General Manager).

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

[158] In 2008, Bloomington Transit had 3 million riders. Bloomington has a population of approximately 70,000. Indiana Department of Transportation.

The Indiana University Campus Bus System travels to all points on campus, to downtown Bloomington, and to the College Mall. The service is available every day of the week, with reduced service during breaks and on holidays. The service is a fare-free system, and includes BT buses. BT initiated its free-to-students initiative in 1999 and saw a marked increase in student ridership. Currently, students comprise approximately two of every three BT riders.[159]

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.

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

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 picks up and drops off passengers at several IU campus locations.

[159] 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 and Greyhound stations, 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 slice of the transportation pie. Only a small portion of the population makes use of it. As discussed earlier, only 2.8 percent of all work commutes are on public transit.[160] 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.[161]

1. Fuel prices will be volatile and will increase.

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. 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."[162] 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 are predicted to 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. IU is 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.

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[160] 2000 U.S. Census

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

[162] Michael Cooper, "Transit Use Hit Five-Decade High in 2008 as Gas Prices Rose," *The 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 an 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. Bloomington Transit has an 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 supply disruptions could shut down the public bus system, right at a time when the need for public transit would be the greatest.

BT has already taken steps to reduce its dependency on petroleum. 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. Hybrid buses average about 25 percent better mileage than conventional diesel buses of the same size.

A peculiar federal funding formula essentially makes transit dependent on the federal gas tax. Gas tax revenue will decline as gasoline use declines. For that reason, we will need to invest much more substantially in public transit from local funds 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.[163] However, switching to transit will often come at the expense of time.

In Bloomington, while it is likely not too difficult for most people close to the city center to find a bus stop within short walking distance, once a patron is on the bus, she may be faced with a long ride to get to a destination as the bus probably does not take the direct route one would follow when driving. 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. BT has an 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 residents (See Map F, following page[164]). To make BT a more viable and attractive alternative to the automobile, it would have to offer more frequent service, including weekends and late at night as well as add routes to previously under-served areas. This would require a considerable increase 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.

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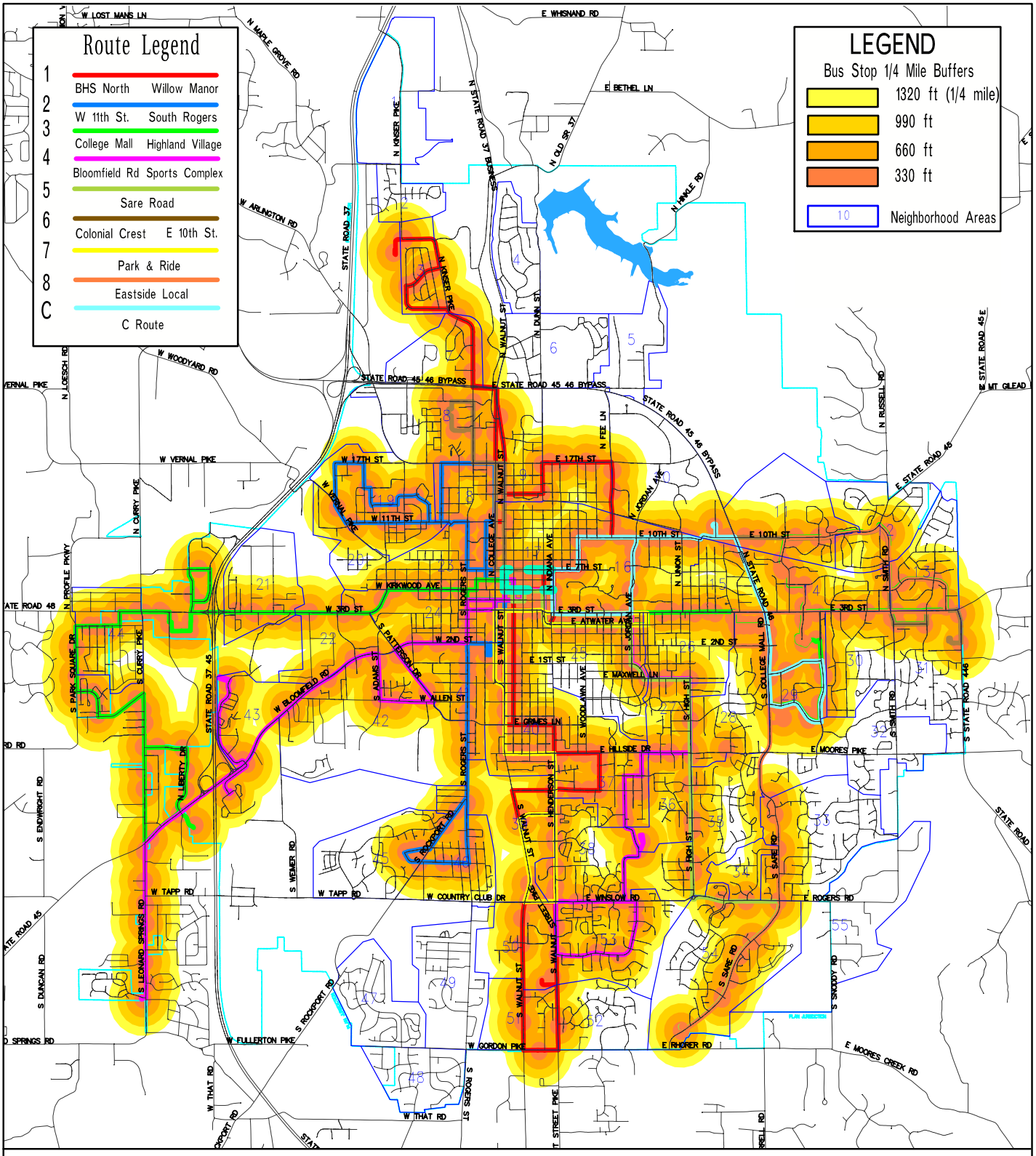
[163] American Public Transportation Association, *Transit News*, March 9, 2009. http://www.apta.com/media/releases/090309_ridership.cfm

[164] Please note this map should also include Basswood Drive, Whitehall Crossing Shopping enter and S. Walnut from Winslow all the way down to Rhoer Road as stops within walking distance.



MAP F: Walkability of Bloomington Transit Bus Stops

4. Funding is inadequate.

The fact that securing funding for transit improvements will be critical is confirmed by INDOT's 2008 *Mass Transit Study*.[165] The study states that "Local bus systems are undersized in Indiana's cities, and thus currently serve a primarily transit-dependent population."[166] To attract additional riders, the study suggests 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."[167]

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 accommodate the recommended transit investments that are necessary to meet current unmet demands, much less the likely increases in demand as a result of peak oil. The pattern outlined in the INDOT study makes it clear that the national trend of driving less translates into reduced federal fuel tax revenues, which means fewer federal tax dollars are available for transit and highway programs in the State of Indiana.

Investing in our public transit infrastructure to make it easier for people to use the system will result in greater ridership. Greater ridership will translate into greater funding to make up for the shortfall lost to decreased revenue from the federal gasoline tax.

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[165] Indiana Department of Transportation, *Executive Summary, Indiana Mass Transit Studies* PL 203-2007, (December 2008), E-6.

[166] "Transit-dependent" refers to people who cannot drive because they are poor, sick, too old to drive, or disabled.

[167] *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.[168] 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 are not prevalent.

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 others can arrange car pools for daily commuting, cross-country travel, or short occasional trips for shopping or for going to the doctor or to the airport.[169]

7. Monroe County Community School Corporation is highly dependent upon petroleum.

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 is 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 fuel use for buses is somewhere between 1,100 and 1,800 gallons per day. With a 12,000 gallon tank for diesel, this means that MCCSC has only between 6.5 days and

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

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

11 days worth of supplies when all tanks are filled 100 percent. Depending on the frequency of fuel deliveries, actual reserves on hand at any one time could be far less.

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 tried 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.[170] Such a reduced reliance on the car is good practice for preparing for a permanent decline in the availability of cheap oil, but to really prepare for peak, we need to invest in a less petroleum-dependent infrastructure and we need to move towards broader cultural acceptance of walking, biking and public transit and other alternatives to the single-occupancy vehicle.

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 at the price to which people have been accustomed.

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

- Higher fuel prices will consume greater proportions of public and private budgets;
- The distance that raw materials, goods and people travel to reach their endpoint must be reduced;
- Where long-distance 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.

[170] 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

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 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 an 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. These are the price swings symptomatic of oil price volatility we can expect in the future. 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; 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 directing 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 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 decreasing 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 whose residences are distributed over a large area will find someone else close by with whom they are able to share the commute.

Having a well-designed ride-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.

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.[171]

Car sharing: A Brief Review

Car sharing in the U.S. 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 promote car sharing. 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.

Compiled by: Sarah Germann

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

The City should establish or encourage the establishment of a city-wide car sharing program. Car sharing reduces the need for personal vehicle ownership and the demand for parking. It also stands to save residents money and would allow local businesses and non-profits to economize on their fleets.

4. Land use: make 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, walking and transit 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 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 encourage even more mixed uses in our zoning laws, making it possible for small businesses to locate closer to where their customers live, thus reducing the need for automobile trips and facilitating walking, biking, and public transit. 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.[172] 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 propelled from the "bottom up."

[172] Permitting granny flats in residential districts has been a source of much local controversy. Please see the *Housing* chapter for further discussion of granny flats.

To that end, we recommend that:

- The City, in cooperation with other local entities like *Transition Bloomington*, the City of Bloomington Commission on Sustainability, the Center for Sustainable Living, and others, encourage, promote, and support *Transition* training for all 55 *Natural Neighborhoods* (Map D, p. 101) within the next five years. As discussed in the *Economic Context* chapter of this *Report*, the Transition Movement, motivated by the twin challenges of climate change and peak oil, aims to organize citizens at neighborhood and community levels around sustainable living.
- The City staff stay in contact with neighborhoods as they engage in Transition projects and assist them in formulating changes to land use regulations that help them achieve their Transition goals.
- The City promptly implement 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 the *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 IU, Monroe County and the City of Bloomington all draft and implement their plans independent of each other. Within the next five years, 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 Bloomington/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. Increase connectivity for bicyclists.

Build out bicycle boulevards

As discussed above, the City of Bloomington has made a consistent 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* stresses 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 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 should 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

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 and the Allen Street/Covenanter Drive Bicycle Boulevard. 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. They 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 lanes for car 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. [173]

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

Make bike riding on major arterials safer

While the City has made great efforts to improve bicycle transportation and bicycle safety, it 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.

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 and BT should start exploring the cost and feasibility of several fast east-west and north-south routes in which buses have priority. In the long term, such bus lanes would ideally serve a considerable number of neighborhoods. In the short term, the City should work with BT to secure funding for at least one east-west and one north-south connection.

More bus line intersection

Another key improvement to transit is providing more opportunities for people to switch between bus lines. 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 15 years. Possible ways of accomplishing 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, at 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 could be used for school trips. During summers, there may be opportunities to offer unused capacity for long-distance bus trips to the public. 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.

The Task Force recognizes that this proposal comes with constraints. First, the Federal Transit Administration (FTA) prohibits federally-funded transit systems from providing exclusive school bus service and places constraints on competition with freight carriers. Secondly, some parents may have concerns about mixing students with the general population on public transit buses. However, the community can begin the process of moving some public school students (middle and high school students) onto existing public transit routes where existing routes provide good connections to/from schools. If this incremental measure can be proven successful, it will help efforts to expand the use of public transportation for school transportation.

11. Seek greater public investment in the transit system.

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 can no longer 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 transportation alternative will be very limited. The lack of robust, viable transportation alternatives will result in more severe local economic disruptions.

Gas tax

About 20 percent of BT's annual operating 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 percent of the tax is devoted to roads and only 20 percent is dedicated to public transit. Therefore, the current system favors road building over transit and actually encourages 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 problematic approach. Secondly, the tax itself is unstable. Decreased demand for gasoline, as we experienced in the summer of 2008, causes gasoline revenue to drop appreciably and transit suffers.

Funding

As INDOT recommended in its recent analysis of transit in Indiana, to reach levels of service necessary to realize even modest increases in ridership, an increase in funding must come from the local or regional level.[174] Local funding is critical considering that a post-peak environment will occasion both 1) increased demand for transit and 2) decreased state and federal funding.

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

For years, transit has been woefully underfunded at all levels of government. The community, state and nation need to invest much more heavily in our public transportation systems. This might mean new taxes or shifting existing tax funds from other programs to our public transportation system. The City should be visionary here and work with BT to advocate for a greater public investment to improve and expand transit services and to transition buses to non-petroleum sources of fuel.

12. Explore the option of a "no fare" Bloomington Transit system

The IU Campus Bus system currently operates as a "no fee" system. Other communities in Indiana, such as Marion, are operating public transit free of charge. BT should explore the possibility of implementing a "no fare" system. On special days when BT does not charge a fare to ride the bus, it experiences a 15 percent increase in ridership. Bloomington's 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." [175]

However, fares currently bring in around $400,000-$500,000 per year and cover 20-25 percent of BT's transit costs. As the loss of fare revenue would be significant, it might very well mean that some transit service would be cut. The City and Monroe County should work with BT to closely examine such feasibility and should help identify sources of revenue needed to invest in the BT infrastructure to help meet increased demand occasioned by a free fare system.

[175] GPP, Implementation Measure, MT-5, 15.

13. Fully unify the BT and campus bus systems.

A unified transit system wherein IU and BT are joined offers the potential to increase funding from the State of Indiana significantly. Indeed, as much as $2 million could be acquired if the Indiana Department of Transportation approved such unification. $2 million would help provide a higher level of service to the community. The City should work with BT and IU to fully support such a merger.

14. Explore methane digesters to produce biogas for transportation

A large biogas digester in Japan. Source: Sustainable Cities Blog, http://blog.cunysustainablecities.org

Organic, locally-generated waste, such as food waste, is a potential rich store of energy that could be used to fuel transit buses. This waste is a source of methane – a primary component of natural gas. 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. Locally-produced gas that fuels transit buses and school buses would greatly reduce the risks to this community from interruptions in supply of transportation fuels.

A United Nations publication states, "[a]t present biogas is the most immediately practicable means for powering a conventional internal combustion engine from biomass."[176]

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:

> 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.[177]

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

[177] 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

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."[178]

However, the Task Force recognizes that any new technology exacts a cost. Any new fuel brings with it the requirement for substantial investment in infrastructure, the possible necessity to relocate maintenance/fueling facilities, costs to equip new buses with engines appropriate to the fuel, and cost to train personnel on maintaining alternative fuel propulsion systems. Furthermore, sometimes alternative fuels are not as reliable and technologies to use alternative fuels are often much less mature. As a result, buses relying on alternative fuels may break down more frequently, and service may, at times, be unreliable.

The City should work with BT to fully research the costs and benefits of bio-digesters. If research reveals that bio-digesters would work in our community, fuels generated should be used for BT, the City and MCCSC vehicles and placed in locations appropriate for fueling the respective fleets, as well as for fueling the vehicles that collect organic materials. Remaining supplies should be offered to Monroe County or other users. The fertilizer that is generated as a by-product of such digesters would be useful for local gardeners and farmers.

[178] *Ibid*.

15. 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. 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. 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 the Indianapolis transit system. 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 ensure 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.[179]

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

MEDIUM-TERM (5 -15 Years)

1. Increase connectivity and safety for bicyclists

Within the next five to 15 years, there should be at least four east-west and four 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.

2. Improve levels of service for BT

Within the next five to 15 years, plans developed in the first five years should start to 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 to develop additional funding sources and cooperate with MCCSC are 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.

3. Expand 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.

LONG-TERM (15-30 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 have increased in areas where essential services like grocery stores, schools, pharmacies, post offices, public libraries, restaurants, hardware stores, department stores and farmers' markets are located. 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 BT into a positive feedback loop, where increased ridership encourages increased levels of service, and vice versa. We recommend that BT continue its path of carefully-planned improvements in the levels of service, attracting 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 toward establishing those connections.

HOUSING

"Peak oil and climate change require a revolutionary change to all aspects of our lives. The energy used and CO_2 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[180]

Oil and housing are closely linked. Although oil is not directly used by most homes in the U.S., the energy required to heat and cool our homes derives from energy sources reliant on oil for their production and delivery. In Indiana, fully 95% of our electricity is powered by coal. Coal requires oil for mining and transport. Therefore, as the price of oil rises, so too will the price of electricity.

Add to this picture the likelihood that, as the price of electricity increases, more people will look to other sources of energy such as natural gas to heat and cool their homes. As more people rely on natural gas, the price of natural gas will increase. As detailed in *Appendices II and III*, both coal and natural gas production are projected to peak around 2030. All of these effects gear up into what is referred to as "peak energy." In light of peak energy, we must start to imagine alternative ways to heat and cool our homes in ways that conserve energy and save money.

[180] Pat Murphy, *Plan C: Community Survival Strategies for Peak Oil and Climate Change* (New Society Publishers: Garbriola, Island, BC, 2008), 143

REVIEW OF THE CURRENT SITUATION

Housing Units

As of the last U.S. Census, Bloomington had 26,468 housing units. 17,127 (65%) of these units were renter-occupied and 9,341 (35%) were owner-occupied.[181] As defined by the 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."[182] "Housing unit" does not necessarily mean a "house." There are 7,952 single-family owner-occupied homes. The average household size in Bloomington is 2.09 people.

Efficiency

Most of the housing in Bloomington was built in an era of cheap energy. As a result, much of our housing stock tends to be inefficient.[183] The Energy Information Association reports that the least energy-efficient homes are those constructed between 1959-1989. The lowest energy users were generally constructed before 1959, with post-1989 construction coming in a close second.[184] Approximately 46% of the city's total housing units were built between 1960 and 1990. See table and Map G below.

Age of Bloomington Housing Units [185]

Year Structure Built	Number	Percent
March 2000 to present[186]	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	32,615	

[181] 2000 U.S. Census

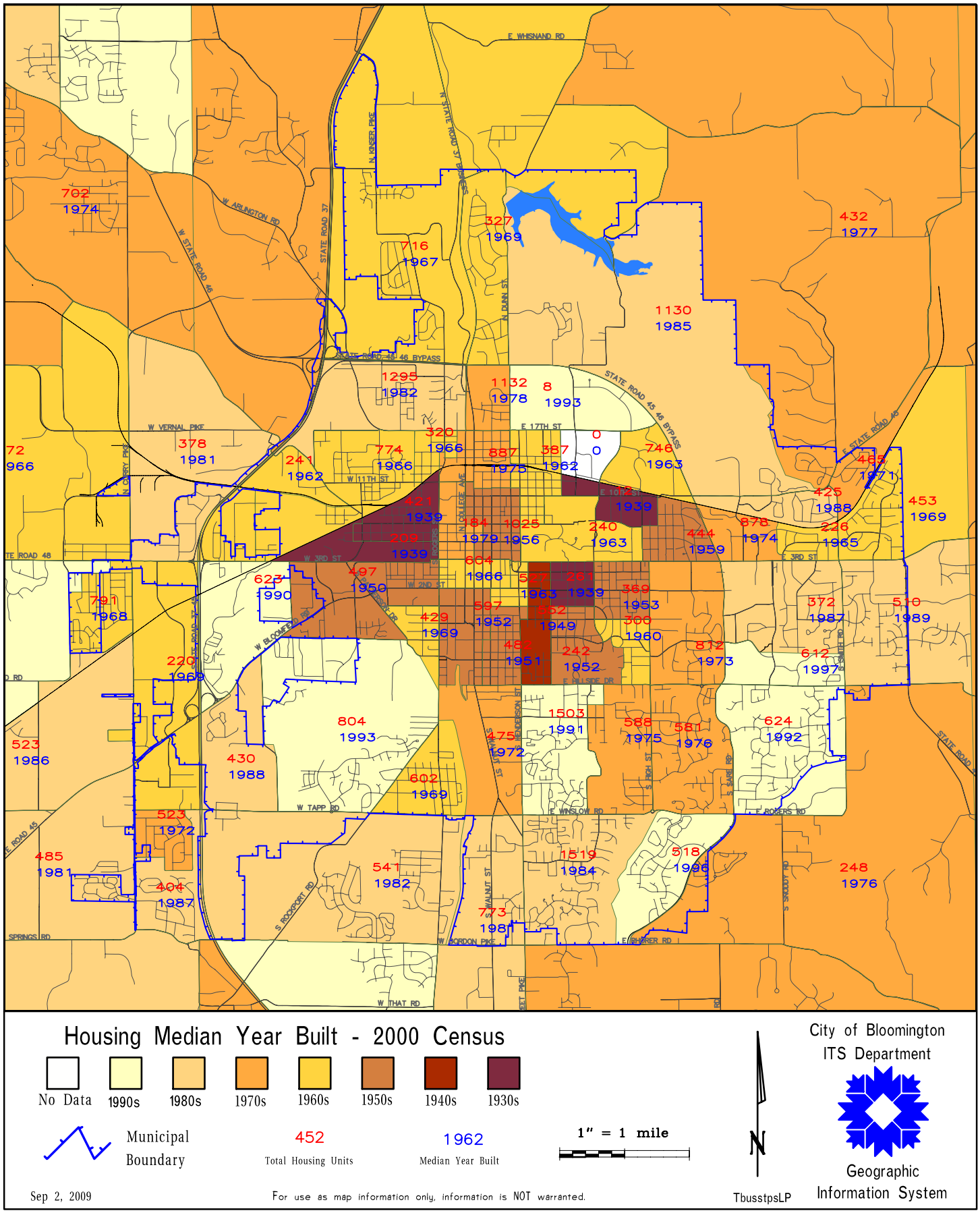
[182] U.S. Census Bureau, Housing Units, http://quickfacts.census.gov/qfd/meta/long_HSG010207.htm

[183] Murphy, 145.

[184] U.S. Energy Information Administration, *The 2005 Residential Energy Consumption Survey*, http://www.eia.doe.gov/emeu/recs/contents.html

[185] U.S. Census Bureau, figures of May 2008

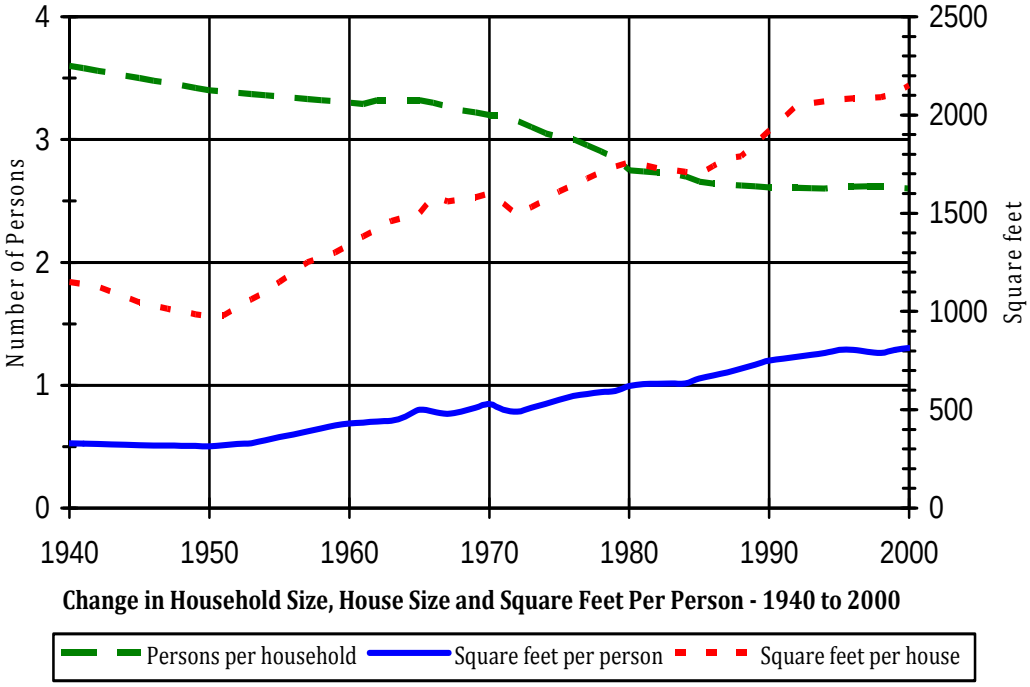
[186] Estimated; note that projections after 2000 are unreliable. The 2000-present figure is predicated on the 1990-2000 annual rate of increase of 2.61%.



MAP G: Bloomington Housing Units -- Median Year Built

Number of People per Square Foot

While homes have become more energy efficient per square foot the effect of these efficiencies has been counteracted by the size of our homes. Over time, the size of our homes has increased, while the number of people living in those homes has decreased. In 2000 the national average household size was 2.59 people. As shown below, this is significantly less than the average of 3.67 in 1940, while over that same time period the number of average square feet per house, and per person, has increased:



Adapted from Plan C: Community Survival Strategies for Peak Oil and Climate Change [187]

Bloomington tracks – indeed exceeds – national trends. In 2000, the average Bloomington household has shrunk while the average size of a single-family residence has increased. In 2000, the average household size in Bloomington was 2.09 people – 0.50 fewer people than the national average.[188] From 2000 to 2009, homes built in Monroe County averaged 2,547 square feet,[189] almost 400 square feet larger than the U.S. average.

[187] Murphy, 146.

[188] U.S. Census 2000. Bloomington's small household size is very likely due to its large student population.

[189] Personal communication, Monroe County Building Department.

Home Heating Fuel

In both Bloomington and Monroe County, most heating fuel is either utility, bottled, tank, or liquefied petroleum gas or electricity. In 2006, natural gas accounted for 59.71% of total energy consumed in the Bloomington residential sector, while coal accounted for the remaining 40.29%. The total amount of coal consumed (95% of electricity production) was equivalent to 292,424,591 kWh. Also that year, the equivalent of 433,462,717 kWh of natural gas was consumed (heating plus 5% of electricity generation).[190] As mentioned previously, both the price of electricity and natural gas are expected to increase as the price of oil becomes more volatile and more expensive.

Energy Consumption Distribution

In addition to looking at sources of our residential energy use, it is important to look at how we use that energy. According to the U.S. Department of Energy, in residential buildings, space heating and cooling, lighting, and water heating account for 66% of the total energy consumption.

ENERGY CONSUMPTION IN RESIDENTIAL BUILDINGS

End Use	Residential Buildings
Space Heating	31%
Lighting	11%
Space Cooling	12%
Water Heating	12%
Refrigeration	8%
Electronics	7%
Cooking	5%
Wet Clean	5%
Computers	1%
Other	9%

Adapted from U.S. Department of Energy, 2007 Energy Data Book.

Any efforts to reduce energy consumption must start with a close examination of space and water heating, cooling and lighting.

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

Local Incentives

The community has taken progressive measures toward fostering energy-efficient housing.

- **Owner-occupied rehabilitation program**. This home rehabilitation loan is funded by federal tax dollars and administered by the City of Bloomington's Housing and Neighborhood Development Department (HAND). An amount of up to $38,500 is available to eligible homeowners for the rehabilitation of their homes. This money can be used to address energy efficiencies.

- **Purchase-rehabilitation program.** This HAND program provides funds for energy efficiency improvements to income-eligible families purchasing a home.

- **EverGreen Village.** This 12-unit subdivision was developed by HAND and incorporates many energy-efficient plans. These plans include a storm water design system that incorporates a restored creek and naturalized rain gardens and homes built using LEED standards. These energy efficient designs coupled with solar energy production make these green homes very efficient and cost-effective.[191]

One of the 12 units in the City's EverGreen development.

- **Furnace insulation program.** HAND has plans for furnace insulation and draft assessment programs for both owner-occupied and rental housing units.

- **Conditional loans to developers.** Through HAND, loans are provided to developers for construction or rehabilitation of affordable owner-occupied homes.

- **Direct assistance to homebuyers.** HAND also provides direct assistance to homeowners to purchase or rehabilitate homes.

- **South Central Community Action Program (CAP) Weatherization Program.** CAP's Weatherization Program assists low-income households in reducing their energy consumption. Certified technicians use energy audits and diagnostic equipment to enable households to stay comfortable year round and save money.[192]

[191] See http://bloomington.in.gov/evergreen for more information.

[192] See http://www.sccap.monroe.in.us/ for more information.

- ***Change a Light, Change the World*.** In 2007, the City partnered with local grocery cooperative Bloomingfoods for the *Change a Light, Change the World Campaign* and has distributed over 40,000 compact fluorescent light bulbs with an estimated savings of $2.0 million over the life of these 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.

- **Development "green" incentives**. The City's Unified Development Ordinance offers a number of "green" incentives to residential and other developers to encourage conservation and greater efficiency. To date, few developers have utilized such incentives. The incentives include:

  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, employment of 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.[193]

- **State incentives.** The State of Indiana offers a number of incentives to homeowners for efficiency improvements. These incentives are detailed in the *Opportunities for Citizen Action* chapter of this *Report*.

While the above-listed incentives are a good start, peak energy will require us to do much more to prepare for ever-increasing costs of electricity and natural gas.

[193] Unified Development Ordinance, §20.05.049.
http://bloomington.in.gov/documents/viewDocument.php?document_id=267

VULNERABILITIES

1. Potential for power grid failure in peak oil scenarios.

"Peak energy" – oil, coal and gas shortages – will translate into the potential for grid failure. As Clifford Wirth points out in *Peak Oil: Alternatives, Renewables, and Impacts*, "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."[194] 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."[195]

Given the coal-sourced nature of electricity in Indiana and the expected increased pressure on the grid, we must anticipate that the electric power grid will become greatly compromised and could experience a number of failures.[196]

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[194] Clifford Wirth, *Peak Oil: Alternatives, Renewables, and Impacts*, July 2008, 46-47

[195] Wirth, 48

[196] 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

2. Housing will occupy an ever-increasing proportion of personal income.

The *Transportation* chapter illustrated the way in which increasing oil prices will consume more and more of personal income. The story is the same with housing. Absent efficiency improvements, heating, maintenance, and monthly housing costs will consume a larger share of household budgets and may push people toward lower-quality housing choices at the same time that auto transportation costs increase dramatically.

Source: Natural Resources Defense Council

3. Big houses and low occupancy translates into great inefficiency.

As described above, Bloomington residents, like most Americans, tend to live in large spaces with few occupants. As fuel becomes scarcer 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. It is likely that large and inefficient homes will not hold their worth and those who have their net worth tied up in such houses may be disproportionately affected.

4. No incentives for landlords to make rental units energy efficient.

For the most part, when renters assume the cost of their utility bills, landlords don't have much financial incentive to make their rentals more energy efficient. This is known as a "split incentive." Owners don't make efficiency investments because it's the renters who pay the energy bills. And renters don't make investments in property they don't own. The result is housing that wastes energy and costs more than it should. Since fully 65% of all housing units in Bloomington are renter-occupied, renters living in inefficient units will face considerable hardship due to peak oil.

5. Restrictive covenants on use of clotheslines.

According to the U.S. Department of Energy, 5.8 percent of residential electricity use goes towards the use of clothes dryers.[197] Many residents are subject not only to state and local laws regarding their property, but also to the rules attached to their property by way of covenants and rules of homeowners' associations. Several Bloomington neighborhoods have such covenants against the placement or use of clotheslines. Whether or not such rules are enforced by the neighborhood, now is the time to change the stigma against clotheslines.

While clotheslines save energy and money, some local neighborhoods ban the use of a clothesline. *Source: Michael Jastremski, Wikimedia Commons*

6. 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 that seem to be necessary for survival in a post-petroleum world, it is questionable whether there are enough people in the community 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.[198] 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 to address questions such as: *Should I install a south-facing window? Build a water storage tank? Add thickness to the walls? Plant a shade tree?*

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[197] U.S. DOE, Energy Information Administration, *U.S. Household Electricity Report*, http://www.eia.doe.gov/emeu/reps/enduse/er01_us.html.

[198] A list of local green building experts is provided by the City's Environmental Commission at: http://bloomington.in.gov/green-building-local-resources

MITIGATION GOALS & STRATEGIES

Source: U.S. EPA

SHORT-TERM (1-5 Years)

1. Conserve energy.

The first step in reducing vulnerability to power grid failure is to conserve. It's estimated that 50% of household electricity use in the U.S. is simply wasted; we can make huge improvements merely by identifying the points of waste and eliminating them.[199] As Greg Pahl observes:

> conservation is the least expensive strategy we have available and the least harmful to the environment. . . .[R]eductions 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.[200]

Tips for energy conservation are widely-available and include those offered by the City's Environmental Commission on its *Bloomington Environmental Quality Indicators* (BEQI) webpage, "Energy-Saving Tips."[201] Residents can reduce energy costs by 10-50% by implementing relatively simple energy-savings measures. (Please see *Opportunities for Citizen Action*.)

[199] Grant Smith, Executive Director of Citizens Action Coalition, personal communication, November 15, 2008.

[200] Greg Pahl, *The Citizen-Powered Energy Handbook: Community Solutions to a Global Crisis* (Chelsea Green River Publishing Company: White River Junction, VT, 2007), 29.

[201] Bloomington Environmental Commission, *Bloomington Environmental Quality Indicators Report*, http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

2. The community should explore the possibility of local power generation from renewable sources.

As of 2008, there were 72 cities in Indiana which had municipally-generated power utilities.[202] Generating energy from renewable sources such as the landfill or wastewater treatment facilities is discussed in the *Municipal Services* chapter. Local power generation obtained from renewable sources will become critical when power from conventional (centralized, coal-based) sources becomes problematic. Local power generation also has the added benefit of diversifying the local economy and creating jobs.

3. Establish a revolving fund in HAND to offer loans to homeowners for installation of renewable energy.

As the grid becomes ever-more taxed and unreliable, household production of energy will afford residents a degree of energy security. HAND's current home rehabilitation programs are federally funded and do not include the installation of renewable energy such as solar panels. The City should establish a revolving fund to be administered by HAND for providing low-interest loans to income-eligible residents to install renewable energy systems.[203]

4. New residential construction should both: a) meet strict energy requirements and b) tend toward a smaller size.

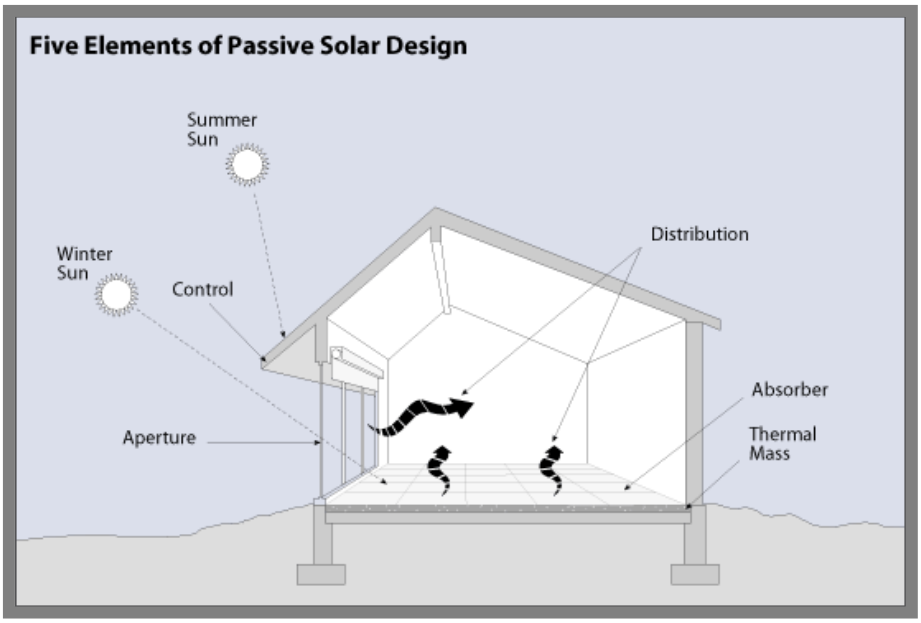
All new homes should be both more energy efficient and smaller. Passive solar homes, smaller homes, and granny flats should be encouraged.

[202] Indiana Municipal Electric Association, http://www.imea.com.

[203] For example, 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 solar energy system. http://solar.calfinder.com/blog/news/berkeley-finalizes-solar-lending-program/

Passive solar houses

In addition to being oriented properly to take advantage of the sun, passive solar houses are well-insulated and feature an airtight building envelope.[204] 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.[205] 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 design doesn't involve the use of mechanical and electrical devices, such as pumps, fans, or electrical controls to move the solar heat.[206]



Source: U.S. DOE, http://www.eere.energy.gov/de/passive_solar_design.html

[204] U.S. Department of Energy, *Passive Solar Home Design*, http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10250

[205] Murphy, 155

[206] Supra note 202.

Granny flats

Source: U.S. EPA

In Bloomington, there has been vocal opposition to granny flats or accessory dwelling units (ADUs).[207] An ADU is a self-contained apartment in an owner-occupied, single-family home or on a lot that is either attached to the principal dwelling or in a separate structure on the same property. The flat might be a suite above a rear detached garage, above the main floor of a house or detached from the principal dwelling like a garden flat.

While some residents have concerns about 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.[208] ADUs also help to maximize use of existing public infrastructure and reduce the pressure on open space and farmlands from sprawling development. As there is considerable community concern regarding allowing granny flats, the City should engage in greater public awareness regarding the benefits of granny flats.

Micro houses

Source: Tumbleweed tiny house, Justin Thomas, www.treehugger.com

Micro houses are extremely small houses with a maximum area of 500 square feet.[209] While these houses may not be suited for everyone, as household energy prices rise, more residents might find smaller houses more attractive. It should be noted that, for safety purposes, the Indiana Residential Code requires that every dwelling unit shall have at least one habitable room that shall have not less than 120 square feet.[210]

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[207] Brady Gilliham, "City Plan Commission Votes Down Granny Flats," *Herald Times*, May 5, 2009, p. A6.

[208] State of Massachusetts, Smart Growth/Smart Energy, *Accessory Dwelling Units*, http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-adu.html.

[209] See, Building Home and Garden, *Micro Homes*, http://www.buildinghomegarden.com/micro-homes.html

[210] R 304.1, the Indiana Residential Code is modeled on the International Residential Code

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

While it is important that *new* homes are as efficient as possible, it saves even more energy to ensure that *existing* homes are as energy efficient as possible. This could be accomplished by major efforts such as reducing home size, thickening the building's envelope, and moving heating and ductwork within conditioned space. [211] However, it would also be accomplished by relatively simple measures such as installing more efficient light bulbs, addressing leaks, putting up heavier drapes, and switching out appliances. The City should work with community partners to outline **a plan to retrofit 5% of the existing owner-occupied and rental housing stock each year**, starting at least by 2014, if not earlier.

6. Establish an *Alternative Technology Advisory Committee*.

Since many ideas for energy efficiency will involve uncommon techniques or materials, it may be helpful for the City and County to work together to follow the lead of Portland in establishing an *Alternative Technology Advisory Committee*. This committee is made up of experts in sustainable technologies and emerging construction techniques who help building officials evaluate new technologies. A builder wishing to use an emerging, sustainable technology may submit an application to the committee along with any available test data, case studies, or relevant information that shows how the technology can meet the building code. The committee evaluates and advises staff regarding innovative designs and construction methods. [212]

[211] Murphy, 157.

[212] See http://www.portlandonline.com/bds/index.cfm?c=48661 .

7. Actively work to grow building efficiency 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. Home assessment training is typically a week-long intensive program, costing $1,200 - $2,500. The City and other community stakeholders should explore whether it might be possible to help subsidize the cost of some of this training for local residents. In return, trainees could promise to conduct a certain number of free or reduced-rate home assessments for low-income residents and/or non-profit organizations, once they are certified[213].

8. Promote green mortgages.

The City should work with local banks to promote Energy Efficient (EEM) and Energy Improvement Mortgages (EIM). EEMs are mortgages that credit a home's energy efficiency in the mortgages themselves, while EIMs allow 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.[214]

9. Implement incentives to make rental units more energy efficient.

In an effort to address the "split incentive" dilemma, the City should think through ways it might encourage landlords to make rentals more efficient. A number of local governments have implemented programs either to provide reimbursements to landlords who weatherize their rental units or to allow tenants to allot a portion of their rent to efficiency improvements.

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[213] Such training is offered by organizations such as Indianapolis-based Energy Efficient Homes Midwest, http://www.eehmidwest.com/Energy_Efficient_Homes_Midwest/Home.html; North Carolina's Southface, , http://www.southface.org/web/programs&events/courses&training/sf_courses-trainings.htm and the Tennessee company, Building Performance Institute, Inc., http://www.bpi.org/content/home/index.php .

[214] See Energy Star, *What is an Energy Efficient Mortgage*? http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.energy_efficient_mortgage

In helping the City devise incentives, the following examples may prove instructive:

- **Chicago's "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.[215]

- **The New York Energy $mart Multifamily Performance Program**

  This program targets the operational efficiencies of multi-family buildings by engaging a partner network made up of engineers, energy consultants, and other industry professionals. 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. If the building meets its target, the owner is eligible for funding. The goals of this program include: saving thousands of dollars a year on energy costs, improving the value of the building and providing tenants with a comfortable and affordable living environment. [216]

- **Minnesota - Rental Energy Loan Fund Program**

  This program provides low-interest five-year loans to landlords to improve the efficiency of their rentals. The program 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.[217]

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[215] 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

[216] New York State Energy Research and Development Authority, http://getenergysmart.org/MultiFamilyHomes/ExistingBuilding/BuildingOwner.aspx

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

10. Educate and motivate citizens to change habits.

As Pat Murphy points out, "Changing habits is as important as changing infrastructure."[218] In addition to making citizens aware of energy-techniques, such as those outlined in the *Opportunities for Citizen Action* section of this *Report*, below are several strategies that may be useful in helping people understand the need to make changes and learn how to make them.

- **Launch an "Efficiency Pioneers" Program**

  The City should create an Efficiency Pioneers program. Participants in the program would undergo a home energy audit subsidized by the City in order to discover best ways to drastically reduce utility use. Participating households would hold regular open-house or neighborhood events showcasing their efforts. All efficiency modifications should be well documented and publicized. Part of the cost of the program might be underwritten by area businesses (home assessors, lumber yards, building suppliers, architects, and contractors).

- **The City should sponsor an energy conservation competition.**

  Community stakeholders such as Indiana University and the Southern Indiana Renewable Energy Network (SIREN) have conducted or initiated energy conservation competitions with great success.[219] The City should expand this effort by sponsoring an energy conservation competition for the citizens of Bloomington. The goals of the competition would be to demonstrate how easy it is to reduce consumption and to create permanent community habits.

  Throughout the competition, the City should publicize the effort widely. The City could partner with efficiency experts to sponsor efficiency workshops and webinars. Newspaper feature stories, film festivals and an energy efficiency display in the atrium of City Hall could be part of the outreach effort.

  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.

[218] Murphy, 162-3.

[219] IU's effort is known as a yearly "Energy Challenge" while SIREN's effort is known as an "Energy Showdown."

- **"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.

  A customer would set up an energy savings account with her or his local bank. A baseline utility use would be established, along with a direct payment program. Each month, the customer would pay her or his 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 customer'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.

MEDIUM-TERM (5-15 Years)

1. **Approximately half of the City's housing stock should be retrofitted for energy efficiency within the next 15 years (by 2024).**

LONG-TERM (15-30 Years)

1. **Close to 100% of the City's housing stock should be retrofitted for energy efficiency within the next 30 years (by 2039).**

SUSTENANCE:
FOOD, WATER, WASTE & HEALTH CARE

"Sustenance" can be understood as the maintenance and nurturance of health and life. The elements of sustenance include: food, water, waste handling, and health care. At present, these elements are centrally provided by private companies, government, and publicly-owned corporations and are entirely dependent on petroleum. 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 contract within the next five to 15 years.

To prepare for this contraction, 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. The distribution of food for sale must also move closer to consumers who can be expected to travel less by car and more on foot, bicycle, and public transit in the future. The process of providing for our own daily needs while reducing our reliance on fossil fuels is the essence of building community resilience.

We expect that it will take decades to achieve levels of self-reliance comparable to those enjoyed by Indiana communities a century ago, so we must outline and prioritize those actions which will address our greatest vulnerabilities first. The path to community self-reliance 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

Over the last 100 years, the way we feed ourselves has changed radically. Chiefly from the use of pesticides, herbicides, fertilizers, and mechanization, agricultural production over the last century has more that tripled. However, the modern food system is both highly centralized and almost entirely dependent on oil. It relies on oil both for *production* and for *transportation* from farm to table. Indeed, little more than 2 percent of the food we eat comes from local sources. Our food travels thousands of miles on average, most of it is carried by diesel-powered trucks.[220] As Bloomington consumers, we complete deliveries to the 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.

Source: Woodrow Wilson International Center for Scholars

This system of production and consumption is a very energy intensive one. Approximately 7.3 calories of fossil energy go into harvesting and serving up one calorie of solar-derived food energy.[221] Of this total, 1.6 calories go into farm operations, transport requires 1.0 calorie, processing and packaging require 1.7 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).

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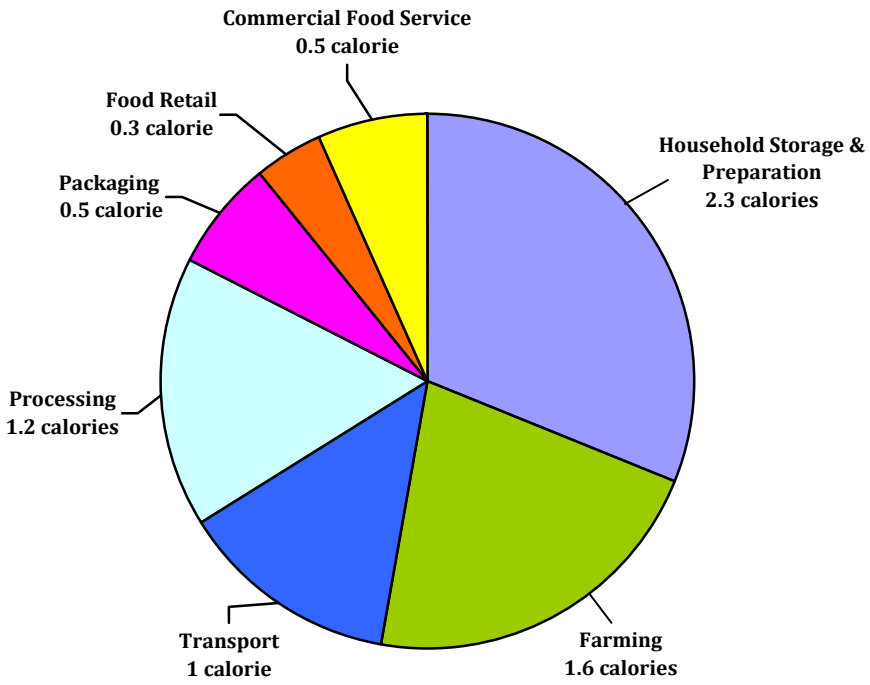
[220] It is fair to assume that Bloomington foodmiles do not differ that much from the national average. Produce in the U.S. travels, on average, 1300 - 2000 miles from farm to consumer.

[221] 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

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.[222]



Energy Used to Yield One Food Calorie.[223] The U.S. American food system uses 7.3 calories to produce and deliver one calorie of food energy.

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

[223] Adapted from Heinberg and Bomford, *Food and Farming* 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).

VULNERABILITIES: Daily Bread

The vulnerabilities inherent in our current well-oiled way of feeding ourselves are manifold. Some of the more obvious threats to Bloomington's food security due to peak oil include:

1. **Increased food prices due to fuel-related cost hikes affecting production, processing, and transport.**
2. **Increased food prices and/or shortages due to falling food production resulting from energy-related shortages of agricultural inputs (fuel, fertilizer, irrigation water).**
3. **Increased prices, or shortages of 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.**
9. **Less than 2 percent of the food consumed by city residents is produced within the city, its surrounding region or the state.**

Many of these vulnerabilities are interrelated and are likely to compound each other. In a world of contracting energy supplies, our present food system is set up to fail. Therefore, it is imperative to begin creating an alternative system free of fossil fuels by which the city and area residents may be assured their daily bread.

Local Food Production

Efforts to promote local food production 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. [224] 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 Indiana.[225]

[224] For comparison, Mother Hubbard's Cupboard serves about 1 percent of this volume to its clients each year.

[225] 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

While more and more people are planting gardens, we could grow substantially more of our own food. It is likely that Bloomington tracks national gardening trends. Nationwide, approximately 32 percent of households have grown gardens. The National Gardening Association estimates that for 2009 that 38 percent of 114 million households will grow food gardens – almost 20 percent more than in 2008.[226] While it can be assumed that the portion of settled households gardening in our community is similar; 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 in Bloomington.

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 ten pounds per state resident. Most of this 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.

[226] 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

The Current U.S. Diet

Americans eat an average of just under 4,000 calories per person per day.[227] 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,[228] 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.

At present, food energy comes two-thirds from calorie-intense foods (meat, dairy, eggs, fats, and sweeteners) and one-third from nutrient-intense foods (fruits, vegetables, grains, nuts, and legumes).

THE TYPICAL U.S. AMERICAN DIET [229]
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

[227] Murphy, *Plan C*, 202.

[228] Heinberg, *Food and Farming*, 2.

[229] Adapted from Murphy, *Plan C*, 205-211.

The following table lists per capita averages of various food groups combined with estimates of land area needed to grow each type of food. "E" indicates “estimate” due to variations in the land intensity of products grouped together in each category. [230]

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	44E	
Nuts	10	22	0.01
Beans & Legumes	7	35 E	0.01
TOTAL	**2,013**		**2.60**

The Foodshed

A “foodshed” is commonly understood to mean a local bioregion that grows food for a specific population.[231] 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 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?

[230] Yield figures are derived from commercial averages.

[231] Arthur Getz, “Urban Foodsheds,” *Permaculture Activist*, 7(3) (1991).

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[232]				
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 the U.S.D.A. 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."[233] Despite this definition, an examination of the region's agricultural history paints a more productive picture of the land available to us for food production.

[232] Adapted from U.S. Census of Agriculture, 2007.

[233] Soil Survey Staff. "Soil Survey Manual". Soil Conservation Service. U.S. Department of Agriculture Handbook, 1993. http://soils.usda.gov/technical/manual/print_version/complete.html.

Indiana agriculture reached its apex in 1900. In that year, approximately 21.6 million acres of the state's 23 million acres were in farms 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 at the time of Indiana's agricultural peak 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 in 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 from 1997 to 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.

A Monroe County Farm

Can Bloomington Feed Itself?

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 in this *Report*, we expect oil prices to increase again. As they do so, some disruptions in the current distribution of food and other goods are likely.

Potatoes at the Bloomington Community Farmers' Market
Source: Daniel Orr

One critical way to mitigate the effects of ever-increasing food costs is to grow more food locally. 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. [234] 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

[234] City of Bloomington Environmental Commission, *Greenspace Trends in Bloomington, 2003-2007*(2007). http://bloomington.in.gov/media/media.php?media_id=2738

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, then at least 2,500 of the 3,500 residential acres not covered with buildings or pavement might be made suitable for gardening, adding 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.

Example of biointensive gardens. Source: www.home-farming.com

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*,[235] has clearly demonstrated that enough food can be produced to support one adult for one year on 4,000 square feet without compromising nutritional requirements. Jeavon's approach is a biointensive one which focuses on maximum yields from a minimum area of land while simultaneously improving the soil. This approach suggests that enough land exists, even within the corporate boundary of Bloomington, to provide a basic, albeit primarily vegetarian, diet to all city residents.

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 price increase and shortage, people are strongly motivated to consider alternatives to their present modes of eating and sourcing food. This was the case in Cuba during the *Special Period* of 1991-94. 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

[235] 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).

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 that incorporated relatively easy adjustments 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. (See table, following page). Such a modified diet would:

- eliminate most caloric sweeteners (substituting smaller amounts of honey, maple syrup, and sorghum syrup—all locally sourced sugars);
- reduce the amount of fats and oils by 60 percent while doubling the volume of nuts and seeds;
- reduce dairy consumption by about one-third;
- provide two-fifths of the meat consumed today;
- add about seven times as many beans and legumes; and
- add about 50 percent more grain, flour and cereals.

This diet 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 substitution 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 is one that is based on familiar foods and is roughly the same volume and calories per person as current average consumption. This diet, and the land required to maintain it, is detailed below.

A LOCALLY-GROWN DIET 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 biointensive production should be employed. 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.

Factors Which Moderate Food Demand

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 in light of the following factors which moderate local food demand.

1. Many students at Indiana University and other area colleges depart the region for travel, study, or to return home to family during breaks, reducing by several percentage points the food requirements of the area. In the event that food shortages emerge as a chronic social condition, the resident population may be reduced as 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' biointensive gardening methods produce 11 times the fruits and vegetables per unit 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.)[236]

In conclusion, 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.

[236] http://www.pathtofreedom.com/about/urbanhomestead.shtml

MITIGATION GOALS & STRATEGIES: PLANTING SEEDS

Photo: Cheryl DeWolfe, Wikimedia Commons

While Bloomington may be a long way from achieving self-reliance in food – and indeed may never be required to be completely self sufficient – we should begin now to increase all forms of food production, processing, and storage in an effort to build community resilience.

The short-term goals and strategies presented here aim to mobilize the community to begin self-provisioning. These recommendations are also intended to change attitudes so as to make both legitimate and preferable the idea 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 significant level of local self-reliance for the Bloomington region, thereby ensuring the well-being and food security of the citizenry.

These initiatives 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 process will depend to a great deal on the support of the public sector and on the willingness of private citizens to share their knowledge and discoveries. The community – and local government especially – can aid this process by exhortation and encouragement. The rewards of local food production are potentially substantial: improved nutrition and health, a more beautiful and productive environment, less waste, enhanced food security, and a new basis for local industry and commerce. With this greater self-sufficiency, we can also hope for an increase in sociability and prosperity in our neighborhoods and for stronger households and families.

Toward Greater Local Food Production

The recommendations which follow are based on these principles:

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 such that the city achieves 20 percent self-provision in vegetables, fruits, nuts, seeds, and small animal proteins, the following is recommended:[237]

1. **Create a community food security plan.** 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 its Community Gardens initiative. The City should expand these efforts substantially and plant edible public landscapes along streets, in parks and surrounding public buildings, especially City Hall. For example, North Vancouver is considering a plan to create edible boulevards. The idea is to bring food production within social spaces.

Under consideration: edible boulevards in North Vancouver. Source: Green Skin Labs

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 Departments;
   - 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, pre- and post-consumer food waste, brush trimmings);
   - Promote home-scale composting of kitchen wastes;
   - Create a City arboretum of economic species; and
   - Establish additional seed banking facilities in Bloomington.

[237] 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.

4. **Expand water storage within the city to support agriculture.**

5. **Subsidize the cost of materials and education for building a resilient infrastructure.** To start, establish:
   - farm stands or agricultural parks in areas of greatest population density and activity;
   - food storage systems at schools; and
   - grants for neighborhood associations to be used for rainwater catchment tanks, root cellars, and 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*.**
   A *Slow Food City* supports local food production and processing that is good, clean, and fair and that aims to effect lasting change in the food system.[238] Locally-grown food and locally-based cuisine should be incorporated into the Lotus Festival and at least one other showcase event or location, preferably in connection with Indiana University.

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.[239]

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.**

[238] See further, Slow Food USA. http://slowfoodusa.org/index.php

[239] http://bloomington.in.gov/documents/viewDocument.php?document_id=2121

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 support to efforts at Monroe County School Corporation (MCCSC) schools to launch gardening programs;
- Request Monroe County Public Library to increase its holdings of relevant literature and media; and
- Work with the State of Indiana 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.

Volunteers harvesting at Banneker Community Garden

11. Remove or reduce legal, institutional, and cultural barriers to farming within and around the city, and open institutional markets to local food.

- Increase the number and scale of community garden plots;
- Promote local food to Monroe County Community School Corporation, Bloomington Hospital, Ivy Tech, and IU;
- Make solar access for passive energy capture and food production a limited right of all city homeowners; and
- Amend the City's Unified Development Ordinance (UDO).

  The City Council took an important step forward in fostering urban agriculture with its recent amendment to the UDO to allow community gardens and urban agriculture in residential zones of the city. Urban agriculture allows the growing of food crops through plant cultivation and includes such activities such as: gardens (front, back and/or side yard), edible landscapes, rooftop gardens, berry patches, and other activities. This amendment does not permit animal husbandry. The UDO should be further amended in the following ways:

  - Urban gardening and community gardens should be permitted in *all* zones of the city, not just residential zones;
  - At present, livestock are only permitted in Residential Estate [RE] zones of the city. Animal husbandry should be permitted in *all* residential zones and appropriate non-residential zones. Residential zones might be limited to smaller animals such as chickens, goats, rabbits and bees while bigger lots should be permitted to harbor any livestock; and
  - The only exception to the city-wide prohibition against animal husbandry is the "chicken ordinance." The ordinance allows residents in RE and RS zones to keep no more than five hens if *all* their adjacent neighbors waive the general prohibition against chickens in these zones. Furthermore, the ordinance requires a prospective chicken harborer obtain a permit and pay a fee. Permits are only good for one year and are conditioned upon an inspection by the City's Animal Care and Control Department. Not only does this create significant hurdles for residents wishing to raise chickens, but it also creates a significant administrative burden for the City. As more and more residents turn to growing and raising their own food, the burden will only increase. The City should eliminate its protracted waiver, permitting, fee and inspection system and permit all citizens in residential zones to keep chickens. The enforcement of the provision should shift to a complaint-based system where problems of noise, odor, and other nuisance are addressed only after they arise.

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 identify an additional 500 acres for future use.**

14. **The City should work to increase the area available for year-round growing (covered or greenhouse space) to 200,000 square feet (just under 5 acres).**

***The community should increase local food marketing and processing ten-fold – from an estimated 1-2 percent of local consumption to between 10-20 percent. Toward that end, the City should*:**

15. **Identify and zone appropriately a food processing and distribution hub in each of the city's 55 *Natural Neighborhood* districts** (See Map D, p. 101).

16. **Permit transitional uses in these districts to bring these hubs into existence.** For example, these hubs could be outdoors initially, then be covered and then eventually add indoor space. The hubs could begin with buying clubs, becoming neighborhood-run food co-ops that evolve to storefront commercial operations.

17. **Inventory commercial-rated kitchens within the city and identify unused capacity**.

18. **Launch at least one food-processing business incubator.**

19. **Acquire and make available to local animal farmers at least two mobile abattoirs for safe and economic local processing of poultry and other meat animals.**

20. Work toward a year-round regional farmers' market.

Begin working to realize a regional farmers' market/food hub that provides year-round facilities for covered stall and indoor stall sales by local and regional producers. Such a market should provide adequate public access and facilities for receipt and processing of farm-scale loads of produce, on a scale ***at least ten times larger than the present Bloomington Community Farmers' Market*** in Showers Plaza. The regional market should include indoor market space and shop space for food brokerage, processing, and other related businesses.

Farmer at the Bloomington Community Farmers' Market

In the interest of a regional market, the City and community partners should:

- Identify an appropriate location;
- Seek state support and other funding (private, county, charitable); and
- Consider creating a tax-funding district to channel revenues.

21. Map a strategy to harvest, compost or otherwise process and recycle to soil 100 percent of the city's organic waste.

22. In cooperation with other stakeholders, the City should work toward the establishment of 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.

23. Reserve open land for agriculture and make additional land available for food production. Specifically the community should:

- Inventory existing farmable land within the city, county, and region;
- Ban suburban-type development within the City's corporate boundary;
- Shift development focus to brownfield sites and increase density in areas with good services and transit (See *Land Use* chapter);
- Re-zone planned greenfield developments to include larger-scale agriculture;
- Provide incentives for households to establish mini farms where appropriate;
- Support the establishment or direction of regional land trusts to hold farmland for long-term lease and usufruct; and
- Discourage the conversion of golf courses, sports fields, or other large tracts of open land to development. Instead, reserve them for future food production.

MEDIUM-TERM STRATEGIES (5-15 Years)

1. **Establish an agricultural park in every *Natural Neighborhood* district (Map D, p. 101) 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 *Natural Neighborhood* district (Map D, p. 101)**

3. **Provide 100 percent organic and local or regional food to students in the Monroe County Community School Corporation 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 with a significant fraction of this community service dedicated to local sustenance issues.**

6. **Establish region-wide farm training programs at local institutions and train and deploy 10,000 new farmers in the region.**

Source: Daniel Orr

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, publicly-controlled seedbank and arboretum of food and useful plant species for propagation and sale within the region.**

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. **Encourage the IU Kelley School of Business to offer at least a graduate degree in local business design and the School of Public and Environmental Affairs to offer a degree in applied environmental design.**

13. **Work with Monroe 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 (15-30 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 (at 2 acres per person).**

5. **Extend the local food production system to other central and southern Indiana communities within our region and support the expansion of similar systems within the state and the Midwest.**

WATER: A HOUSEHOLDER'S PERPECTIVE

Water is an essential element of life's sustenance—one we take almost entirely for granted. At present, just about all our water is provided by a highly-centralized, fossil fuel-driven system. By any standard our public water supply is a miracle of civic order and technical prowess. However, water's centrality to life, health and the economy makes it especially vulnerable to a decline in cheap oil.

The chapter on *Municipal Services* has covered much of the technical material related to the City of Bloomington's Utility Department operations and vulnerabilities. Here, we look at the water situation from the perspective of households and local food production to see how the present centralized water system can be supplemented and the community made more water-secure.

MITIGATION GOALS & STRATEGIES

There is much that households can do to help foster water security. Water security is shaped by combined 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 rainwater and roofwater collection.

At present, Bloomington households consume about 85 gallons of water per person per day. Without compromising essential services, this rate of consumption could be reduced by more than 90% by making relatively simple changes. These changes include structural ones, such as new plumbing devices and appliances, and behavioral ones. Such demand-side changes are by far the cheapest way to foster water security.

Households can contribute significantly to improved water management and water security. The average non-conserving North American single-family household consumes about 70 gallons/capita/day (gpcd) 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.[240]

1. Flush smart.

A program of conservation by improved plumbing fixtures has been estimated to reduce indoor water use by 40% to approximately 42 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 simple 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;
- 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;

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

- 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 apply, 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 (ironically) aridity of climate, and in older housing stock (because of leaks, older plumbing fixtures and appliances).

4. Collect rainwater

Source: U.S. EPA. A rain barrel used to collect rooftop runoff using a gutter/downspout system.

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.

WASTE: THE PERSPECTIVE OF LOCAL FOOD PRODUCTION

The City collects mixed household waste and yard waste from residents. County residents take bagged, mixed household waste to transfer stations. As discussed in the *Municipal Services* chapter, there is no local landfill. All community mixed waste is trucked 55 miles away to Vigo County. Yard waste and leaves collected by the City are disposed in one of two ways: 1) the waste is taken to a private company which the City pays to dump the trimmings (the company turns the trimming into mulch and sells the mulch on the open market); 2) the leaves are deposited at a decommissioned wastewater plant contaminated by PCBs. Liquid waste is delivered 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.

VULNERABILITIES

The practice of shipping our trash a considerable distance is certainly vulnerable to a decline in cheap oil. So too is the City's centralized waste treatment plant. Sewage treatment – like water treatment – is highly reliant on a series of electric pumps and is subject to disruptions of the electrical grid.

However, while these waste streams are a source of vulnerability, they also represent potential resources for local food production. We throw away a lot of organic material that we should be using to fertilize our gardens. Yard trimmings and food residuals constitute approximately 24 percent of our waste stream.[241] The building of a local food system requires that we redirect local organic nutrients from the landfill to the garden through composting, chip-and-mulch, and other appropriate processes. In addition to tree and shrub trimmings, grass clippings and collected yard waste, a great deal of the community's solid waste consists of organic and compostable materials such as food waste, boxboard,

[241] US Environmental Protection Agency. *Wastes - Resource Conservation - Reduce, Reuse, Recycle – Composting*. http://www.epa.gov/waste/conserve/rrr/composting/basic.htm

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

In the long-term, the only way to mitigate the costs and vulnerabilities presented to our current waste system is to capture and divert the organic fraction of Bloomington's present waste stream to supply fertilizer for the local food system.

Yard waste and food scraps are rich sources of soil nutrients when composted. Source: Wikimedia Commons

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, or a private entity.

2. **Create a "compost corner" in each of the 55 *Natural Neighborhoods* where smaller-scale composting could go on to supply the community gardens and home. (See Map D, p. 101).**

3. **Encourage home composting to divert residential organic waste.**

4. **Encourage organic source separation by city residents; 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.**

HEALTH CARE

The implications of peak oil for health care is a topic of increasing discussion, not only among self-organized community groups, but also among and between mainstream health care organizations, such as the American Medical Association and Johns Hopkins.[242] Marion County, Indiana has one of the first county health departments to initiate a task force devoted to examining the implications of peak oil for public health.[243]

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 suggest that oil scarcity will affect health care through effects on: 1) medical supplies and equipment, 2) transportation, 3) energy generation, and 4) food production.[244] Many medications such as aspirin and antibiotics are made from petroleum derivates, and many medical supplies (such as bandages, prosthetics, syringes, tubing, etc) contain oil-derived plastics. 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 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 have 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 health care was largely beyond the purview of the group. However, the subject is addressed here in the interest of highlighting the implications of peak oil and health care on a local level. We hope that local health providers and stakeholders will examine this more closely.

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[242] 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

[243] 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/

[244] Frumkin, Howard; Jeremy Hess; Stephen Vindigni, "Peak Petroleum and Public Health" *Journal of the American Medical Association* 298, no 14 (2007): 1688-1690.

VULNERABILITIES

Until now, health care in the United States has been primarily a private concern that has evolved in an era of cheap energy. It has been predicated on the assumption that specialized equipment and teams of highly-skilled professionals are the critical elements in health care. While this model of health-care delivery is superb at dealing with trauma, it is less well-suited to dealing with the environmentally-induced or diet-based degenerative illnesses that have become so common.

Source: Wikimedia Commons

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. High cost care is not necessarily high quality care. The World Health Organization ranks the U.S. 37th among nations in quality of health care.[245] Already excessively dependent on emergency interventions at high cost, the system is likely to lurch further toward poor care 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. 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 major employer of people from throughout the region and serves 10 Indiana counties. The hospital is situated in Bloomington's downtown and is served by Bloomington Transit (BT). The hospital has recently merged with a large Indianapolis-based group of hospitals and has plans to relocate outside of the City's corporate boundary – ostensibly to better serve the wider region by emphasizing ease of commuting by highway. BT is limited to operations within the City's corporate limits. If the 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 certain to rise substantially over the next decade.

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[245] *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 Marino, Andorra, Malta, Singapore, Oman, Iceland, Luxembourg, Netherlands, Colombia, Saudi Arabia, United Arab Emirates, Chile, Dominica, Morocco, Cyprus, and Costa Rica.

MITIGATION GOALS & STRATEGIES: RE-IMAGINING CARE

While the City has little direct influence over the health care of its citizens, it can support a new way of thinking about health that may make our increasingly-scarce health dollars stretch further and may help a vulnerable medical establishment transition to an era of lower energy resources. Our present medical model is so dependent on oil in part because it focuses on intervention rather than prevention. Beyond just working to substitute materials for the medical supplies that are so petroleum dependent, we need a new model of taking care of ourselves and each other.

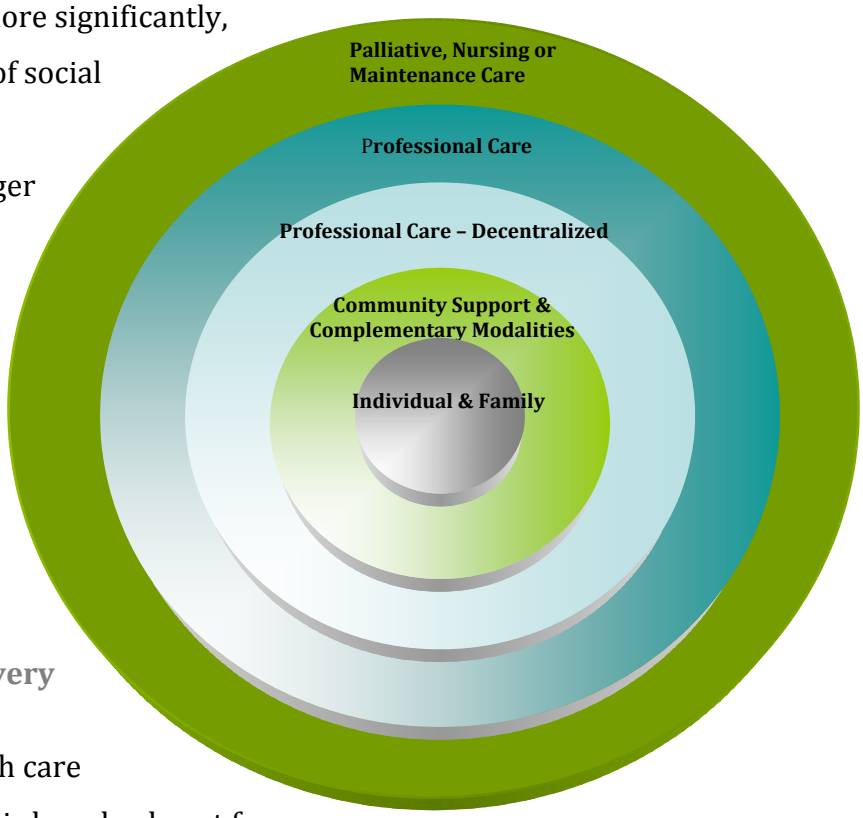
Peak oil presents us with an opportunity to do things better. We will need to re-conceive our present notion of personal responsibility *away* from paying for one's own insurance and medical care *to* better measures of personal care beginning with diet and family health. It is instructive to re-imagine 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 still necessary components of the system are more distant.

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 avoidance of 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. These modalities 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. Perhaps more significantly, we exist in a matrix of social and environmental relations. The stronger and more connected the community is, the more easily individuals can maintain their own health.



The Third Layer: Decentralized Delivery Systems

A third layer of health care provision -- one that is largely absent from the U.S. system but which is present in 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, doctors' offices are located in every neighborhood. As transportation becomes more costly, it will be necessary to decentralize care and move 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 revise 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, or as far, and even to the possibility of regular power interruptions.

The Fifth Layer: Palliative, Nursing & Maintenance Care

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.[246]

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. A layered approach to health is most effective when *all* the elements in it are integrated and mutually reinforcing. Regrettably, the current medical model is poorly equipped to suture the layers of health together 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.

[246] Thanks to Dr. Jifunza Wright, M.D. of Chicago, Illinois for suggestions contributing to the new model of care.

The aim 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 these recommendations involve action steps for City government.

1. Expand and support alternative health care options as 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, where appropriate and protective of health: reinstate the use of autoclave equipment;[247] and

d) Prepare to manage intermittent power outages.

- **Increase on-site fuel storage and**
- **Provide employee training in low-energy diagnoses needing only low-tech tools and materials.**

[247] Equipment used to sterilize equipment at high temperatures.

Opportunities for Citizen Action: What can YOU do?

"Find your place on the planet. Dig in, and take responsibility from there."
– Gary Snyder

Peak oil is both a personal and collective call to action. It is an opportunity to find out what we can do when we apply our collective adaptability and creativity. While most of this *Report* focuses on what institutional actors can do to mitigate the effects of peak oil, there are many things we can all do to reduce our reliance on petroleum. These changes will be good for our community, the local economy, the environment and our own pocketbooks.

Learn

Learn more about peak oil. The *Further Reading* references at the end of this *Report* might be a good place to start. Share what you learn with others.

Drive Less

- Carpool, walk, ride your bike, or take the bus.
- Telecommute if possible.
- Ask your employer to consider a four-day work week.
- Move closer to work or work closer to home, if possible.
- If you own any vehicle that gets less than 20 miles per gallon, it is time to trade it for a far more economical means of transportation.
- If you must use your personal automobile or truck, don't travel during peak traffic periods, consolidate your trips to reduce fuel consumption, drive slower, and make sure your tires are properly inflated.
- Campaign for dramatic increases in funding for public transportation.

"Power Down" at Home

Electricity

Simple changes at home can make a big difference. Residents can reduce energy costs by 10-50% by implementing relatively simple measures such as the following:[248]

- **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 raising 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 clothes in cold water**.
- **Air dry dishes** instead of using your dishwasher's drying cycle.
- **Air dry your clothes. Put up a clothesline.**
- **Turn off your computer, monitor and other appliances** when not in use.

[248] Parts of this list are borrowed from: Bloomington Environmental Quality Indicators Report (BEQI Report) *Energy-Saving Tips*. http://bloomington.in.gov/documents/viewDocument.php?document_id=2987

- **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.** Changing your light bulbs to compact fluorescents will reduce your electric bill. 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.

Water

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.

- **Flush Smart.** Most flush toilets use over 10gpcd. Low flow toilets are 1.6 gallon/flush units which are estimated to reduce indoor water use by 40% to approximately 42 gpcd.
- **Take short showers.**
- **Don't rise dishes before loading them.** 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.
- **Turn tap off while you brush and shave.** Toothbrushing or shaving in front of a running tap can waste up to 200 gallons per month of water.
- **Keep a pitcher of cold water in the refrigerator.** This provides cold water on demand without running the tap until the stream is cool.
- **Recycle your bath water**. 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. Used bathwater can be "re-used" for hand laundry. Dishwater (held in dishpans) is more than suitable for flushing toilets.
- **Install a stop-valve on the showerhead**. Using such a valve when soaping and scrubbing conserves dozens of gallons of hot water with measurable cost savings.
- **Wash only full loads of dishes and clothes**. Running laundry machines and dishwashers at full capacity instead of doing small loads saves water on every load.
- **Install new fixtures.** New fixtures improve water use efficiency and providing the same services at a lower water cost.
- **Collect rainwater.** It is possible to increase water supply available for outdoor and non-potable indoor water use by collecting rainwater from roofs and other runoff.

Make efficiency improvements

The following sites provide guidance for making your home more energy efficient.

- **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 websites.
  http://www1.eere.energy.gov/buildings/building_america/homeowners.html

- **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

Explore alternative power

Only after you've worked to conserve as much energy as you can, does it make sense to explore alternative power. Since solar panels are still expensive, it doesn't make 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.[249] Below are a few places to start your exploration:

- **Southern Indiana Renewable Energy Network (SIREN)**
  Mission: to educate citizens about renewable energy and assist in renewable energy projects. www.sirensolar.org

- **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/

[249] See www.sirensolar.org for more information

State and utility residential renewable energy and efficiency incentives

A number of residential efficiency and renewable energy incentives are available for homeowners. These incentives range from property tax credits, to public and private grants and rebates. The terms of these incentives frequently change. Please consult with the appropriate entity for the specifics of each program.

- **Database of State Incentives for Renewables and Efficiency**
  "DSIRE is a comprehensive source of information on state, local, utility, and federal incentives and policies that promote renewable energy and energy efficiency. Established in 1995 and funded by the U.S. Department of Energy, DSIRE is an ongoing project of the N.C. Solar Center and the Interstate Renewable Energy Council."
  http://www.dsireusa.org.

- **Energy Star: Federal Tax Credits For Energy Efficiency**
  http://www.energystar.gov/index.cfm?c=tax_credits.tx_index

- **Duke Energy: Smart $aver Program™**
  http://www.duke-energy.com/indiana/savings/smart-saver.asp

- **Indiana Office of Energy Development**
  www.in.gov/oed/

- **South Central Indiana REMC – Heating and Cooling Rebate Program**
  "South Central Indiana REMC's rebate program is designed to encourage members to purchase energy efficient equipment. The rebates are based on the Seasonal Energy Efficiency Rating (S.E.E.R.). The higher the S.E.E.R. the more efficient the equipment resulting in lowering operating costs." The program focuses on central air, heat pumps and geothermal heat pumps.
  http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IN13F&state=IN&CurrentPageID=1&RE=1&EE=1

Leverage local expertise

Bloomington is home to a growing number of energy efficiency and renewable energy experts. Local experts are listed on the City of Bloomington Environmental Commission's green building page: http://bloomington.in.gov/green-building-local-resources

Learn to make simple repairs around your home.

You can learn a large number of home repair skills at classes offered by the City and by local home improvement stores. Can you repair a break in a water line? Repair weather-stripping? Install or repair rain gutters? Learning to handle these skills with manual tools could be a real security issue, not to mention a potential source of future income. [250]

[250] Source: Austin's Crude Awakening, *Preparing for a Post-Peak Lifestyle*, http://www.crudeawakening.org/Preparing.htm

Be Neighborly

- **Get to know your neighbors.**
  Close groups of neighbors can really strengthen a neighborhood. It is generally unrealistic to assume that 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.[251]

- **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 computer repair. A skills database is a great way to start relocalizing because it helps everyone access the resources that are right in their own neighborhood. [252]

Buy Local!

The average food item travels more than 1,500 miles before it ends up on your kitchen table. Each consumed product that comes from a non-local source requires a lot of oil to transport it while our hard-earned dollars are exported to other communities, instead of strengthening our own local economy.

Plant an edible garden.

Plant your own garden or work with your neighbors to plant a community garden. 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. Learn how to save seeds for the next season. Create compost out of your kitchen and yard waste. Use drip irrigation to save water. The Monroe County Extension Office is a good resource for home gardeners.
Create a Neighborhood Garden Tool Pool. Read *How To Grow More Vegetables (and Fruit, Nuts, Berries, Grains and Other Crops) Than You Ever Thought Possible on Less Land Than You Can Imagine* by John Jeavons. This book describes biointensive approaches to vegetable gardening.

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[251] *Ibid*.

[252] The Relocalization Network, *Build a Neighborhood Skills Database*, http://www.relocalize.net/guide/skillsdatabase

CONCLUSION

The peaking of production in liquid fuels and other energy sources in the near future will reshape our everyday lives. It will profoundly affect 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, assumptions, physical structures, and cultural practices that will recognize lower energy availability not as a problem, but as 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. The City of Bloomington will have to intensify 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 from past eras. Others have never been applied. In all cases, the answers require us to take greater responsibility for self-provision, for thoughtful cooperation with those around us, and for greater attention to the resources and possibilities of our homes, our neighborhoods, and our community.

FURTHER READING

The following sources provide useful information about peak oil and peak energy and reveal a diverse range ideas on those topics. The Task Force does not necessarily endorse every opinion in every work listed.

BOOKS

BROWN, Lester. ***Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble.*** W.W. Norton, 2006. Plan B has three components: (1) a restructuring of the global economy so that it can contain civilization; (2) an all-out effort to eradicate poverty, stabilize population, and restore hope in order to elicit participation in the developing countries; and (3) a systematic effort to restore natural systems. http://www.earth-policy.org/Books/PB2/index.htm.

CAMPBELL, C.J. ***The Coming Oil Crisis***. Multi-Science Publishing, 2004. An interdisciplinary treatment of how much oil remains to be found and for how long global oil resources can continue to support the expected growth in demand. Campbell concludes that given current production rates, peak production will be reached some time in the first decade of the new millennium. Based on this conclusion, Campbell examines three scenarios and offers some interesting insights into the possible consequences to a world that has to adjust to a dwindling oil supply.

CATTON, William Robert. ***Overshoot: the Ecological Basis of Revolutionary Change*****.** University of Illinois Press, 1980. Suggests that humanity has already exceeded the long-term carrying capacity of the earth and is now relying on the "phantom carrying capacity" of non-renewable resources that will some day disappear.

DEFFEYES, Kenneth. ***Hubbert's Peak: The Impending World Oil Shortage***. Revised ed. Princeton University Press, 2002. Deffeyes employs the methods of M. King Hubbert to conclude that world oil production will peak in this decade.

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EBERHART, Mark. ***Feeding the Fire: The Lost History and Uncertain Future of Mankind's Energy Addiction.*** Harmony, 2007. Eberhart documents the history of energy and the evolution of energy dependence. He demonstrates the imminence of the crisis that looms if we continue current consumption patterns.

GILBERT, Richard, and Anthony Perl. ***Transport Revolutions: Moving People and Freight Without Oil***. London: Earthscan, 2008. Asserts that, in the future, land transportation will shift toward movement by grid-connected electric vehicles, while air travel and air freight will go into severe decline.

GOODSTEIN, David. ***Out of Gas: The End of the Age of Oil.*** W.W. Norton, 2005. Goodstein outlines the scientific principles of the inevitable fossil fuel shortage and points to the promise afforded by switching to other sources of energy.

GREER, John Michael. ***The Long Descent: a User's Guide to the End of the Industrial Age*****.** New Society Publishers, 2008. Greer contends that peak oil will lead to the "catabolic collapse" of industrial civilization – not an immediate collapse, but a long, slow one lasting many decades, with periods of relative equilibrium alternating with periods of decline

HEINBERG, Richard. ***Blackout: Coal, Climate and the Last Energy Crisis.*** New Society Publishers, 2009. Heinberg notes that "Only recently have a few analysts attempted peaking forecasts for world coal, and those forecasts show a likely peak for world coal production before mid-century, possibly as soon as 2025." He also highlights the dependency of coal as an energy source on petroleum-based transportation, suggesting that "Peak Oil May hasten Peak Coal."

HEINBERG, Richard, and C.J. Campbell. ***The Oil Depletion Protocol.*** New Society Publishers, 2006. Describes a possible international agreement, the "oil depletion protocol" (originally proposed by Campbell), whereby nations would voluntarily reduce their oil production and oil imports. The purpose of the protocol is to reduce international rivalry over oil supplies and prevent possible resource wars. The book provides a review of the history and literature of peak oil and explains the protocol and its implications for government and industry. It also explains how municipalities and citizens can become involved.

HEINBERG, Richard. ***The Party's Over: Oil, War and the Fate of Industrial Societies*****.** New Society Publishers, 2005. A useful , eye-opening introduction to the subject of peak oil. Heinberg was a member of the Oakland peak oil task force whose report is cited above.

HEINBERG, Richard. ***Powerdown: Options and Actions for a Post-Carbon World.*** New Society Publishers, 2004. In this sequel to *The Party's Over*, Heinberg provides and update and reviews four primary ways that society can approach energy supply issues. He concludes that the prudent way to handle the energy shortage is to "power down" through intelligent, informed, cooperative means while simultaneously working to build community solidarity and to preserve knowledge, artifacts, and tools.

HOPKINS, Rob. ***The Transition Handbook: From Oil Dependency to Local Resilience*****.** Green, 2008. Declaring that "peak oil and climate change mean that small is inevitable," Hopkins argues for economic relocalization, with individual communities to prepare "energy descent action plans" for the transition to a low-energy future.

JEAVONS, John. ***How to Grow More Vegetables Than You Ever Thought Possible on Less Land Than You Can Imagine*****.** Ten Speed Press, 1991. Describes a biointensive approach to gardening. The method requires minimal watering and care and provides guidance for those wishing to plant a few plants in a tiny space to those who wish to plant enough to feed a family of four on less than half an acre.

KUNSTLER, James Howard. ***The Long Emergency: Surviving the End of the Oil Age, Climate Change, and Other Converging Catastrophes.*** Atlantic Monthly Press, 2005. This controversial author discusses peak oil in the context of climate change, infrastructure challenges, and habitat destruction. Describing the political, social, and economic consequences of peak oil, he argues that our way of life will have to become intensely more local, that our economy will have to be structured around food production, and that land will have to be reallocated.

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LOVINS, Amory, et al. ***Winning the Oil Endgame: Innovation for Profit, Jobs, and Security.*** Rocky Mountain Institute, 2005. Co-funded by the Pentagon, this study provides a plan for reducing U.S. oil use by 50% by 2025 and ending dependence on foreign oil. To achieve these goals, Lovins proposes four steps: (1) Double the efficiency of oil use through measures such as ultra-light vehicle design. (2) Apply creative business models and public policies to speed the profitable adoption of super-efficient light vehicles, heavy trucks, and airplanes. (3) Embark on the crash development of biofuels, cellulosic ethanol in particular. (4) Apply efficiency measures to save 50% of the projected 2025 use of natural gas.

MACKAY, David J.C. 2009. ***Sustainable Energy – Without the Hot Air.*** UIT Cambridge Ltd., 2009. Attempts to answer somewhat the question: Is it possible to power modern civilization with renewable energy alone. The answer is "Yes but" – it would take "country-sized" facilities, and it wouldn't be easy. Also available online at http://www.withouthotair.com. The focus is primarily on Britain, but there are also discussions on North America and the world.

MOBBS, Paul. ***Energy Beyond Oil.*** Matador Press, 2005. Mobbs provides a detailed account of the peak oil phenomenon and makes the argument that, while it will be a collective shock, life after the peak promises a more sustainable reality.

MURPHY, Pat. ***Plan C: Community Survival Strategies for Peak Oil and Climate Change.*** New Society Publishers, 2008. Explores the risks inherent in trying to continue our energy-intensive lifestyle. A resource for anyone interested in living a lower-energy sustainable lifestyle.

PIMENTEL, David, ed. ***Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks*****.** Springer, 2008. A detailed look at some specific aspects of renewable energy production.

ROBERTS, Paul. ***The End of Oil: On the Edge of a Perilous New World.*** Houghton Mifflin, 2004. Roberts documents the alarming rate at which the global supply of petroleum is being depleted and explores which energy sources will replace oil, who will control them, and how disruptive the transition to the post-petroleum world will be. He stresses the importance of acting now in order to bring about meaningful long-term results.

RUBIN, Jeff. ***Why Your World is About to Get a Whole Lot Smaller: Oil and the End of Globalization.*** Random House, 2009. Traces the connection between the present economic crisis and the preceding run-up in oil prices. As the subtitle indicates, argues that increasingly expensive oil in the future will lead to the "end of globalization" because of the greater cost of transporting goods over long distances.

SIMMONS, Matthew. ***Twilight in the Desert.*** J. Wiley & Sons, 2005. Investment banker Simmons provides a field-by-field assessment of Saudi Arabia's key oilfields, highlights many discrepancies between the kingdom's actual production potential and its seemingly extravagant resource claims, and predicts oil prices approach $190/bbl soon.

STRAHERN, David. ***The Last Oil Shock.*** McArthur & Co./John Murray, 2007. Good for its thorough treatment of the history of the oil industry, M. King Hubbert, world oil reserves, and its finding that most peak oil assessments are so close as to provide a near-consensus that oil will peak before 2020.

TERTZAKIAN, Peter. ***A Thousand Barrels a Second: The Coming Oil Break Point and the Challenges Facing an Energy Dependent World.*** McGraw-Hill Professional, 2007. The title refers to the staggering rate of oil production and consumption as the world nears peak. Tertzakian tracks the impact of energy sources through a historical lens, arguing how inherent mismatches between dwindling supply and growing demand lead to crises that can be resolved only by innovation.

TRAINER, Ted. ***Renewable Energy Cannot Sustain a Consumer Society*****.** Springer, 2007. An extended review of the literature on renewable energy which arrives at the conclusion stated in the title: however useful various forms of alternative energy might be, individually and collectively they cannot provide enough energy reliably to permit the continuation of "consumer society."

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WEB SITES

Energy Bulletin (http://www.energybulletin.net). "A clearinghouse for information regarding the peak in global energy supply."

The Oil Drum (http://www.theoildrum.com). A collective and very active collective blog whose self-proclaimed mission is "to facilitate civil, evidence-based discussions about energy and its impact on our future." One or two major articles are posted daily. An especially useful feature is the "DrumBeat" column, a daily compilation of articles from all over the web related broadly to the topic of peak oil.

The Post Carbon Institute (http://www.postcarbon.org/). "[H]elps individuals and communities understand and respond to the environmental, societal, and economic crises created by our dependence on fossil fuels."

OTHER MAJOR PEAK OIL TASK FORCE REPORTS

Portland, Oregon, *Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas* (March 2007) http://www.portlandonline.com/OSD/index.cfm?a=145732&c=42894

San Buenaventura, California, *Transforming Urban Environments for a Post-Peak Oil Future* (2007): http://www.cityofventura.net/files/public_works/maintenance_services/environmental_services/resources/post-peakoil.pdf

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APPENDICES

APPENDIX I

FACTORS AFFECTING THE GLOBAL DECLINE RATE

The International Energy Agency recently completed a study of the world's 400 largest oil fields.[253] They concluded that these fields collectively, without added investment, were experiencing an annual decline of 9.1%. Therefore, almost 7mbd of additional capacity must come on line every year just to offset these giant fields.

Besides the decline in these, the largest fields, what else might affect the observable rate of oil production and its availability to the world?

1. ***Technology A.*** Technology may bring more oil on-stream, both from old fields where advanced recovery may yield oil previously thought inaccessible, and from new fields that are often at the margins of what current technology can bring to the market. To be economically viable, both of these options require capital investment. More importantly, they are limited by the energy required to extract the resource. Since it does not make energetic sense to invest more energy than one receives in return, some oil will ultimately remain inaccessible.

2. ***Technology B.*** Very advanced oil extraction technology has already been employed to raise production and extend the life of major fields, such as Canterell (Mexico), and the North Sea (England, Denmark and Norway). However, although advanced technology may extend the production plateau, or raise the rate of production initially, it often results in a steeper rate of decline (15-20% for the cases mentioned above). Thus, it represents an unintended consequence that may increase the overall rate of decline in a very rapid manner.

3. ***Investment in oil exploration and recovery in a time of high volatility of price.*** Exotic oil recovery, in the form of tar sands, heavy – high sulfur oils, and the deep sea requires high prices. The current collapse in the price of oil has limited investment, and thus less resource development has occurred. Since even conventional oil requires years from discovery to delivery, price booms and busts may only add to the discontinuity of supply.

4. ***Export Land Model.*** Developed most fully by petroleum exploration geologist Jeffrey Brown, in its most simple form this model describes decline in oil exports as a consequence of greater demand by the exporting country. This has been cogently

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[253] International Energy Agency, *World Energy Outlook 2008*; See also, Neil King & Fritsch, "Energy Watchdog Warns Of Oil-Production Crunch IEA Official Says Supplies May Plateau Below Expected Demand," *Wall Street Journal*, May 22, 2008. http://online.wsj.com/article/SB121139527250011387.html?mod=hpp_us_whats_news

argued by Brown to dramatically decrease oil supply to importing consumers and to do so at a rate above the observed geologic rate of decline.

5. ***Geopolitical conflict***. Some 17 million barrels per day are shipped out of a very narrow waterway, the Gulf of Hormuz, in the Middle East. Obstruction of this key point of access, in the event of conflict in the region, would have immediate and severe effects on oil importing countries. This is just one of many possible global flashpoints that may affect future oil supply.

6. ***The U.S. dollar***. Denominating oil in dollars brings a clear advantage to the U.S., as does the status of the dollar as the world reserve currency. It is far from certain that this arrangement will continue, as a number of countries have spoken openly of diversifying their exchange portfolio to include the euro, the yuan and the yen. If these proposed arrangements come to pass, the value of the dollar may plunge, and imported oil may become unaffordable for many U.S. citizens.

7. ***Heavy oil, oil shales, tar sands, and biofuels***. These resources offer some limited supply but are constrained either energetically or by other resource inputs (e.g. water, land to grow crops). They will offer only a modest supply of liquid fuels in the future.

8. ***The discovery of new, large fields***. Although fewer and far between, the possibility remains that large fields of tens of billions of barrels may yet be discovered. Some finds of late, such as Tupi off the coast of Brazil in development by Petrobras, or deep water Gulf of Mexico (e.g., the Tiber Field developed by British Petroleum). While these fields may yield billions of barrels of oil, one needs to place it within the context of current world use (a billion barrels are consumed every 11 days). It is also observed that these latest finds are incredibly expensive, and stretch current technology to the limit (Tiber, for instance, requires drilling in deepwater, and at a total depth of 35,000 ft.). Lastly, because field development may take many years, oil discovered today may not be available for some time.

APPENDIX II

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.[254] 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 a 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."[255] 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*."

- 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.

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[254] Energy Watch Group, *Coal: Resources and Future Production* (http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Report_Coal_10-07-2007ms.pdf), Mar. 2007, 6.

[255] *Ibid.,* 24 and 4.

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.[256] By 2007, however, the World Energy Council was reporting a reserve estimate for Indian bituminous of only 52,240 Mt[257] after India stopped reporting "in situ" coal and started reporting "recoverable" coal.[258] 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).[259] Prof. David Rutledge of Caltech believes that the actual amount is considerably lower: 662,000 Mt.[260]

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.

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[256] *Ibid.,* 26.

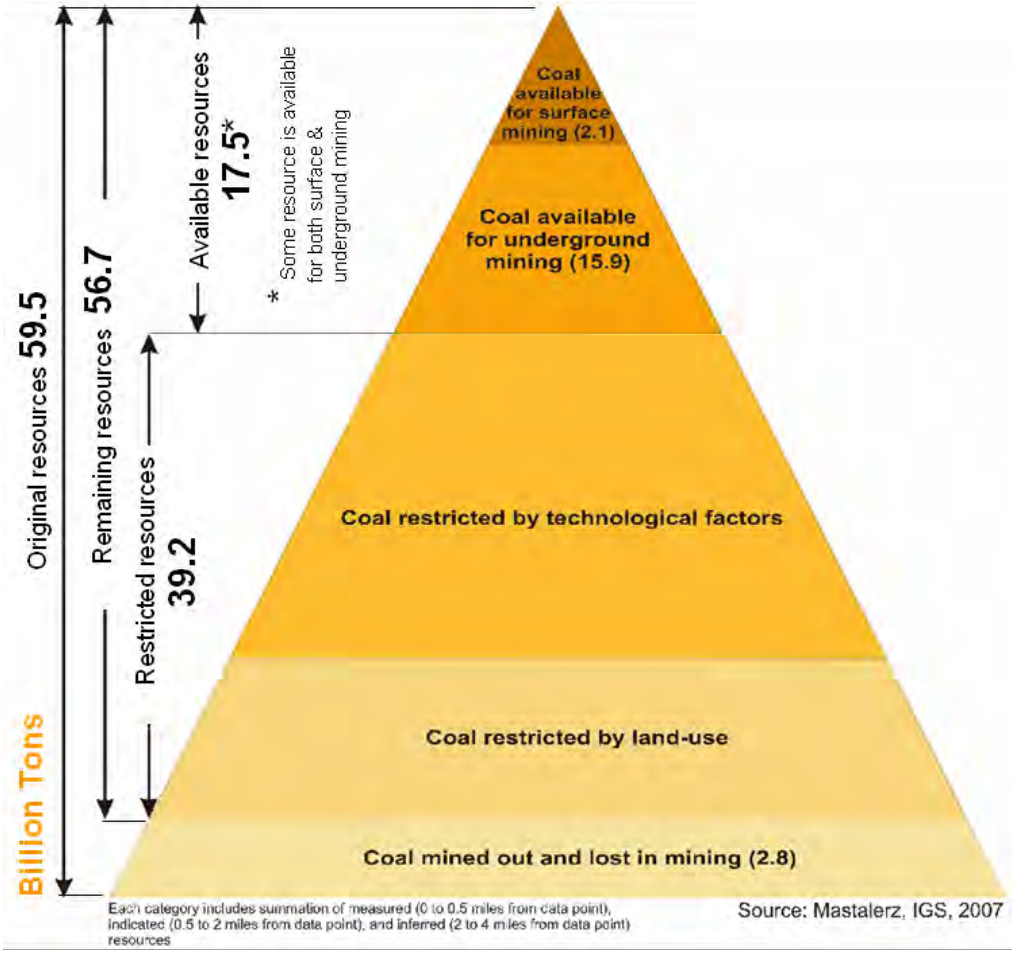
[257] World Energy Council, *2007 Survey of Energy Resources* (http://www.worldenergy.org/documents/ser2007_final_online_version_1.pdf), 10.

[258] *Ibid.*, 2.

[259] *Ibid*., 11.

[260] 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

For example, according to the Indiana Geological Survey, Indiana has about 17.54 billion tons of "available coal resources" remaining:



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.[261]

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."[262]

[261] Maria Mastalerz *et al., Characterization of Indiana's Coal Resource: Availability of the Reserves, Physical and Chemical Properties of the Coal, and Present and Potential Uses*, Open-File Study 04-02, Indiana Geological Survey, July 2004, 16.

[262] *Ibid.*, 23-24.

Unfortunately, stated coal R/P ratios are subject to wild fluctuations, depending on revisions in estimates on the 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,[263] 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.

> 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.

The Indiana Geological Survey's statement that Indiana coal "could last about 585 years" is based on the Survey's conclusion that Indiana has approximately 17.5 billion tons of available coal resources. There is a major discrepancy between that figure 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.[264] 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

[263] Rutledge, *Hubbert's Peak*.

[264] 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 September 2008 (http://www.eia.doe.gov/cneaf/coal/page/acr/table15.html)

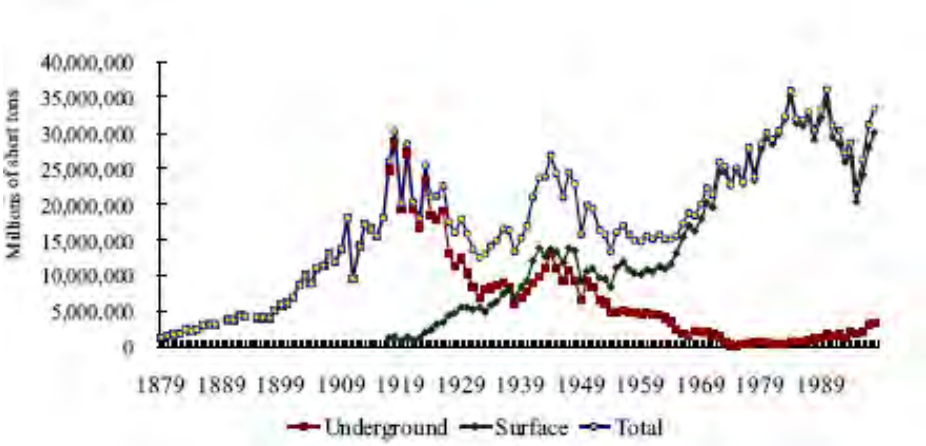
federal agency charged with producing the "official energy statistics from the U.S. government" are perhaps somewhat questionable.

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."[265] 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. Unfortunately, the Task Force does not have the expertise to judge which numbers -- those of the Indiana Geological Survey or those of the Energy Information Administration -- represent a more accurate picture of Indiana coal reserves.

In addition to considering the "reserves" numerator in the R/P ratio somewhat uncertain, we must also note that the "production" divisor 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

[265] Personal communication from George Warholic, Energy Information Administration, December 9, 2008.

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 another trough during the 1950's, and then rising once again to a new and even higher peak, or series of peaks:

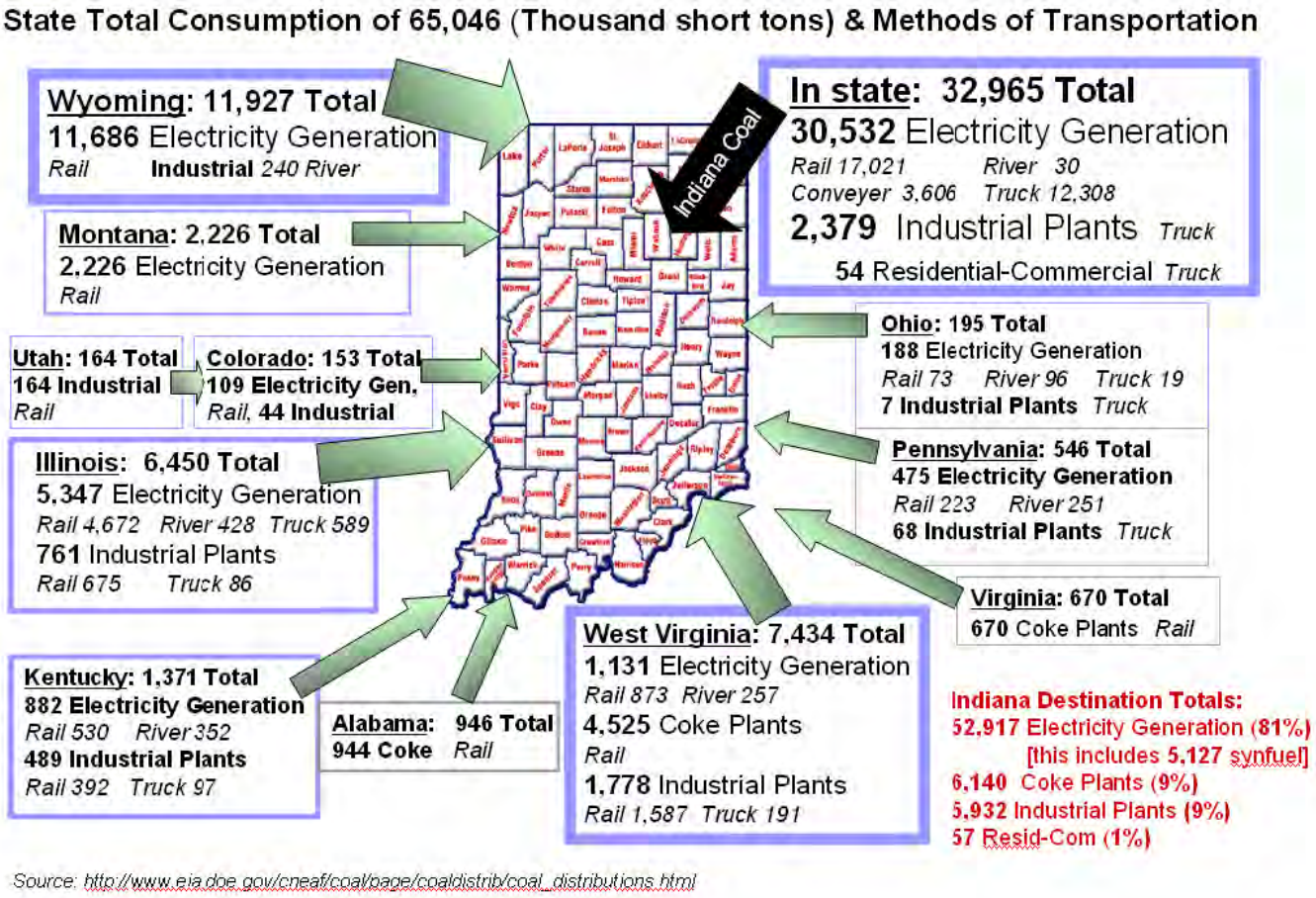


Source: Maria Mastalerz et al., Characterization of Indiana's Coal Resource, 2004, p. 76

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 March 2009, Peabody Energy announced 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.[266]

[266] "Indiana Plans Spur to Big Coal Mine," *Trains*, June 2009, 13.

The statement that "Indiana has 585 of coal remaining at the current rate of production" is apt to be particularly misleading unless consideration is given to 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:



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 among governments and certainly among the general public is that there is "plenty" of coal left in the world, 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."[267] 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."[268]

> The peak of world oil production in 2010 will impact the world economy profoundly. Without a coherent effort to proactively reduce energy consumption further while developing renewable sources, the decline of coal toward the middle of the century will deliver a *coup de grace* to industrial civilization, making the maintenance of the electrical grid impossible. We will then have come to the end of the road, having used nature's endowment of cheap, energy-dense fuels without having built a bridge to the future. What follows is the final Blackout." *Source: Heinberg, Blackout, p. 167.*

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."[269] 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

[267] Energy Watch Group, *Coal*, 27.

[268] *Ibid*., 15.

[269] *Loc cit.*

Kentucky and Ohio will be converted into production"[270] 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.

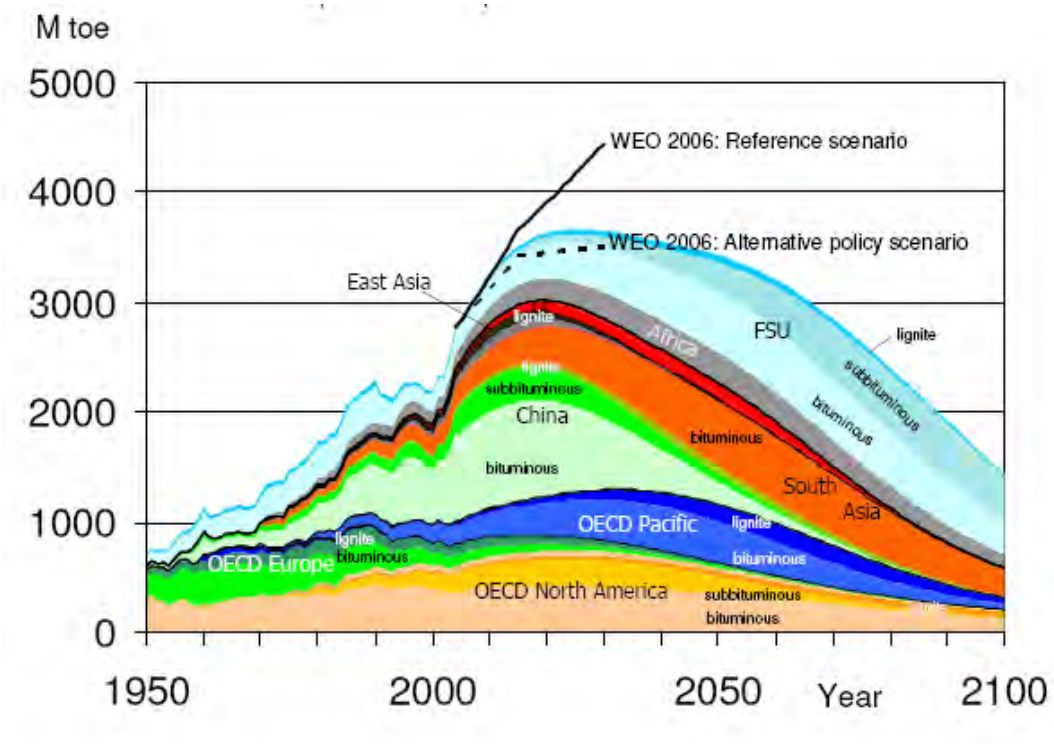
Indiana currently exports only a small amount of coal to power plants in neighboring states, it is possible to imagine a scenario in which Indiana participates in an export boom and significantly increases its production. Should that happen, there would be an increase in the size of the production divisor 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 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."[271] 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**.

[270] *Ibid*., 38.

[271] S.H. Mohr and G.M. Evans, "Forecasting Coal Production Until 2100," http://www.theoildrum/com/node/5256.

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, March 2007

APPENDIX III

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 they had peaked. This was significant because, while natural gas elsewhere in the world, particularly in the Middle East and Russia, is still plentiful, transporting it to the United States presents a problem: in its ordinary gaseous state, it cannot 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."[272]

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.[273]

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."[274]

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 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

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[272] "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.

[273] "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/.

[274] 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.

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."[275] 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.[276] 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.[277] 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 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.

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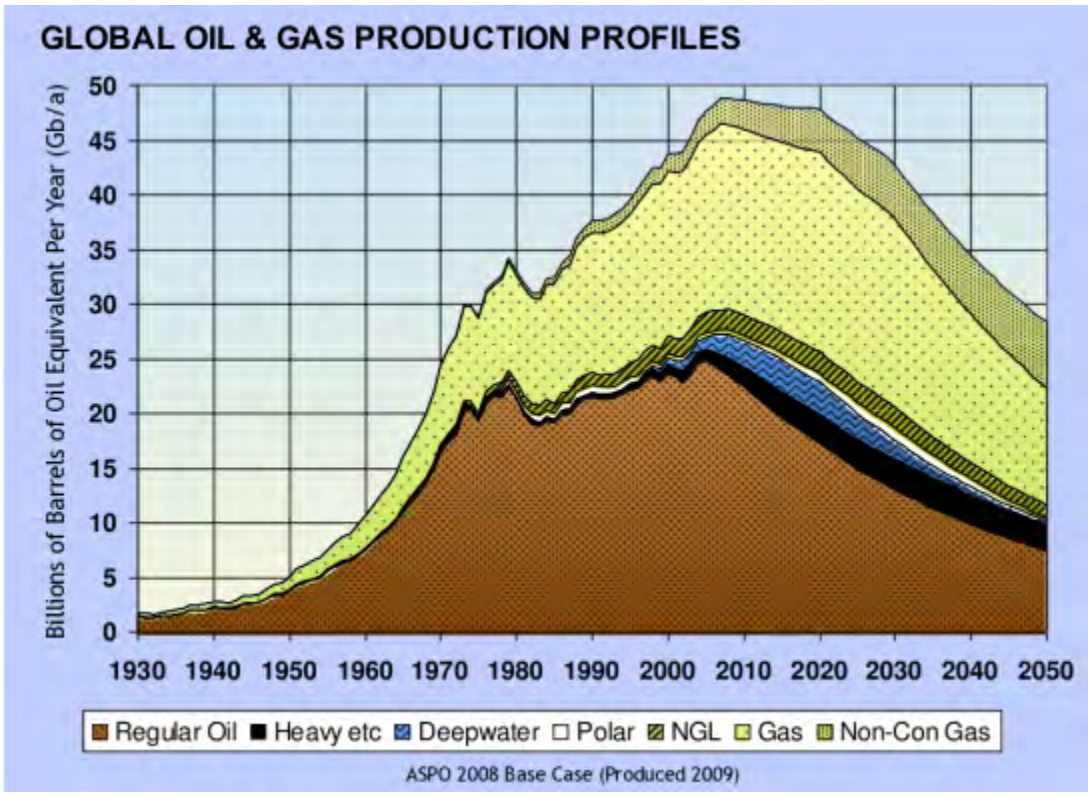
[275] Joseph Romm, "Climate Action Game Changer, Part 1: Is There a Lot More Natural Gas than Previously Thought?" June 3, 2009, http://climateprogress.org/2009/06/03/climate-action-game-changer-unconventional-natural-gas-shale/.

[276] "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/.

[277] Jean Laherrere, *Oil and Gas: What Future?* (paper presented at Groningen Annual Energy Convention, Nov. 21, 2006), pp. 22-23.

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 IV

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

BLOOMINGTON PEAK OIL TASK FORCE MEMBERS

Dave Rollo (Chair) received a Bachelor of Science in Biology at Michigan State University, and a Master's degree in Plant Sciences from Indiana University. Since 1995, Dave has been a Research Associate in the IU Department of Biology, working on a variety of projects in molecular and microbiology. He currently works on a project for bio-solar energy production.

Dave has served on the Bloomington City Council since 2003, where he presided as president in 2007. He has also served on a number of City boards and commissions, including The Environmental Commission and the Sustainability Commission, which he created by resolution in 2005. He co-founded Bloomingpeak (http://bloomingpeak.org/), a local peak oil awareness group in 2005 and sponsored legislation recognizing peak oil and creating the Peak Oil Task Force. Since 2003, Dave has given over 50 presentations on the subject of peak oil.

Peter Bane is publisher of *Permaculture Activist* magazine (www.permacultureactivist.net), a Visiting Professor at Paul Smith's College (NY), and has been a consultant to Indiana University on permaculture design and to Slippery Rock University (PA) on curriculum for sustainability. An advisor to the Ecovillage Training Center in Tennessee, he also helped to found and design Earthaven Ecovillage, an intentional community in the North Carolina mountains. Peter holds the Diploma of Permaculture Design from the British Permaculture Academy.

Gary Charbonneau is Systems Librarian at Indiana University Libraries in Bloomington and a member of the Libraries' Green Team. He has been "peak oil aware" since the oil shocks of the 1970s.

Clay Fuqua is a Professor of Biology at Indiana University, with expertise in microbiology and molecular biology, and significant research interests in environmental microbiology. Professor Fuqua has authored over 70 peer-reviewed research publications, as well as pieces for the wider community. He has served as IU Microbiology Program Director and is currently Associate Chair for Research and Facilities in the Biology Department. Professor Fuqua has resided in Bloomington for over 10 years, over which he has cultivated interests in community environmental issues and Bloomington's resilience in the face of changing resource availability.

Christine Glaser is a partner in GreenFire Consulting Group, LLC. She received the equivalent of an M.A. in Economics from Mainz University in Germany and a Ph.D. in Public Affairs from Munich University. For over 20 years, she has worked as a researcher, college teacher, consultant and advocate at the intersection of environmental and economic issues. She has served on various Bloomington boards, commissions and councils, and has given numerous public talks, lectures, and workshops.

Stephanie Kimball is a former Professor of Education and is currently a homeschooling mother of two with a vision for healthy, sustainable community life. She works with Earth Care and other local non-profits fighting climate change. Stephanie has organized a number of community events in Bloomington, including two Step It Up events (2007), the Earth Summit (2008) and two Cool Earth Relays (2008 & 2009).

Jim Silberstein is an entrepreneur who spends his time on a variety of things. He owns a commercial and residential real estate company with properties in downtown Bloomington. Jim also teaches Business Development at Ivy Tech Community College and works as a Business Advisor for the Indiana Small Business Development Center in Bloomington. Previously, Jim created, owned, operated and sold two well-known food businesses, Tina's Cuisine and the Encore Café, both in Bloomington. He also has served the City of Bloomington as a member of both the Board of Zoning Appeals and the Municipal Facilities Corporation. Within the community, Jim has served as President of the Bloomington Downtown Commission and is in his twelfth year of service as a member of the board of the Wonderlab Museum. Jim has a B.A. in Economics and Business from Macalester College and an M.B.A. in Marketing and Finance from the J.L. Kellogg Graduate School of Management at Northwestern University.

Gregory Travis has been a Monroe County resident for thirty-five years. A previous life as a free-lance writer for various aviation publications, particularly focused on future aviation fuels availability, helped him become aware of the petroleum industry and infrastructure and the phenomenon of "peak oil" -- once a friend who works for Chevron explained that, that was what he meant by "field maturity." In addition to the Bloomington Peak Oil Task Force, Mr. Travis serves on the Monroe County Economic Development Commission, the Monroe County Historic Review Board, the Bloomington Professional Council at Indiana University, and is a board member for Mother Hubbard's Cupboard. He lives with his wife, son, and several animals on a farm just large enough to grow his own food and fuel, should that become necessary.