

Sustainability Summit 2015

Transitioning To A More Sustainable Energy Framework

June 10, 2015



Jeanne Fox

Past NJ BPU Commissioner
and Board President



Mark Warner

VP Gabel Associates

The Need For Goals

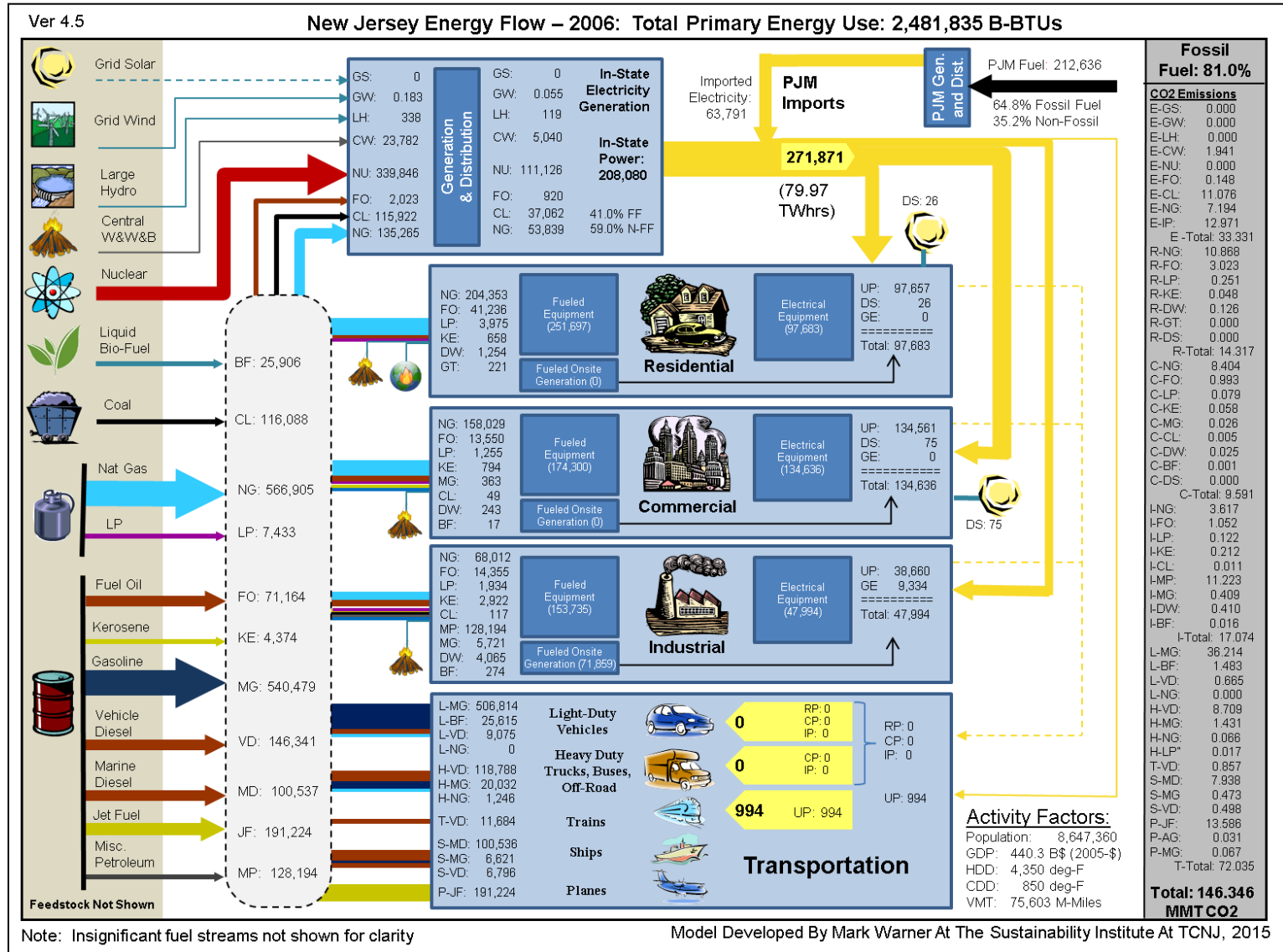
To Set Policy, And As A Result Transform Markets, We Need Sustainable Energy Goals. In NJ We Have:

- **The Global Warming Response Act (2007)**
 - **80% Reduction Of CO2 By 2050 (relative to 2006)**
- **The NJ Energy Master Plan (2008, 2011)**
- **Enabling Legislation**
 - **EDECA**
 - **The Renewable Portfolio Standard and Net Metering**
 - **Consumer Choice and competition**
- **Clean Energy Programs and Associated Regulations and Processes**

Goal Setting Examples

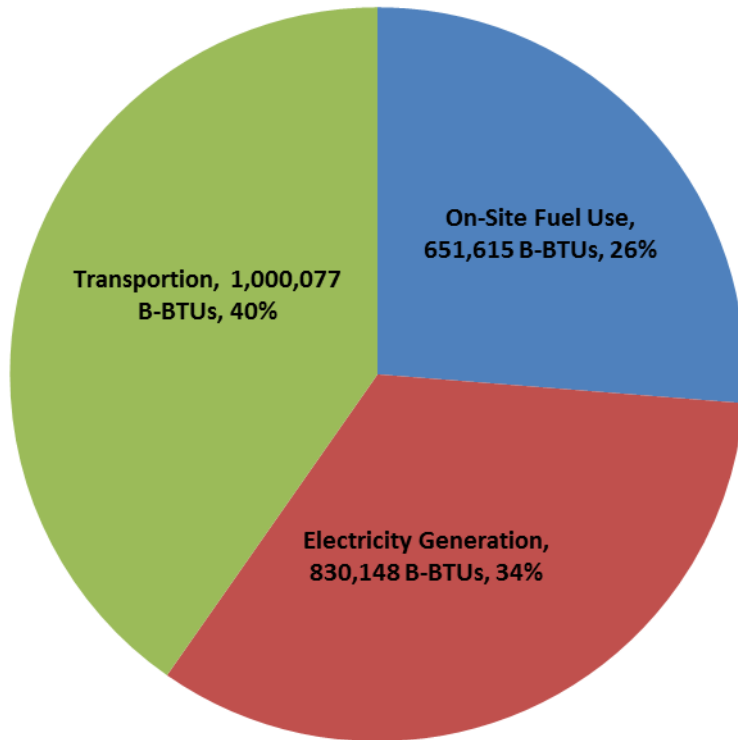
- **IPCC Goal:**
 - Limit warming to 2-deg Centigrade
 - Implies an 80% reduction in CO2 from all sources
- **Recent “Brussels Agreement” For The EU (October 2014)**
 - 40% Reduction Of GHG Emissions By 2030 (relative to 1990)
 - 27% Improvement In Building Efficiency
 - 27% Of Energy From Renewable Sources
- **Recent US-China Agreement (November 2014)**
 - China: 20% Of Energy From Zero-Emission Sources By 2030, Carbon Peak in 2030
 - US: Reduction Of Net GHG Reductions By ~27% By 2025 (relative to 2005)
- **Recent Executive Order For Federal Buildings (March 2015)**
 - 40% Reduction Of GHG Emissions By 2025 (relative to 2008)
 - 2.5% Reduction In Building Energy Use Every Year Through 2025 (efficiency)
 - Ensure Federal Agencies Get 20% Of Energy From “Clean Sources”
 - Reduce Federal Vehicle Emissions By 30% Compared With 2014 (per mile)

Energy Use In NJ (2006)

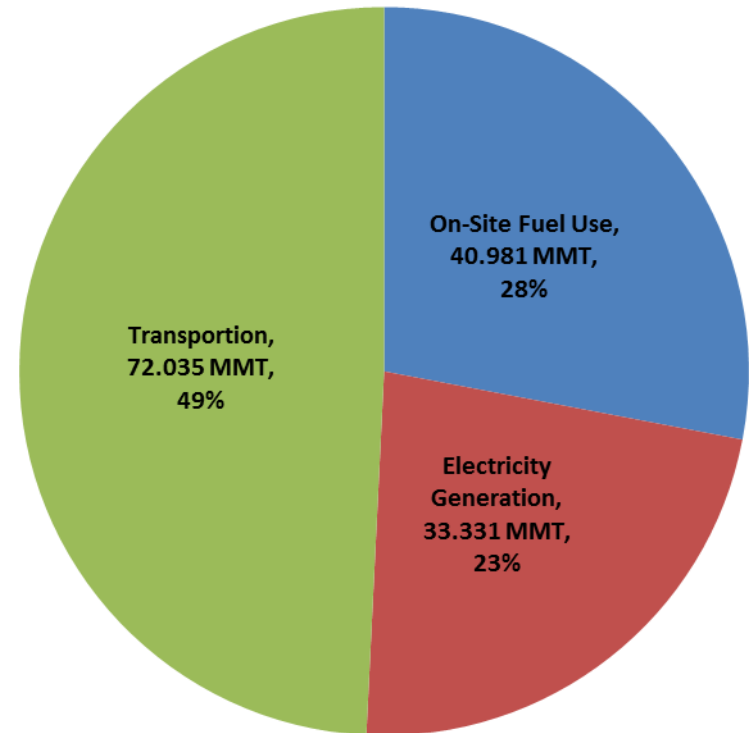


Energy Use In NJ (2006)

NJ Primary Energy Use (2006) (2,481,840 B-BTUs)



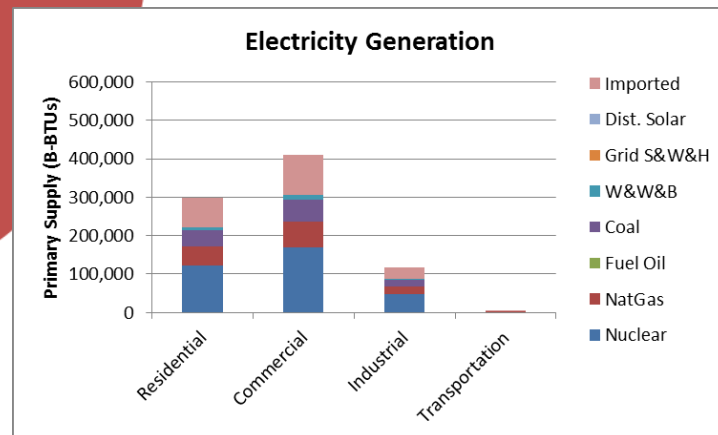
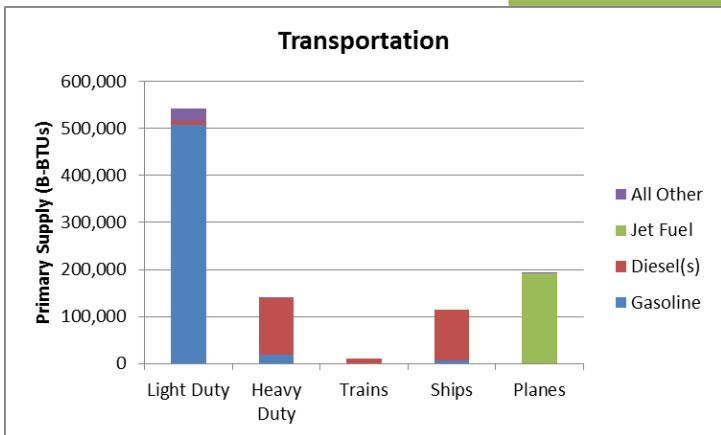
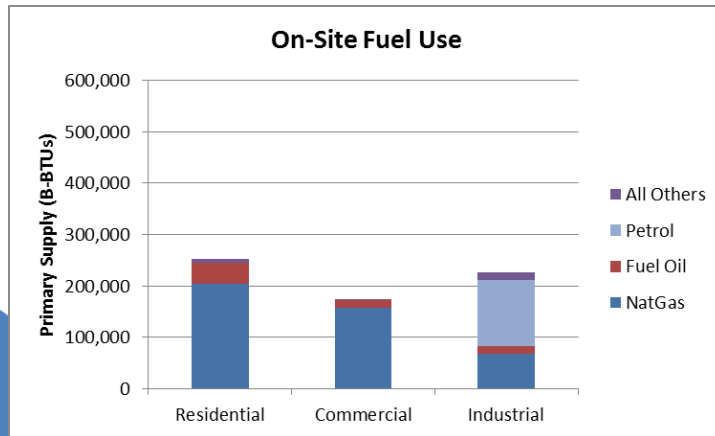
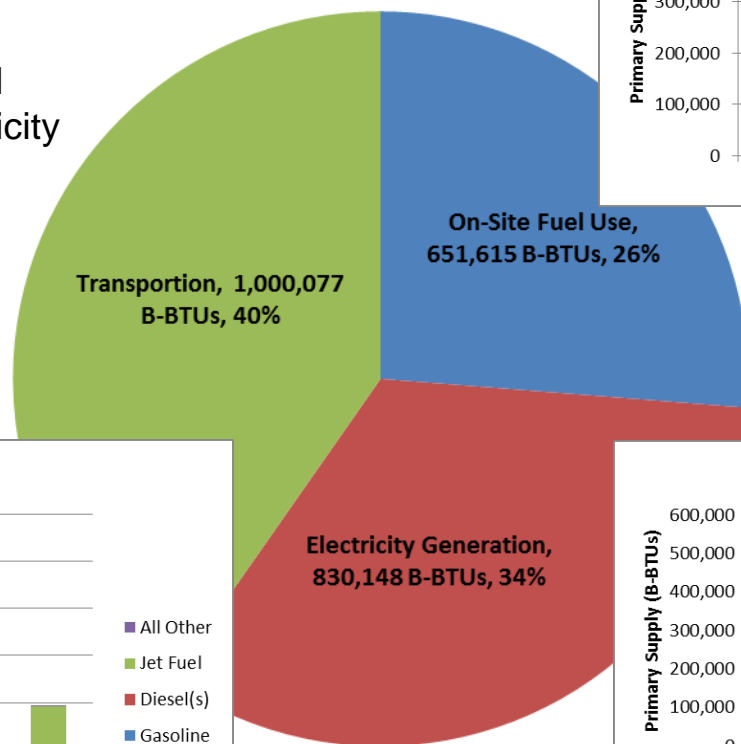
NJ Energy-Related CO2 Emissions (2006 - 146.346 MMT)



Energy Use In NJ: Primary Supply (2006)

2,481,840 B-BTUs

- + 26.2 % Misc. Petroleum
- + 22.8% Natural Gas
- + 21.8% Gasoline
- + 19.0% Non-Fossil Fuel
- + 5.6% Imported Electricity
- + 4.8% Coal



Note: on-site generation of electricity in the industrial sector captured in "On-Site Fuel Use", not shown in "Electricity Generation"

Note: Electrically fueled transportation (mostly trains) shown captured in "Electricity Generation", not "Transportation"

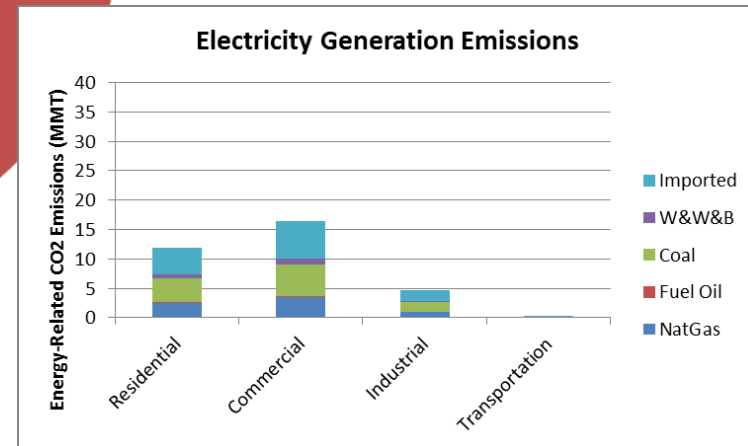
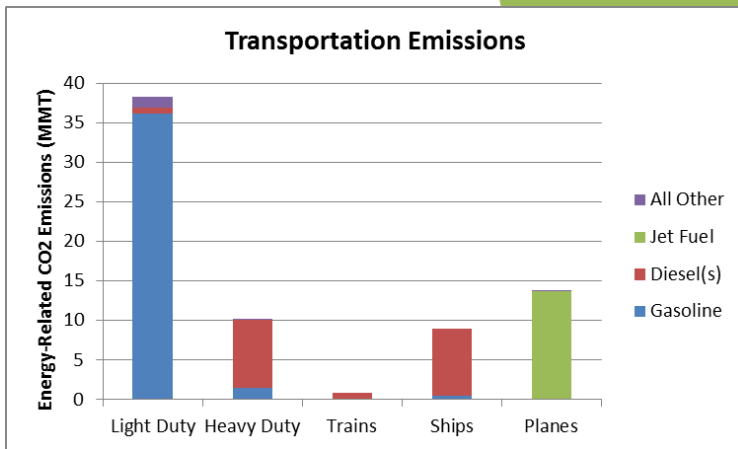
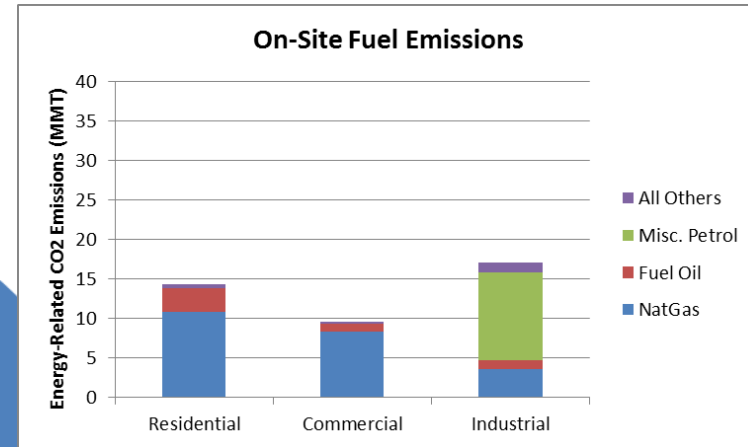
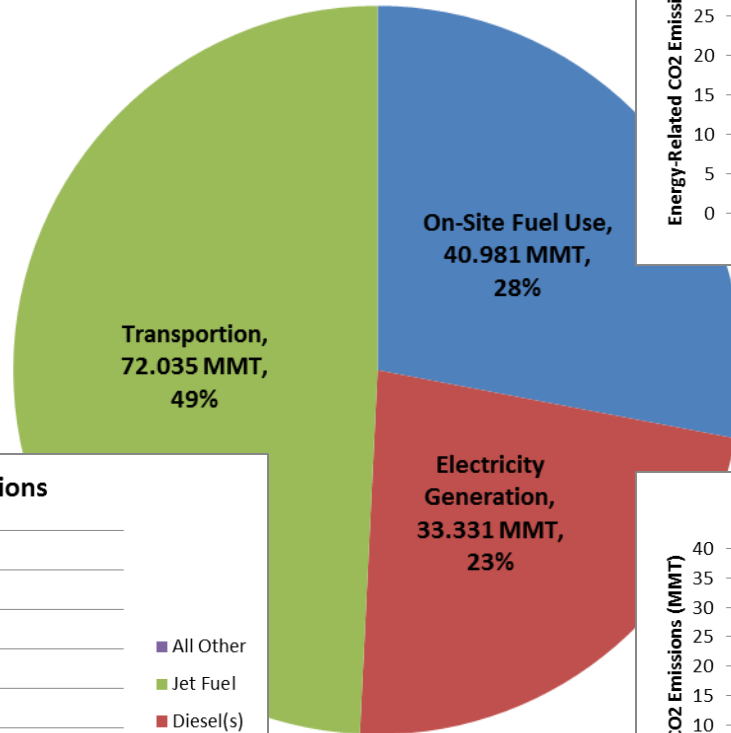
Source: NJ Energy Model Developed By Mark Warner At The Sustainability Institute At TCNJ, 2015

Energy Use In NJ: CO2 Emissions (2006)

29.269 MMT of CO2 (2050 Goal)

146.346 MMT of CO2 (2006 Actual)

117.007 MMT
Required CO2
Reduction
By 2050



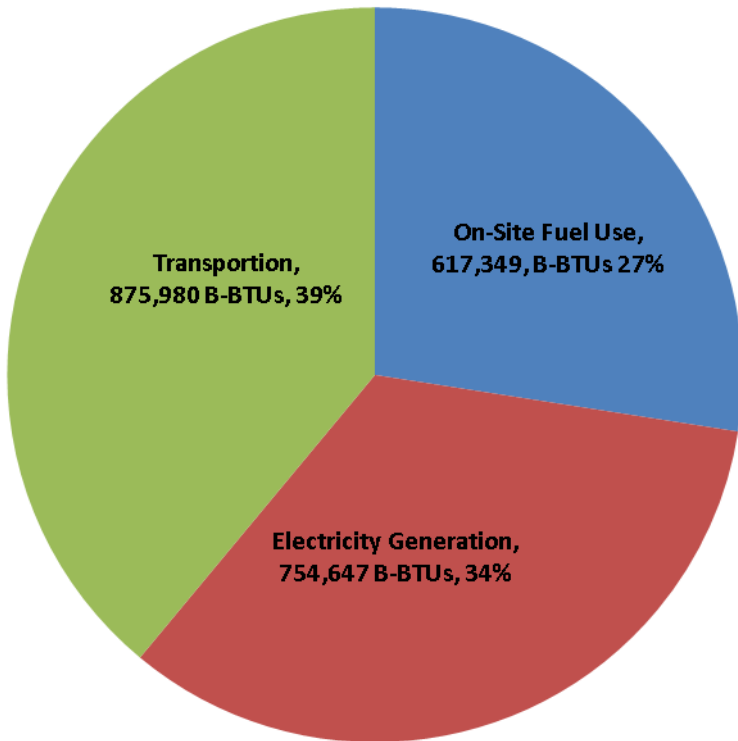
Top 10 Energy-Related CO2 Sources In NJ (2006)

- 24.7% Use of gasoline in light duty vehicles (cars, pickups, mini-vans, motorcycles)
- 9.5% On-site use of fuel oil and natural gas in the residential sector
- 9.3% Use of jet fuel by planes departing NJ
- 8.9% Emissions of imported electricity (from PJM)
- 8.2% On-site use of natural gas in the commercial & industrial sectors
- 7.7% Use of miscellaneous petroleum by industry (mostly process heat, not feedstock)
- 7.6% Use of coal for in-state electricity generation (serving all sectors)
- 6.0% Use of diesel in heavy duty road vehicles (buses, trucks of all types, etc)
- 5.8% Use of diesel(s) by ships departing NJ
- 5.0% Use of natural gas and fuel oil for in-state electricity generation

These 10 fuel/end-use segments represent ~93%
of energy-related CO2 emissions in NJ

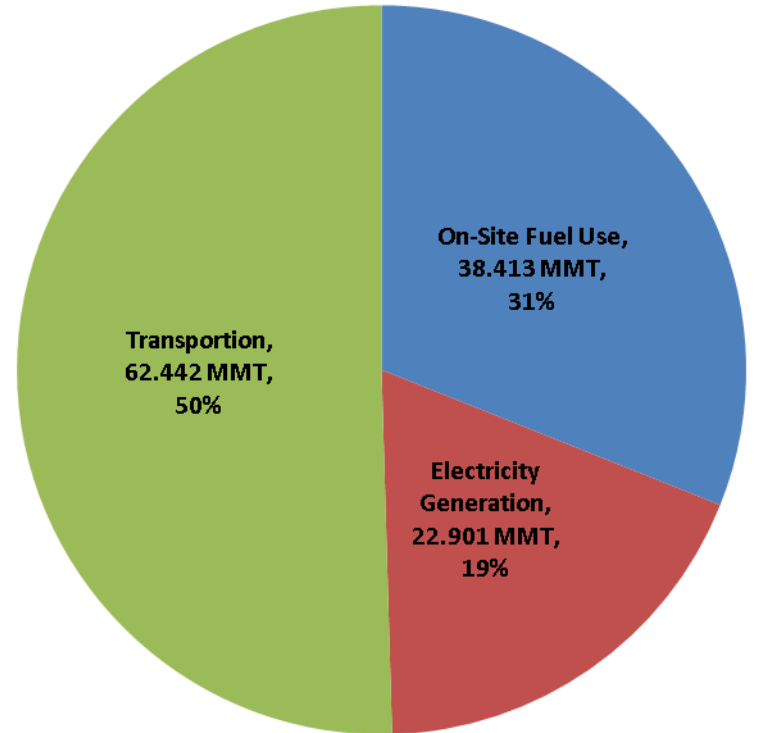
Energy Use In NJ (2012)

NJ Primary Energy Use (2012)
(2,247,976 B-BTUs)



9.5% Reduction In Energy Use
Compared With 2006

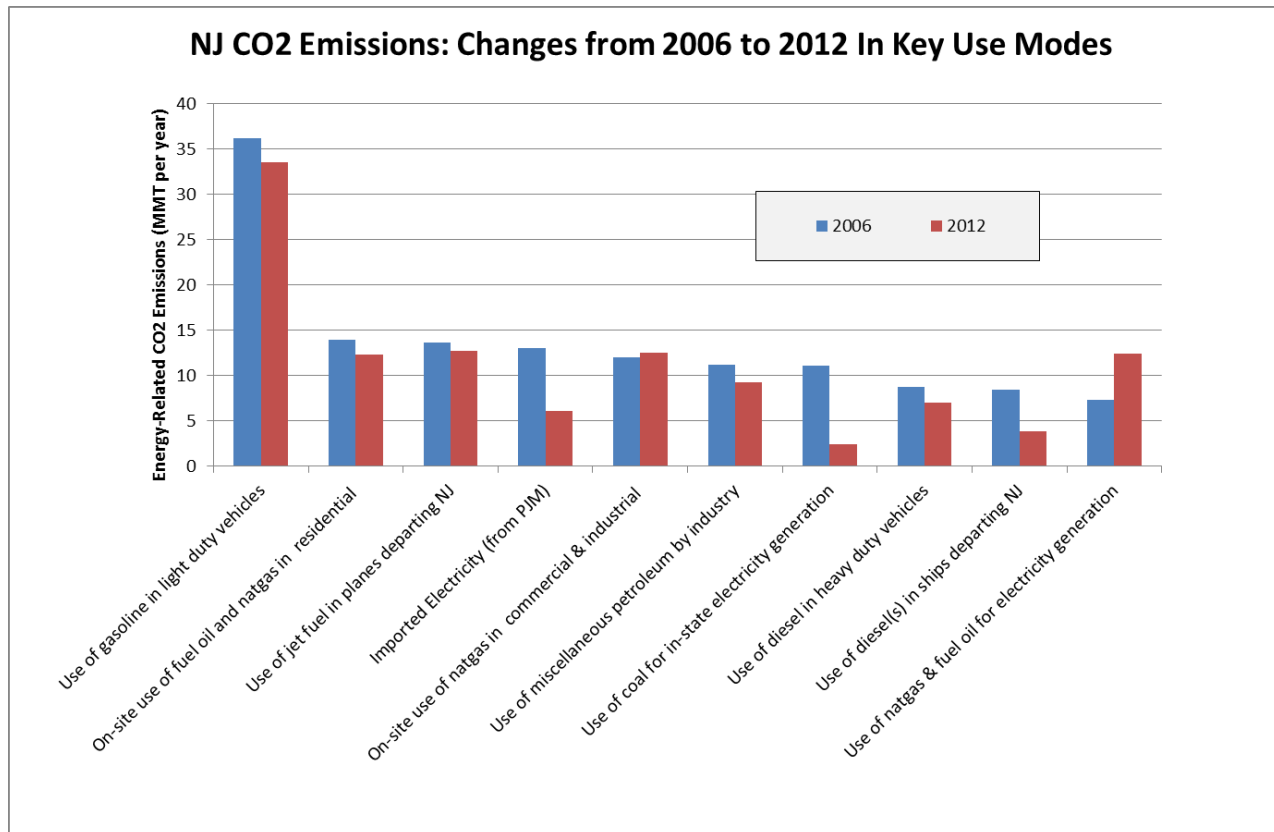
NJ Energy-Related CO2 Emissions
(2012 - 123.756 MMT)



15.5% Reduction In CO2 Emissions
Compared With 2006

Changes From 2006 To 2012

	<u>2006</u>	<u>2012</u>	
Population:	8,647,360	8,867,749	
GDP:	440.0 B-\$	438.2 B-\$	(2005-\$)
Heating Load:	4,350 HDD	4,220 HDD	(Deg-F)
Cooling Load:	850 CDD	930 CDD	(Deg-F)
VMT Traveled:	75,603 M-Miles	74,000 M-Miles	



CO2 Emission Changes From 2006 To 2012

	2006	2012	Absolute Change (2012-2006)	%-Change of 2012 WRT 2006
<i>Fuel Type and End-Use Segment</i>	CO2 (MMT)	CO2 (MMT)	CO2 (MMT)	CO2 (MMT)
<i>Use of gasoline in light duty vehicles</i>	36.214	33.550	-2.664	-7.4%
<i>On-site use of fuel oil and natgas in residential</i>	13.891	12.256	-1.635	-11.8%
<i>Use of jet fuel in planes departing NJ</i>	13.586	12.734	-0.852	-6.3%
<i>Imported Electricity (from PJM)</i>	12.971	6.112	-6.859	-52.9%
<i>On-site use of natgas in commercial & industrial</i>	12.021	12.541	0.520	4.3%
<i>Use of miscellaneous petroleum by industry</i>	11.223	9.281	-1.941	-17.3%
<i>Use of coal for in-state electricity generation</i>	11.076	2.445	-8.631	-77.9%
<i>Use of diesel in heavy duty vehicles</i>	8.709	7.048	-1.661	-19.1%
<i>Use of diesel(s) in ships departing NJ</i>	8.436	3.584	-4.852	-57.5%
<i>Use of natgas & fuel oil for electricity generation</i>	7.342	12.444	5.102	69.5%
<i>Total:</i>	135.470	111.995	-23.475	-17.3%
			^^ Negative Number = Reduction ^^	

<- reduced VMT, increased MPG

<- warmer winter, efficiency, eliminate Fuel Oil

<- more in-state generation, less imports

<- almost complete elimination of coal!

<- Displaced fuel oil & coal with natural gas & warmer summer

Significant decrease of CO2 emissions in all use-modes from 2006 to 2012, except for increase in natural gas use for building heat and electricity generation, with a net 17.3% reduction overall.

The fact that CO2 reduction (17.3%) exceeds absolute energy use reduction (13.2%) implies that the dirtiest fuels are being displaced.

Strategies For Achieving 2050 Goals

Sustainable Energy Strategies: Group “Top 10” Use-Modes Into Bundles Of Related Interventions

Strategy

Realization Tactic & Reduction Target

Electrify Light Duty Vehicles (fueled from clean grid)

Short Term: decreased VMT, increased MPG (CAFE)
Medium Term: EV adoption, assuming a clean grid

De-Carbonize The Grid

- + Displace PJM Imports With Low Carbon Supply
- + Displace In-state Coal With Low Carbon Supply
- + Displace Fossil Fuels With Low Carbon Supply

- 1) Building and equipment conservation and efficiency (electricity): minimal CO₂-reduction impact long term, but a) reduces costs, and b) reduces the amount of RE capacity needed.
- 2) Electricity storage: allows for grid optimization short term (especially peak reduction and improved plant utilization), and increased RE penetration levels long term.
- 3) Deployment of in-state RE assets: solar (grid supply, behind the meter, and shared solutions), off-shore wind and wave.

Efficiency & Fuel-Switching Of Other Transport

- + Heavy Duty Vehicles
- + Ships and Planes

Short Term: decreased VMT, increased MPG
Medium Term: fuel switching to electricity and alternative fuels

Transform Heating In Buildings

- + Reduce Fossil Fuel Use In Residential
- + Reduce Fossil Fuel Use In Commercial & Industrial

Short Term: displacing fuel oil with natural gas, building efficiency (thermal)
Medium Term: building conservation and efficiency, alternative fuels

Reduce Industrial Use Of Petroleum (process)

Short Term: process efficiencies
Medium Term: process efficiencies, alternative fuels

These strategies, if fully exploited without offset from other changes, would deliver ~90% of the 117.077 MMT CO₂ reduction needed by 2050.

The Role Of Sustainable Jersey Actions

Recently introduced or updated actions. **New actions being developed for 3Q15.**

	Climate, Planning & Efficiency	Renewable Energy & Adv-Infra	Alternative Vehicles
Energy Impact Of Municipal Operations	<ul style="list-style-type: none"> • Municipal Carbon Footprint • Energy Tracking & Management • Complete Energy Audit • Energy Transition Plan • Implement EE Measures • Hi Performance Buildings 	<ul style="list-style-type: none"> • On-Site Solar Energy • On-Site Geothermal • On-Site Wind Energy • Purchase Renewable Energy 	<ul style="list-style-type: none"> • Fleet Actions • Procurement Actions
Municipal Impact On Community Energy Use	<ul style="list-style-type: none"> • Community Carbon Footprint • Climate Action Plan • HPwES Program • HPwES Outreach • Direct Install Program • Direct Install Outreach 	<ul style="list-style-type: none"> • Wind Ordinance • Make Your Town Solar Friendly • Renewable GEA Program 	<ul style="list-style-type: none"> • Make Your Town EV Friendly • Public EV Chargers