Tompkins County Energy Roadmap

February 2016

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For Tompkins County Planning Department

Presentation Outline

- Overview
- Potential
- Scenarios
- Next Steps

Motivation for Energy Roadmap

Overview

Isn’t Climate Change a Global Problem?

Overview

What difference will it make to achieve climate goals here in Tompkins County?

- If everyone says that, then no one will move the dial
- Keeps money spent on energy in the local economy instead of in multi-national corporations’ pockets
- Creates local jobs – can’t outsource insulating a house
- Reduces pollutants and improves health
- Makes buildings more comfortable to live in
- Increases our resilience in the face of a changing climate

Tompkins County 2015 Comprehensive Plan

Overview

Principle

Tompkins County should be a place where the energy system meets community needs without contributing additional greenhouse gases to the atmosphere

Policy

Reduce greenhouse gas emissions to reach a minimum 80% reduction from 2008 levels by 2050 and reduce reliance on fossil fuels across all sectors

What is the Energy Roadmap?

Overview

1. Assesses potential of local renewable energy sources

2. Assesses potential for energy efficiency and demand management to reduce energy demand

3. Identifies scenarios for how both energy demand and greenhouse gas emissions goals can be met in 2050

- Concrete evidence that achieving goals is possible and show paths that could be taken

- Direction for near and long-term local actions

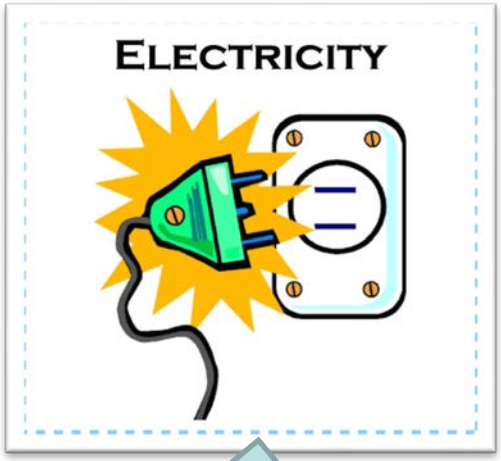
What the Energy Roadmap is NOT

Overview

- Concrete action steps to achieve goals (wait for the Updated Energy Strategy in 2016)
- An evaluation of all technologies available today – limited to those most pertinent to community
- A guide for solving all of the grid-level issues the nation needs to address to incorporate high amounts of renewables –
  - Utility rate structure, interconnection, energy storage, peak demand, balancing renewable generation, infrastructure limitations, etc.
- A crystal ball that predicts energy pricing and new innovations in technologies and policy developments

What Creates GHG Emissions

Overview



Grid- Nat Gas, Coal

Nat Gas, Oil, Propane

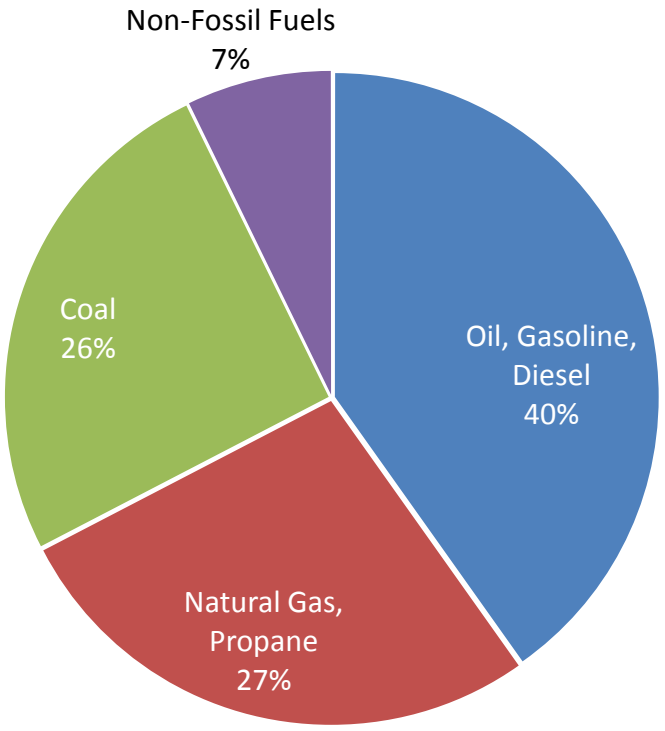
Gasoline, Diesel

GHG Emissions

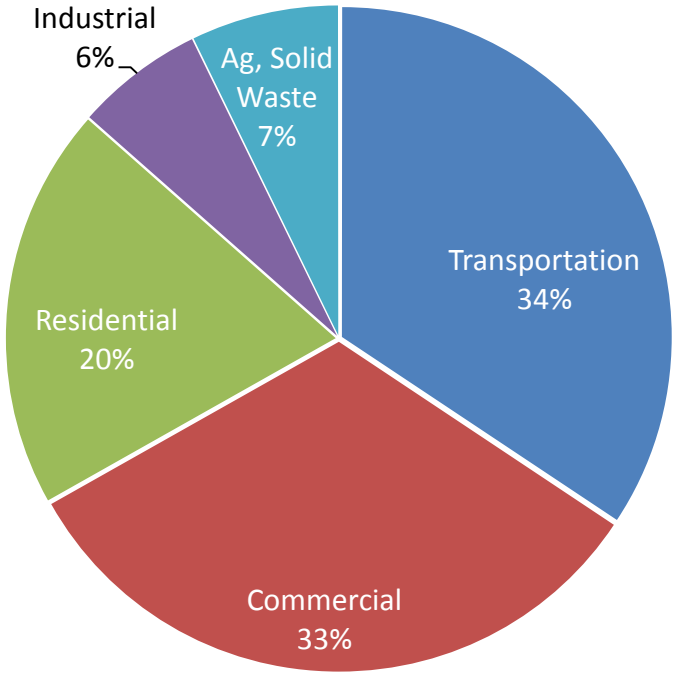
2008 Greenhouse Gas Emissions Inventory

Overview

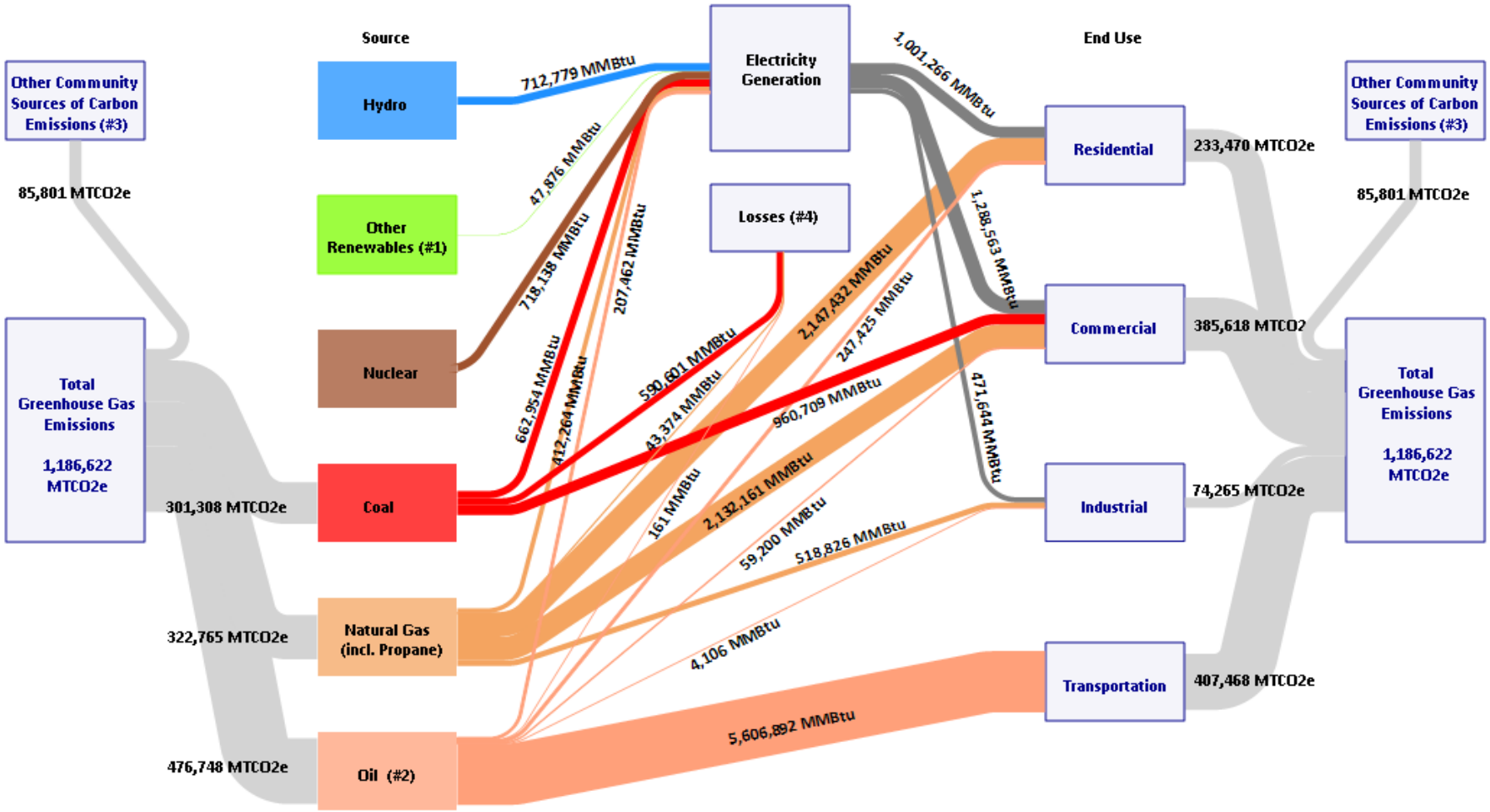
Emissions by Energy Source



Emissions by End Use



2008 Tompkins County Energy Flow and Greenhouse Gas Emissions

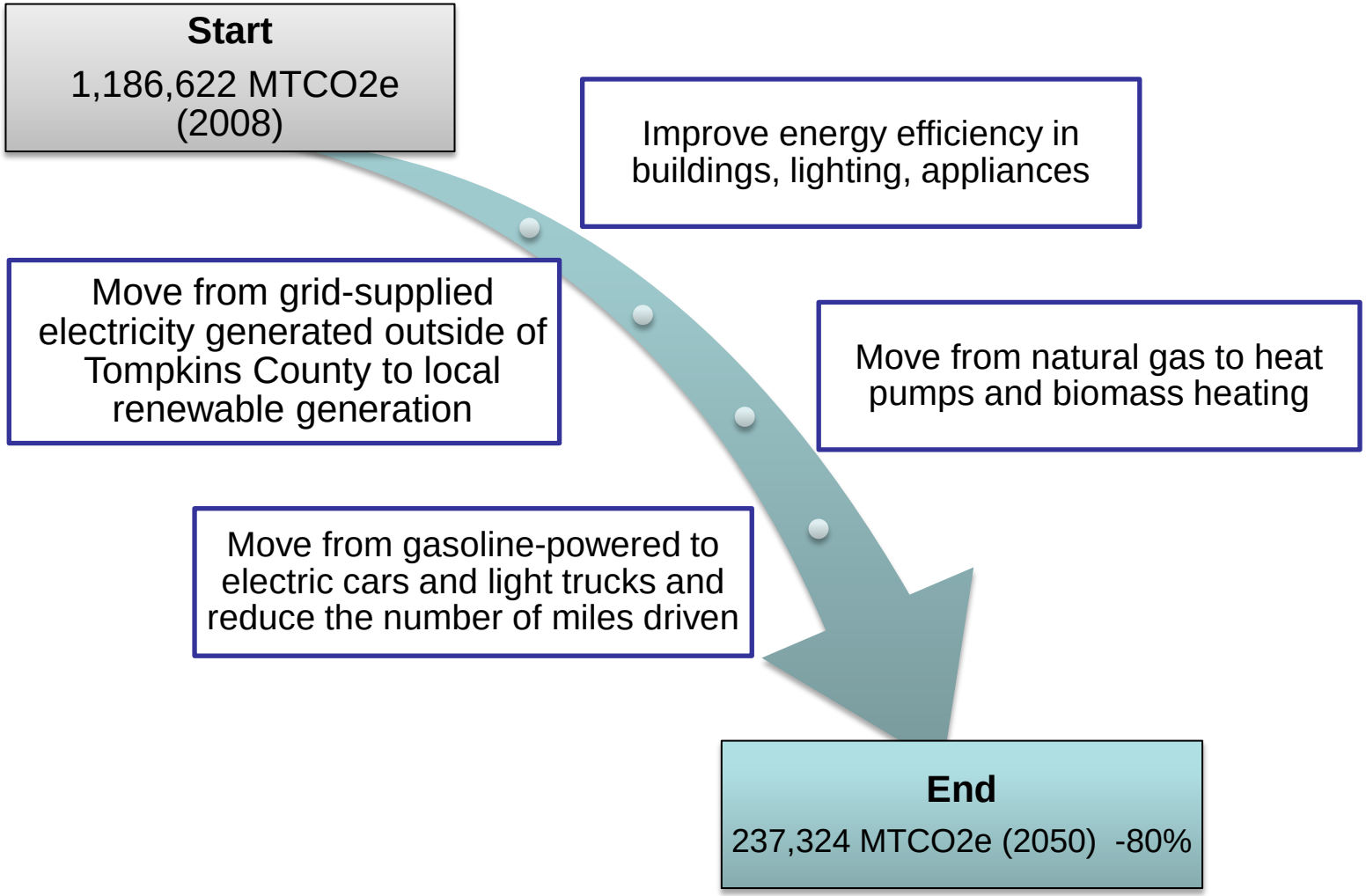


Data Sources:
Energy use by sectors and greenhouse gas emissions sources from Tompkins County 2008 GHG Emissions Inventory, developed using the 2009 version of ICLEI's Clean Air Climate Protection (CACP) software. Electricity fuel sources used for Tompkins County 2008 GHG Emissions Inventory is EPA eGRID Profiler, Year 2005 eGRID Subregion Resrouce Mix, NPCC Upstate NY: Nuclear 27%, Hydro 26.4%, Coal 21.5%, Natural Gas 15.5%, Oil 7.8%, Biomass 1.2%, Other Fossil Fuel 0.4%, and Wind 0.1%. Energy use of Cornell University is accredited to the Department of Energy & Sustainability and the Department of Facilities Management under the Cornell Infrastructure Properties and Planning.

Notes:
#1. Other Renewables include solar, wind, biomass, and geothermal energy sources.
#2. Oil includes heating fuel, diesel, gasoline, motoryde gasoline, and transit bus diesel.
#3. Other Community Sources of Carbon Emissions include Waste (41,792 MTCO2e), Agriculture (43,996 MTCO2e) and Groton Electricity Use (13 MTCO2e).
#4. Energy losses in the conversion from fossil fuel to electricity and/or thermal energy.

Achieving the 80% Reduction

Overview



Presentation Outline

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- Scenarios
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Approach to Quantifying Potential

Potential

- Used only technologies that are commercially available today
- Tried to be conservative in our assumptions about feasibility
- Used sound methodology and defensible numbers
- Thorough review by Steering Committee

All detailed topic chapters are available online at tompkinscountyny.gov/planning/energy-climate

Wind - Electricity

Potential

Scale			Annual Energy Output (GWh)
Small-scale			33
Medium-scale			2,097
Large-scale			516
Total			**2,646**

327% of Total 2008 Electricity Demand

Solar - Electricity

Potential

Category			Annual Electricity Output (GWh)
Residential	Urban*		16
	Rural		109
Nonresid#	Commercial		132
	Industrial		21
	Community and public services		81
PV Farms			2,093
Total			**2,453**

303% of Total 2008 Electricity Demand

Micro-Hydro - Electricity

Potential

Potential Sites			Annual Energy Output
			726 GWh

- Generation potential at individual sites varies from 100 kW - 2,950 kW
- Most sites could generate between 100kW - 600kW

90% of Total 2008 Electricity Demand, but less certainty in numbers

Biomass – Heating

Potential

Type of Biomass/Land Cover	Suitable Acres		MMBtus/yr
Wood - Forests	69,775		454,191
Energy Crops - Inactive Ag, Brush, Grass Land	29,668		2,373,440
Ag Waste - Active Agricultural Land	24,548		798,846
Total			**3,626,477**

59% of Total 2008 Heating Demand

Building Energy Efficiency

Potential

			Potential Energy Savings
Commercial Retrofits			2,451,102 MMBtus
Residential Retrofits			2,268,059 MMBtus
Total			**4,719,161 MMBtus**
Amount for heating alone (71% of avg. building total)			***3,350,604***

54% of Total 2008 Heating Demand

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Scenarios

- ***Scenario A – Business as Usual***
- Scenario B – Mixed
- Scenario C – All Electric
- Scenario D – Maintaining Half of 2008 Natural Gas Use

All Except for “A” meet goal of 80% reduction from 2008 levels by 2050

Scenario A
“Business as Usual”

Timeframe for This Analysis

Scenarios

35 Years

Baby Tyler in 2015

Tyler in 2050

Scenario A: Business As Usual

Scenarios

In 2015, Tyler's family is likely to:

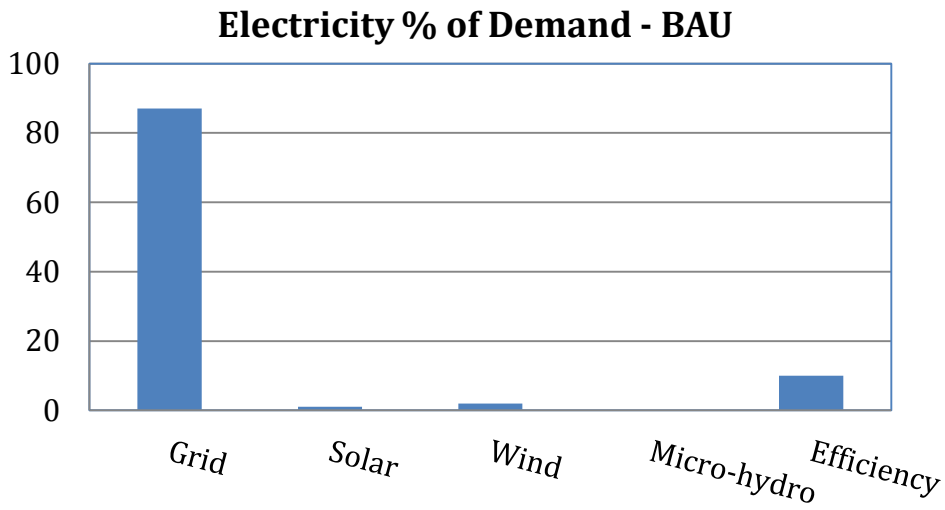
- Live in a house heated by natural gas
- Get electricity from a grid powered by nuclear, hydro, natural gas and coal
- Live in the suburbs or country and drive to work in Ithaca
- Drive a vehicle that gets about 20 miles per gallon of gasoline

In 2050, Tyler's family is likely to:

- Live in a house heated by natural gas
- Get electricity from a grid powered by more renewables than in 2015
- Live in the suburbs or country and drive to work in Ithaca
- Drive a vehicle that gets about 55 miles per gallon of gasoline

. . . but they may not be smiling

Scenarios

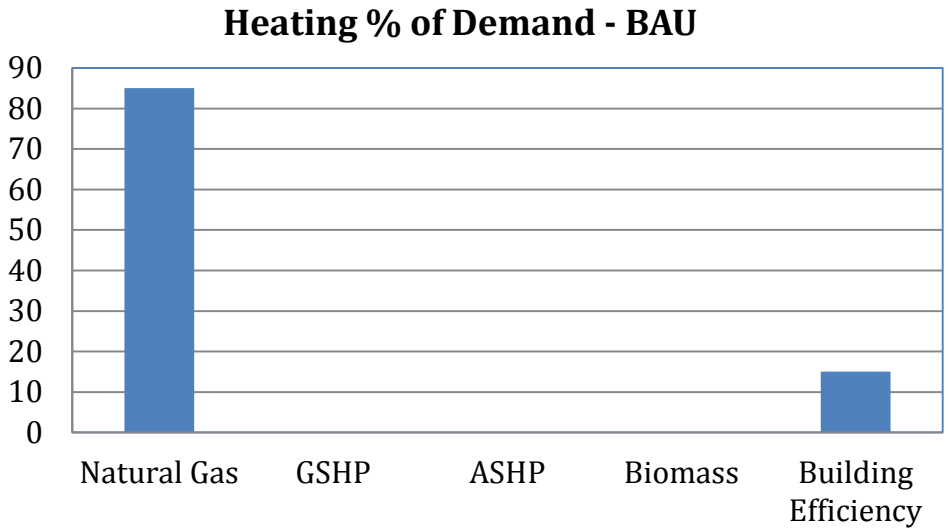


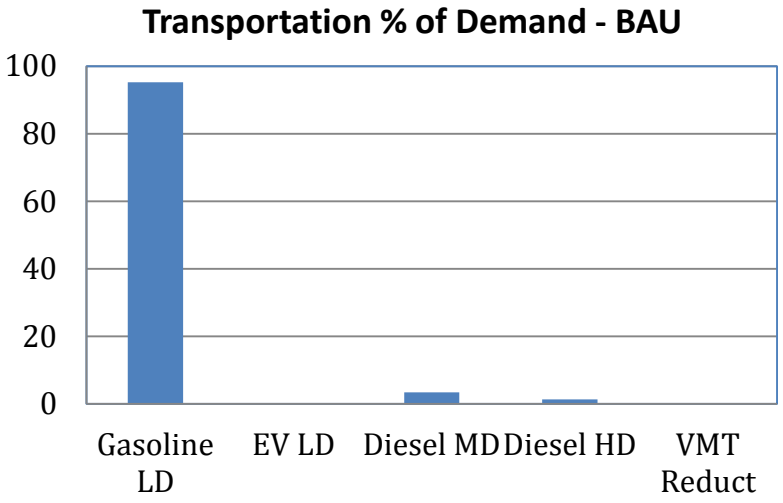
Scenario A (BAU)

Percent of Energy Demand Met by Source in 2050

Mostly:

- Electricity from Grid
- Heating from Nat Gas
- Cars fueled by Gasoline





Scenarios

- *Scenario A – Business as Usual*
- **Scenario B – Mixed**
- **Scenario C – All Electric**
- **Scenario D – Maintaining Half of 2008 Natural Gas**

Guiding Assumptions

Scenarios

- Achieve goal of 80% reduction from 2008 levels by 2050
- Utilize local resources given reasonable assumptions
  - 50% solar potential
  - 20% wind potential
  - 20% micro-hydro potential
  - 80% of lighting and appliance efficiency potential
  - 50% building energy efficiency potential
  - 25% reduction in VMT (growth in centers, transit, carpooling)
- Balance needs of environment, economy and equitable society

Scenario B
“Mixed”

Scenario B (Mixed) - Compared to BAU

Scenarios

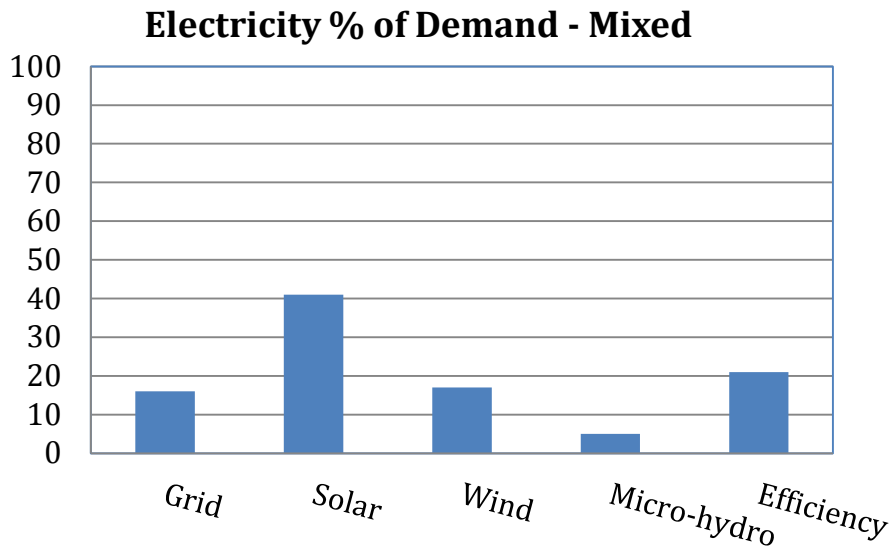
In 2050 BAU, Tyler's family is likely to:

- Live in a house heated by natural gas
- Get electricity from a grid powered by more renewables than in 2015
- Live in the suburbs or country and drive to work in Ithaca
- Drive a vehicle that gets about 55 miles per gallon of gasoline

In 2050 Mixed, Tyler's family is likely to:

- Live in a house heated by heat pumps or biomass
- Get electricity from locally produced solar or wind
- Live in one of the villages or the City of Ithaca
- Have a 50% chance of driving an electric vehicle or walk, bike or take the bus

Scenarios

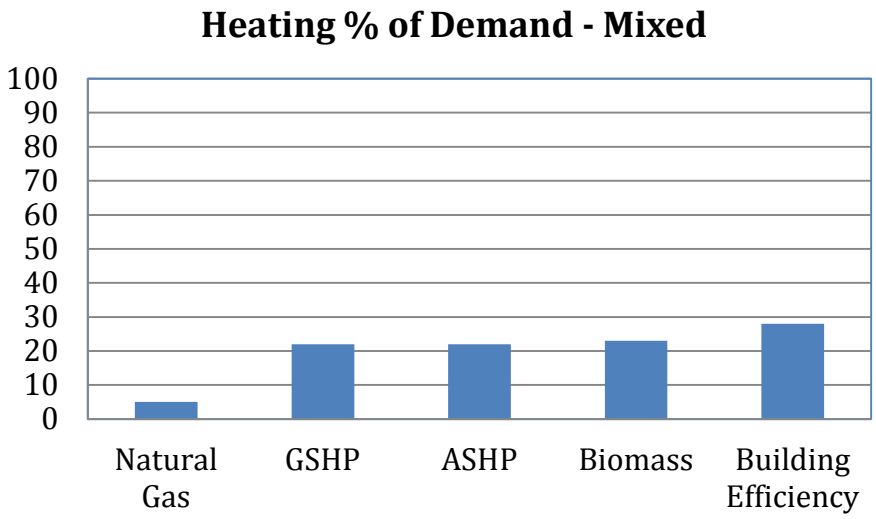


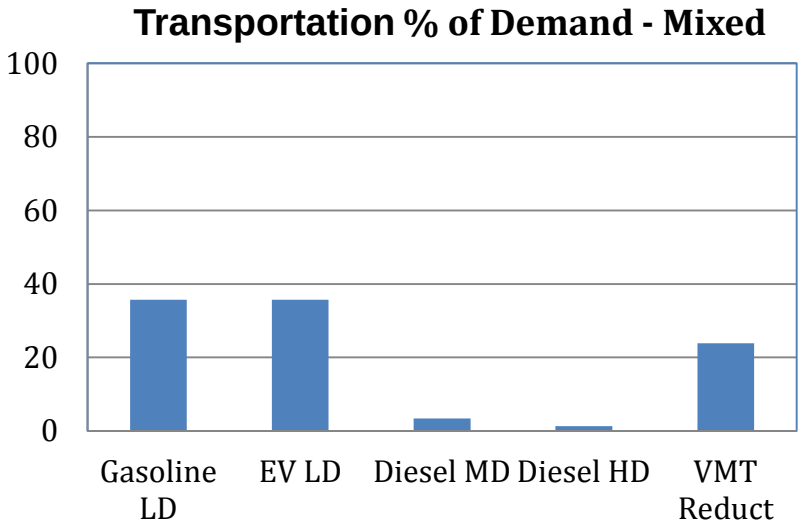
Scenario B (Mixed)

Percent of Energy Demand Met by Source in 2050

Mostly:

- Electricity from local renewables
- Heating from Heat Pumps and Biomass
- Cars fueled by EV and Gasoline





Scenario C
“All Electric”

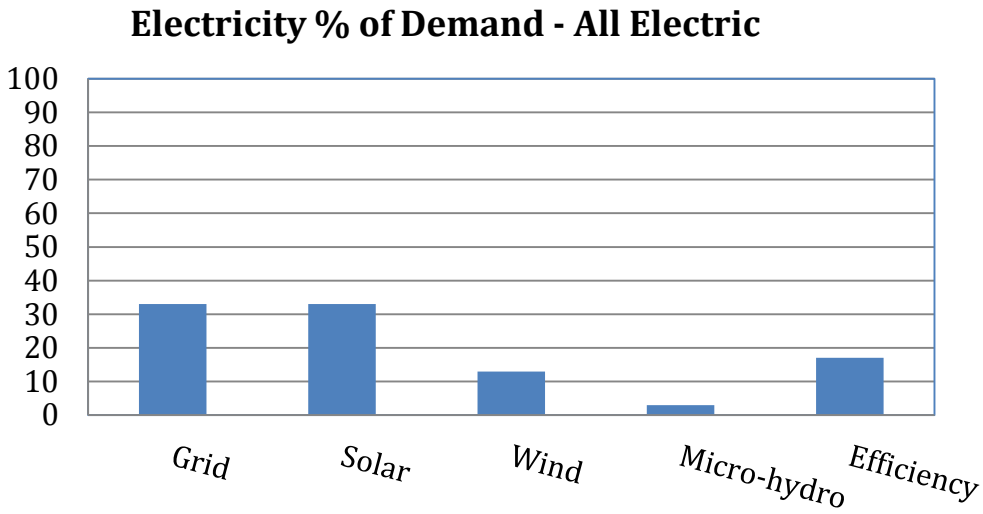
Scenario C (All Electric)

Scenarios

Key Differences Between All Electric and Mixed

- No natural gas use, compared to 10% of 2008 levels in Mixed
- No gasoline use, compared to 50% in Mixed
- Electric heat pumps and electric cars dramatically increase electricity demand
- Amount of electricity needed is more than may be generated locally at 20-50% of resource potential, so 2.3 times more grid power required than Mixed
- No direct burning of fuels could improve health

Scenarios

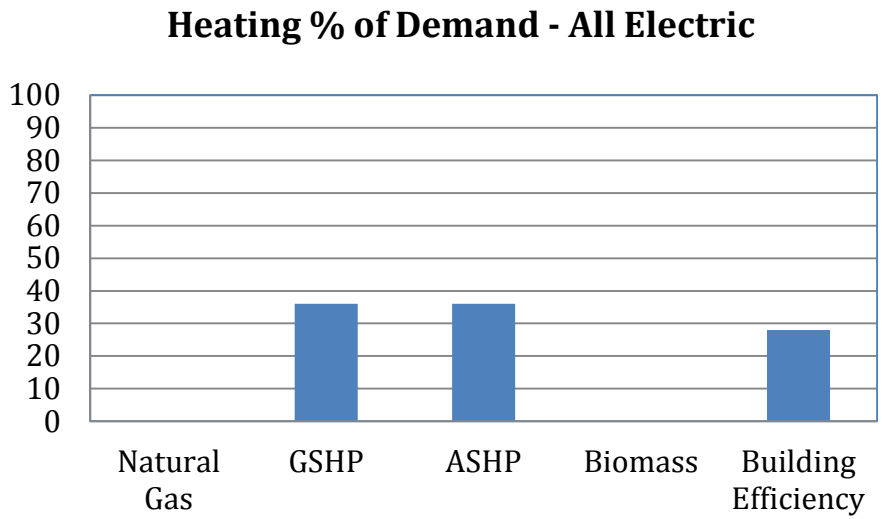


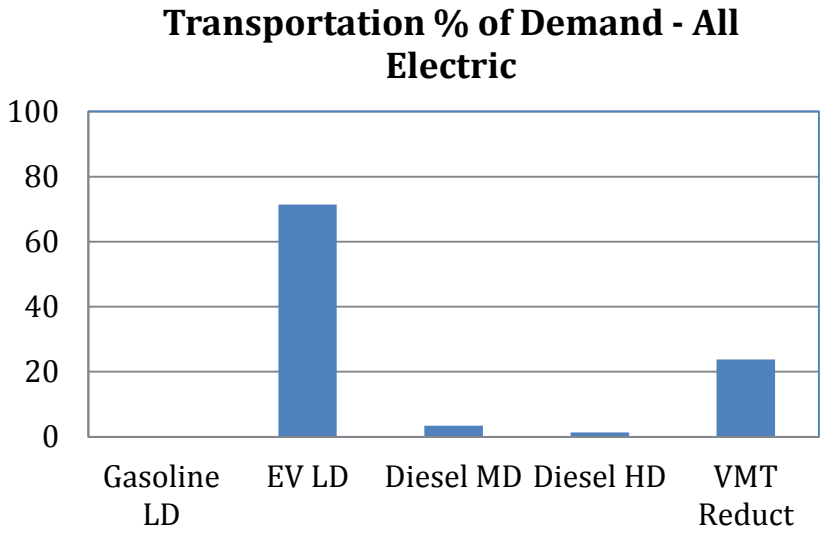
Scenario C (All Electric)

Percent of Energy Demand Met by Source in 2050

Mostly:

- Electricity from Grid/Local Solar
- Heating from Heat Pumps
- Cars fueled by electricity





Scenario D
“Maintain Half 2008 Natural Gas Use”

Scenario D (Half Nat Gas)

Scenarios

Key Differences Between Half Natural Gas and Mixed

- Continued use of heating qualities of natural gas, 50% compared to 10% in Mixed
- All light-duty vehicles will need to be electric
- Using this much of a high-emitting resource will require us to do more in other areas, especially for heating:
  - Ramp up retrofits and building efficiency to achieve significantly more of potential than other scenarios
  - Decrease use of electricity-using heat pumps
- Almost all electricity must be from local renewables and efficiency because of emissions associated with grid
- Requires we solve methane emissions leaks from transmission and distribution system

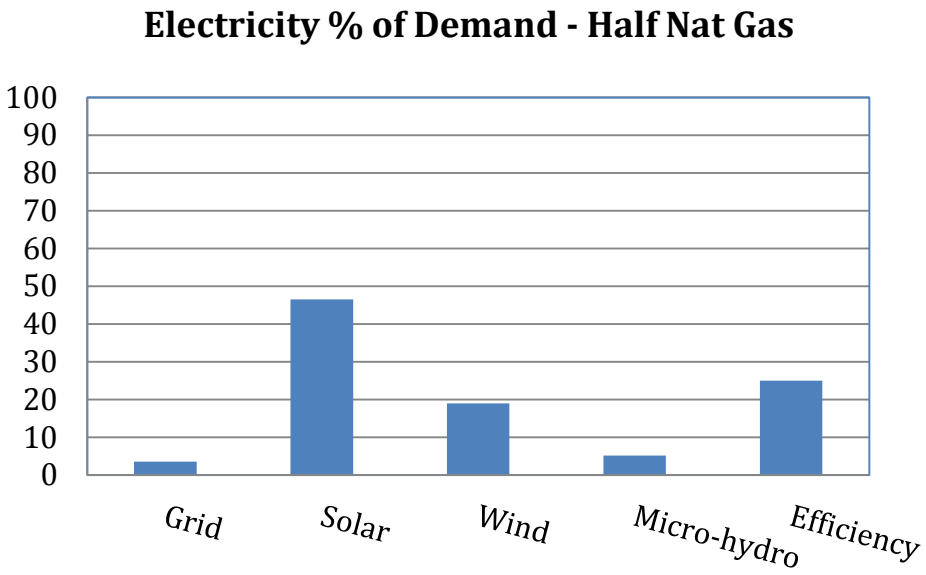
Scenarios

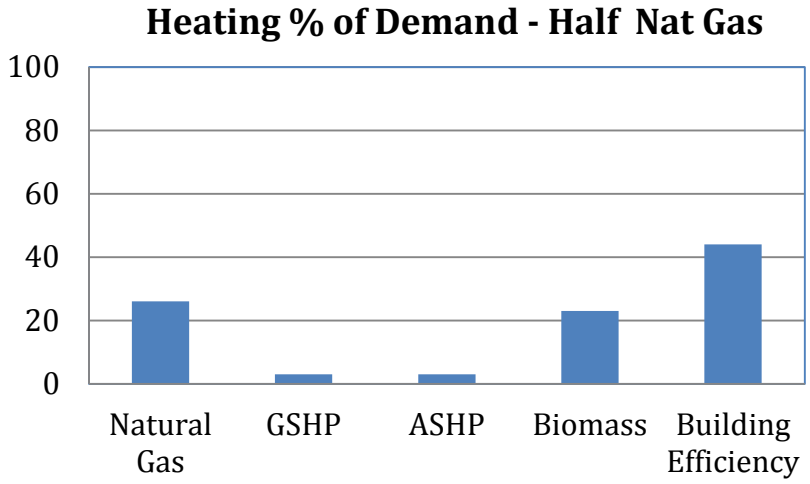
Scenario D (Half Natural Gas)

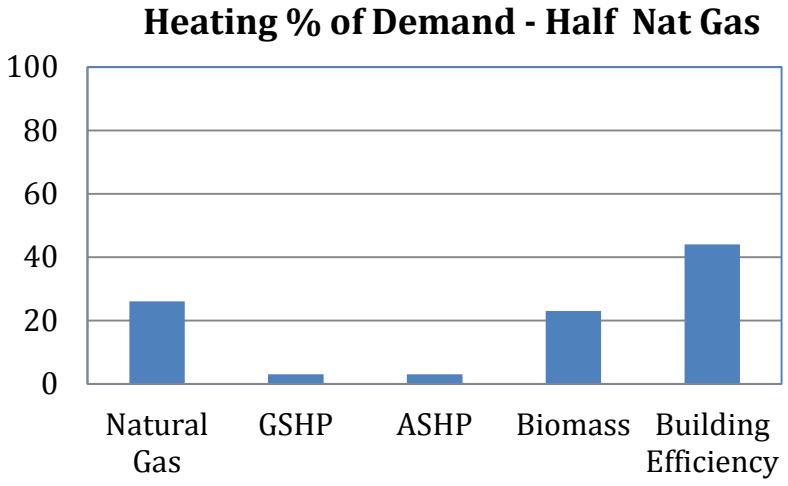
Percent of Energy Demand Met by Source in 2050

Mostly:

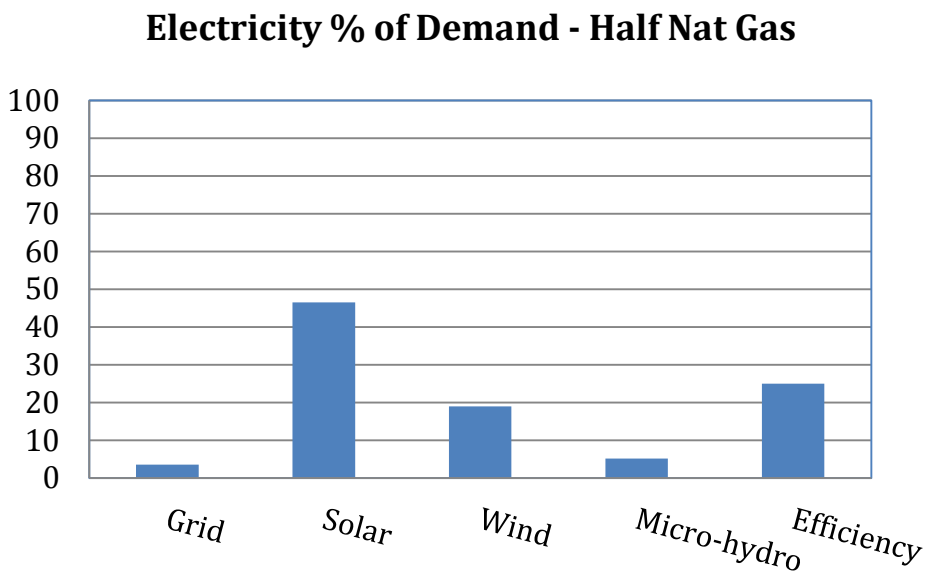
- Electricity from Solar
- Heating from Natural Gas and Biomass
- Cars fueled by electricity







Scenarios



Scenario D (Half Natural Gas)

Percent of Energy Demand Met by Source in 2050

Mostly:

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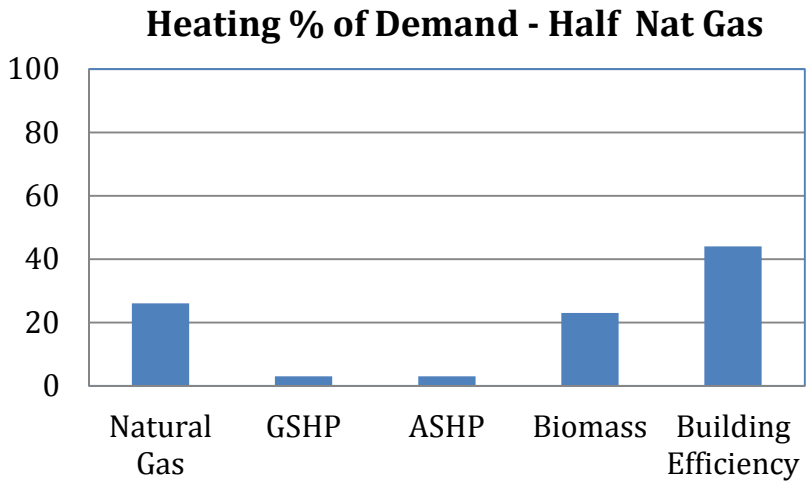
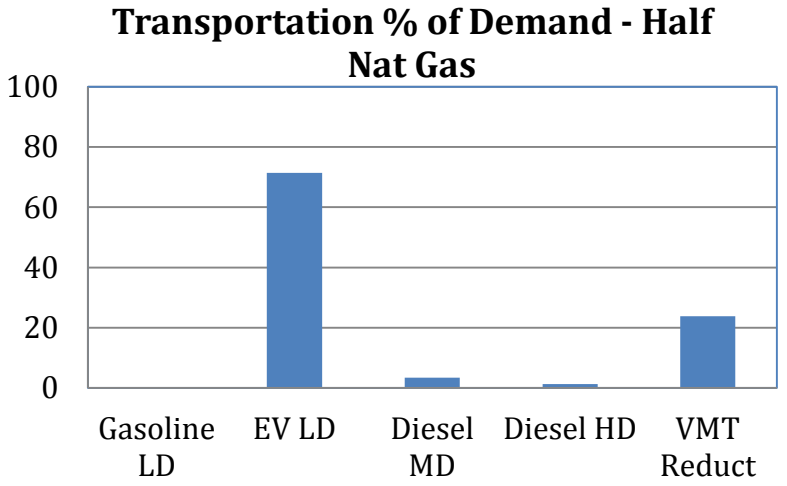
- Cars fueled by electricity





Summary of Future Energy Scenarios

Scenarios

Scenarios	BAU	All Electric	Mixed	Half Nat Gas
% of 2008 Natural Gas Usage Maintained	164%	0%	10%	50%
% of Heating Demand Met by Local Renewables (including heat pumps & biomass)	0%	72%	67%	29%
% of Projected Energy Demand Provided by Efficiency Improvements (in all three sectors)	4%	25%	25%	31%
% of Transp Demand Met by Light-Duty EVs	0%	71%	36%	71%
% of Electricity Demand Met by Local Renewables	3%	49%	63%	71%
% of MTCO2e Reduction	**31%**	**80%**	**80%**	**80%**

Presentation Outline

Overview

Potential

Scenarios

Recommendations

Energy Roadmap Steering Committee

Recommendations

Martha Armstrong, TC Area Development	Tony Ingraffea, Cornell Civil & Enviro Eng
Peter Bardaglio, Black Oak Wind, TCCPI	Tim Mount, Cornell Applied Econ & Mgmt
Scott Bochenek, Iberdrola USA	Gay Nicholson, Sustainable Tompkins
Carol Chock, TC Legislature	Bob Pass, NYSEG
Linda Copman, Cornell Climate Action Plan	Leslie Schill, Cornell Facilities Services
Brian Eden, EMC Energy Committee	Ken Schlather, Cooperative Ext. Tompkins
Nick Goldsmith, City/Town Ithaca	Ian Shapiro, Taitem Engineering
Jerry Goodenough, Cayuga Power Station	(Lew Durland, Ithaca College)

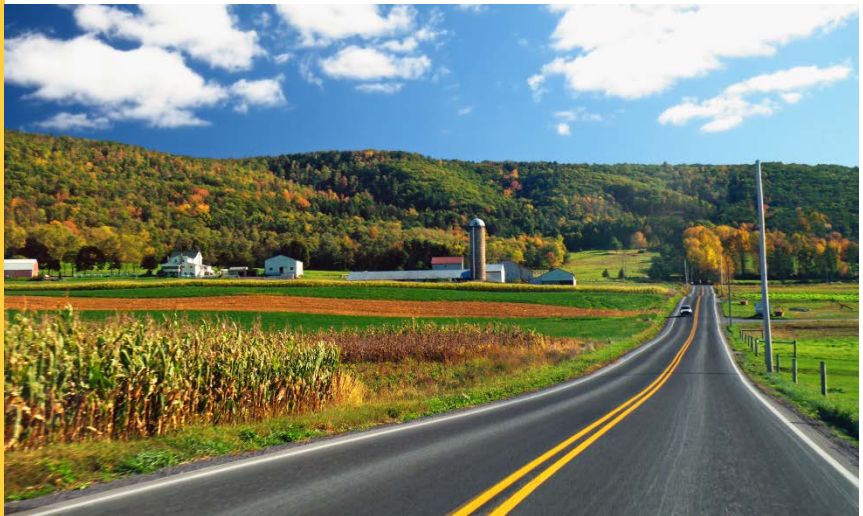
Recommendations – Reducing Demand

Recommendations

By 2050, we should:

- Achieve a 35% reduction in energy use in existing buildings through retrofits and upgrades
  - 2/3 from thermal energy (sealing, insulation)
  - 1/3 from electrical efficiency (lighting, refrig)

- Construct new buildings that are extremely energy efficient
  - Aim for 70% reduction in energy use increasing to net zero by 2030



- Hold vehicle miles traveled at ~2008 level, despite increases in population

Recommendations – Transitioning to Renewables

Recommendations

- Reduce natural gas use by at least 50% from 2008 levels

- Reduce demand for grid electricity generated by centralized power plants or sources outside of Tompkins County by at least 24% from 2008 levels

Recommendations – Transitioning to Renewables

- Develop at least 50% of the identified **solar** energy production potential
  - ➢ One way this could be achieved is by doing all of the following:
    - 1 in 4 urban homes install a 4 kW system
    - 1 in 2 suburban and rural homes install a 7 kW system
    - 30% of commercial, institutional, industrial roof areas install PV
    - 944 MW of PV farms on 4,720 acres (1.5% of County's land area)

Recommendations – Transitioning to Renewables

Recommendations

- Develop at least 20% of identified **wind** energy production potential.
  - ➢ One way this could be achieved is by doing all of the following:
    - Installing 300 medium-scale 500-KW turbines
    - 20 large-scale 2.3-MW turbines

Recommendations – Transitioning to Renewables

- Develop up to 50% of identified **biomass** energy production potential.
  - ➢ One way this deployment could be achieved is by doing all of the following:
    - Managing 36,700 forest acres for sustainable biomass
    - Planting 15,600 acres of inactive ag/grasslands in energy crops
    - Managing 12,900 acres of crop/forage land for sustainable crop residue

Recommendations – Transitioning to Renewables

- Develop at least 20% of identified **micro-hydro** energy production potential
  - ➢ Could be achieved by installing 60 micro-hydro 300 kW systems

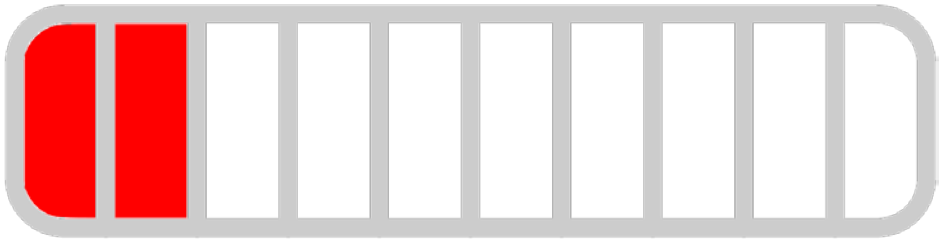
Recommendations – Transitioning to Renewables

Recommendations

- Transition 50% of light-duty vehicles from gasoline to electric
  - Estimated 33,500 vehicles, from 67,000 that may be on the road in 2050

Recommendations – Set Goals and Track Progress

- Set interim GHG emissions goals for 2020, 2025, 2030 and track progress
- Every 2 years review scenarios and update as necessary
- Semi-annually convene stakeholders to evaluate progress, opportunities and barriers to achieving recommendations
  - ➢ Particular focus on equitable distribution of positive and negative impacts



More information available at

tompkinscountyny.gov/planning