Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

GC3 Analysis, Data, and Metrics Working Group Meeting

March 10, 2016
2:00—4:00 p.m.

Connecticut Department of Energy and Environmental Protection

Agenda

2:00	Welcome
2:10	Review list of GHG mitigation technologies and measures for future modeling in LEAP.
2:30	Discuss criteria for selecting scenario bundles (cost and GHG reduction potential).
2:45	Review NEG/ECP interim GHG targets for initial CT assessment.
2:55	Review of hypothetical renewable thermal scenarios modeled in LEAP.
3:15	Natural gas electric generation mix now and into the future.
3:25	New items for discussion
3:35	Public Comments

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Review List of Technologies and Practices

Technologies

- Machinery or equipment
  Zero-emission vehicles, ground source heat pumps, high efficiency lighting

Measures

- Changes in business and consumer practices
  VMT reduction, demand response

Scenarios

- Combinations of technologies and measures modeled in LEAP intended to achieve mid-and long-term GHG reduction targets.
  Scenarios do not identify policies that would be used to achieve the intended levels of technology deployment or behavioral changes

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Prioritizing Technologies and Measures

1. Potential for significant GHG reductions in CT
2. Cost-effectiveness
3. Co-benefits
   - Air quality & public health
   - Economic development
4. Technical limitations and cost considerations
   - Additional infrastructure requirements
   - Technology turnover rate
   - Energy storage
5. Ability to periodically track progress towards GHG goals
6. Ease of implementation and administration

Considerations in Scenario Development

- Not picking technology winners and losers vs. need for technology share assumptions to generate cost info in LEAP
- Rate of technology turnover (e.g., useful life of equipment vs. assumed rate of introduction for new technology)
- Impact of existing policies and practices (e.g., promoting expanded use of natural gas in electricity and thermal)
- Setting mid-term targets for tracking progress and informing policy direction

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Mid-term GHG Reduction Targets

- Need guideline to create initial modeling scenarios for 2030 and 2040
- NEG-ECP August 2015 resolution set 2030 reduction marker range of at least 35% - 45% percent below 1990 levels
- Marker range is for region, not specific to each state and province
- State could strive for more (or less) than the marker range as an individual jurisdiction

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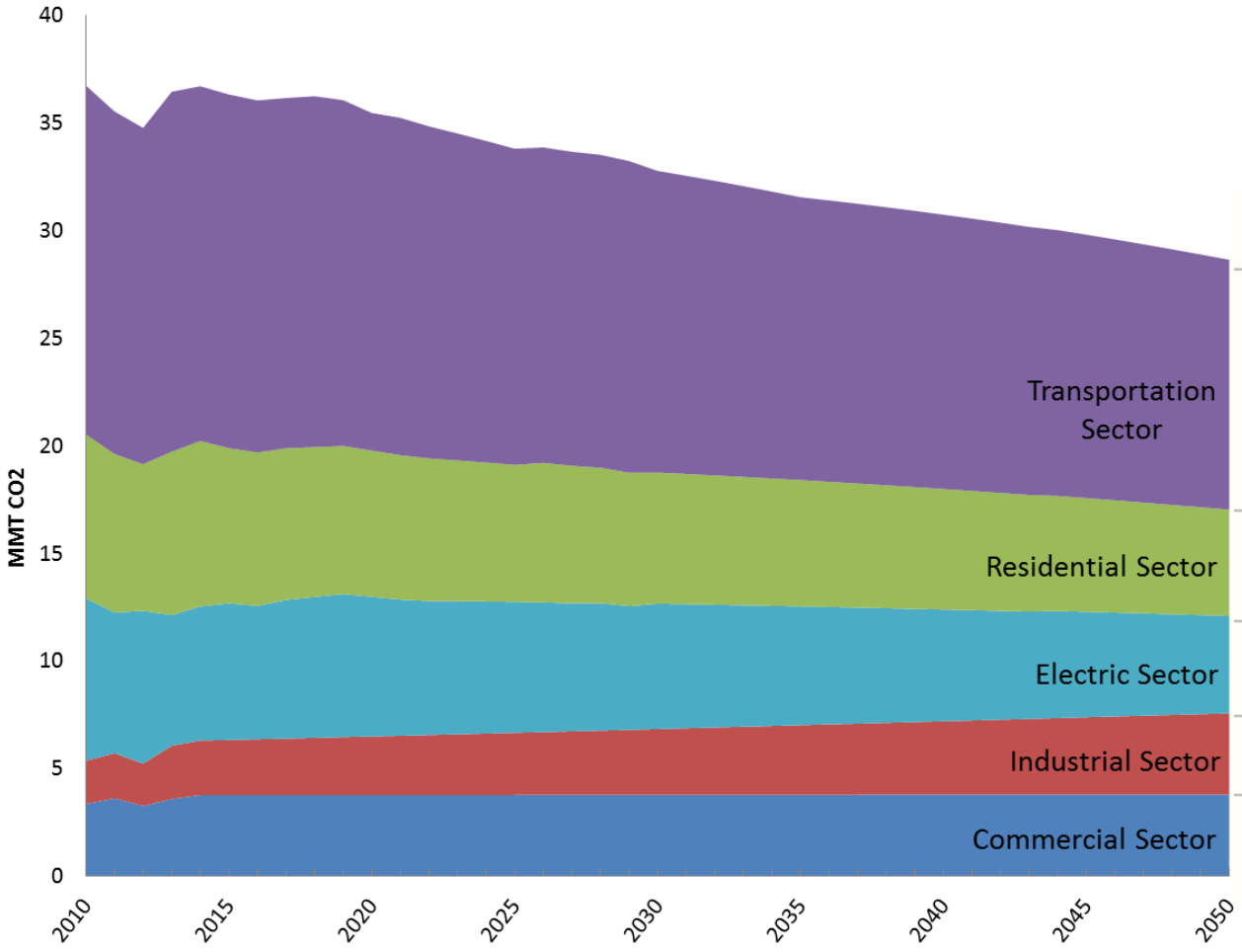
Connecticut Reference Case LEAP Projections by Sector



	2050 GHG Share	2010-2050 Avg. Annual Growth
Transportation Sector	41%	-0.8%
Residential Sector	17%	-1.1%
Electric Sector	16%	-1.3%
Industrial Sector	13%	1.6%
Commercial Sector	13%	0.3%

Transportation approximately 40% of GHG emissions in 2050

Transportation electrification involves technology choices

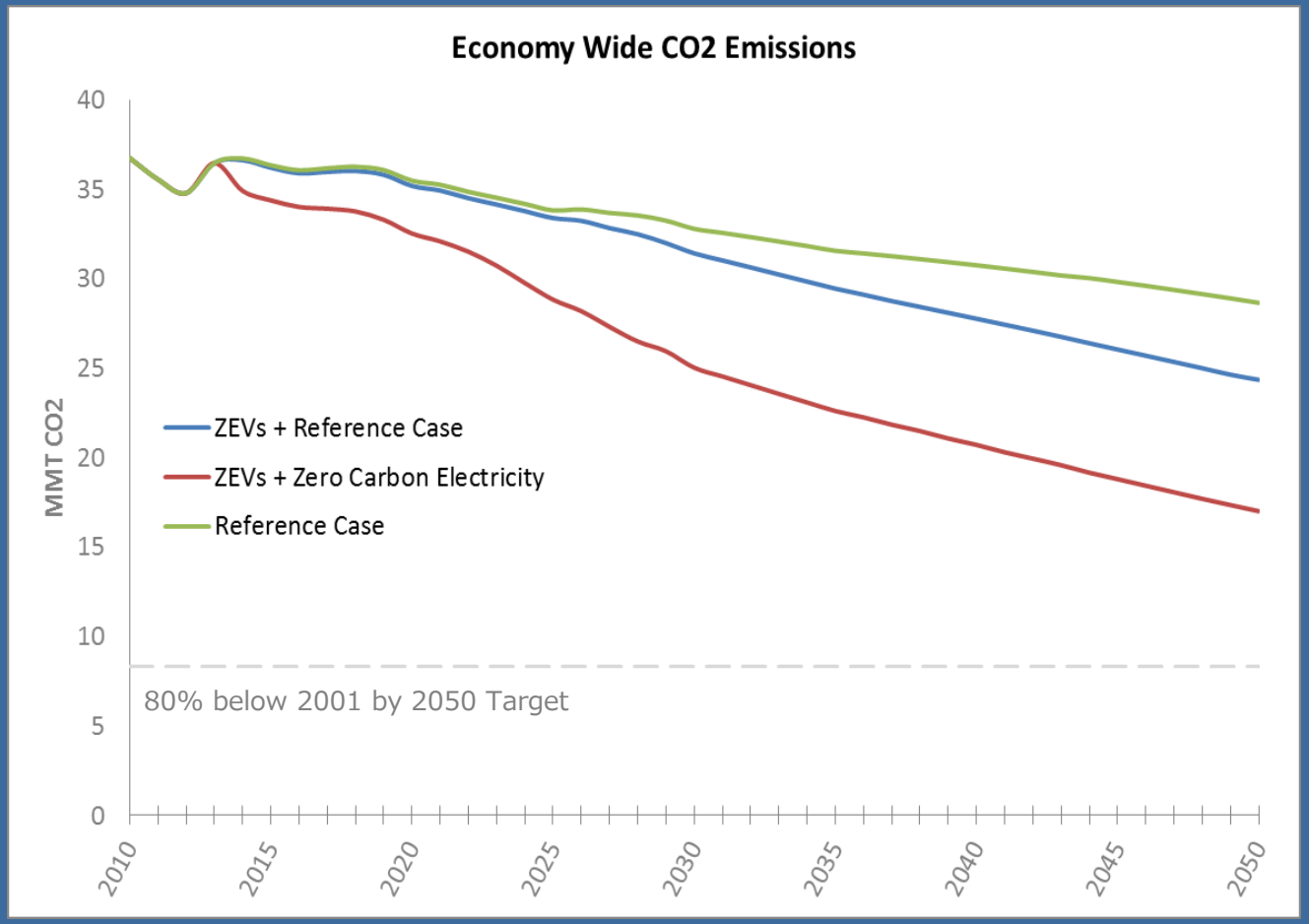
- ☑ Battery electric vs. fuel cell market share
- ☑ Appropriateness for heavy-duty vehicles

Recharging battery electric vehicles affects electricity sector

- Impact of emissions shifting to electricity sector
- Conversely, cleaner electricity sector means cleaner cars

With clean transportation and electricity assumptions used in hypothetical scenario, statewide GHG emissions are still projected to be 2 times CT's 2050 target

Hypothetical zero emission vehicle scenario total CT CO_2 emissions



Reference Case:

- On average 55% fossil fuel electricity generation 2030 - 2050 (AEO extrapolation)

EVs + Reference Case:

- 70% of passenger cars and trucks electric by 2050
- Reference Case electricity generation

ZEVs + Zero Carbon Electricity:

- 70% of passenger cars and trucks electric by 2050
- 80% zero carbon electricity by 2050

Residential/Commercial/Industrial also approximately 40% GHGs emissions in 2050

Renewable thermal technology choices:

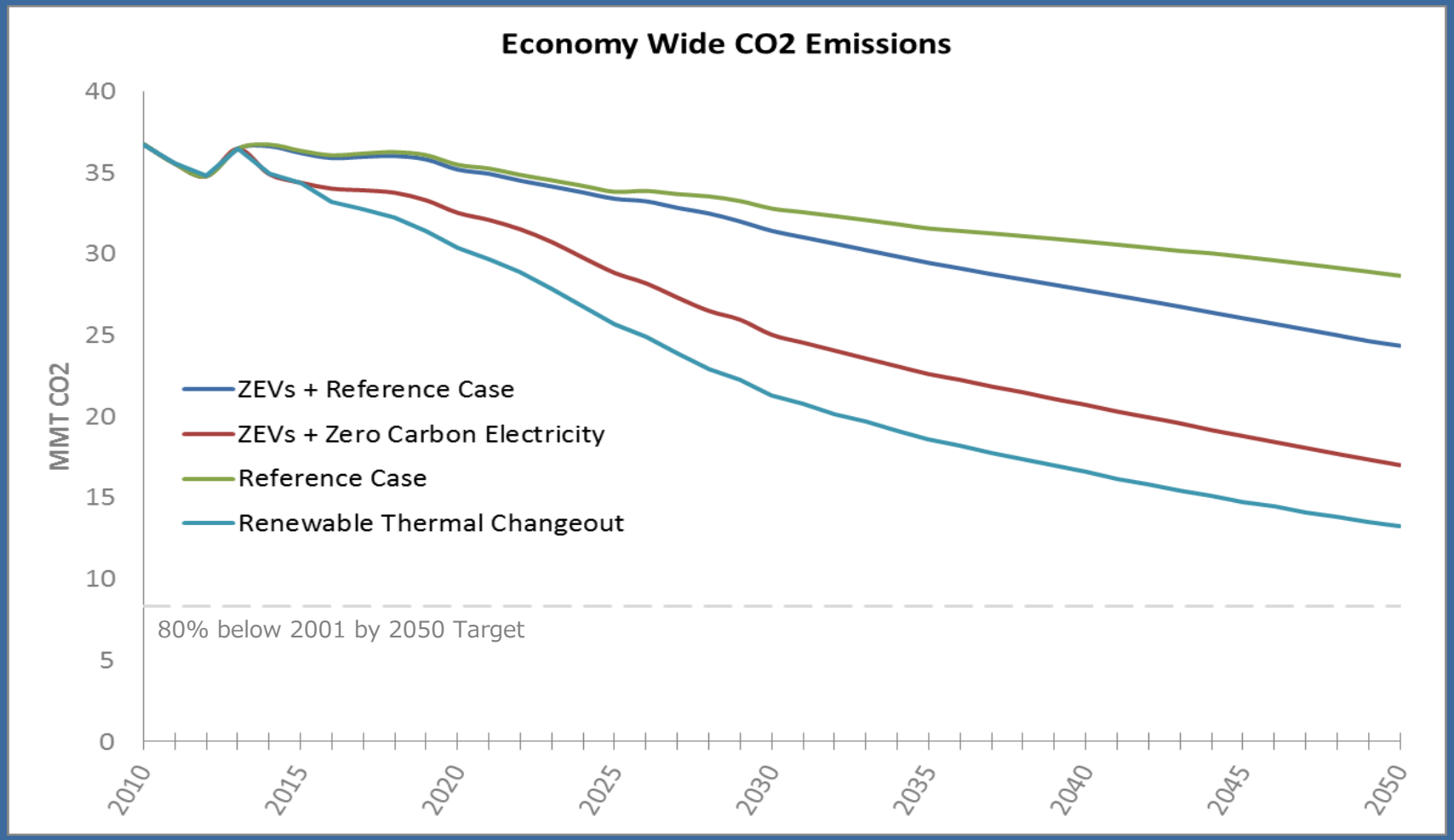
- ☑ Ground and/or air heat pumps
- ☑ Solar thermal
- ☑ Electrification of space heating
- ☑ Biomass thermal
- ☑ Advanced biodiesel

Sector interactions (e.g., electrification of space heating shifts emissions to electricity sector)

Impact of biomass use on air quality and forests

Direct CO2 benefits from biodiesel vs. lifecycle

Hypothetical ZEV & renewable electricity scenario plus renewable thermal technologies



High penetration of RE thermal technologies in residential and commercial buildings. 60 – 80% of thermal needs met by air source heat pumps, ground source heat pumps and solar thermal by 2050.

Renewable thermal technology financing and incentives in CT

Statewide programs providing support for renewable thermal technologies

Rebates

- Residential New Construction (or gut rehab)
- Home Energy Solutions Rebate

Financing

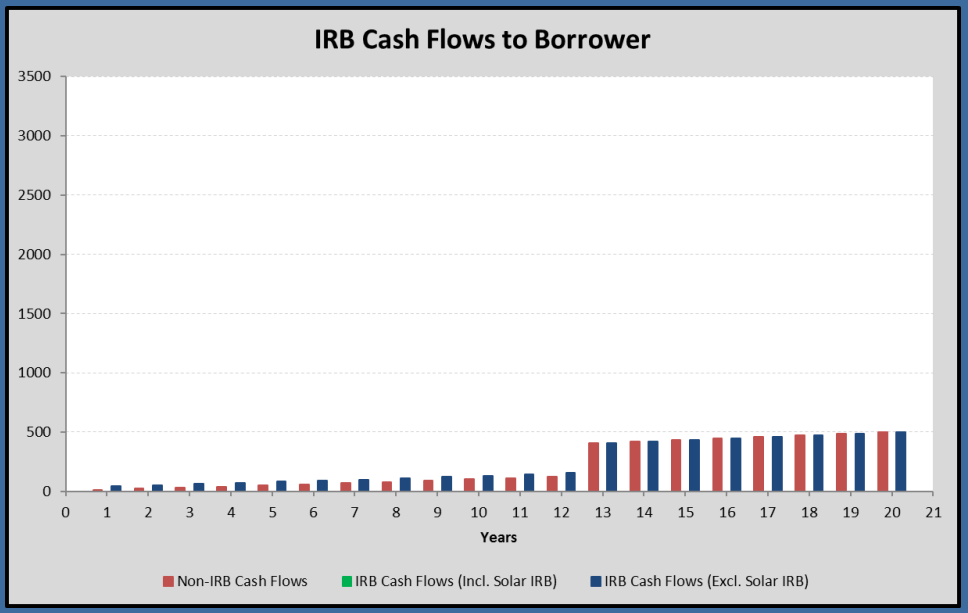
- Smart-E
- Energize CT Heating Loan
- Small Business Energy Advantage Loan
- Energy Efficiency Fund (Electric and Gas) - Residential Energy Efficiency
- Energy Conservation Loan
- Clean Energy On-Bill Financing
- Local Option - Residential Sustainable Energy
- Local Option - Commercial PACE Financing

Tax Exemptions

- Sales and Use Tax Exemption for Solar and Geothermal Systems
- Sales and Use Taxes for Items Used in Renewable Energy Industries
- Sales and Use Tax Exemption for Energy-Efficient Products

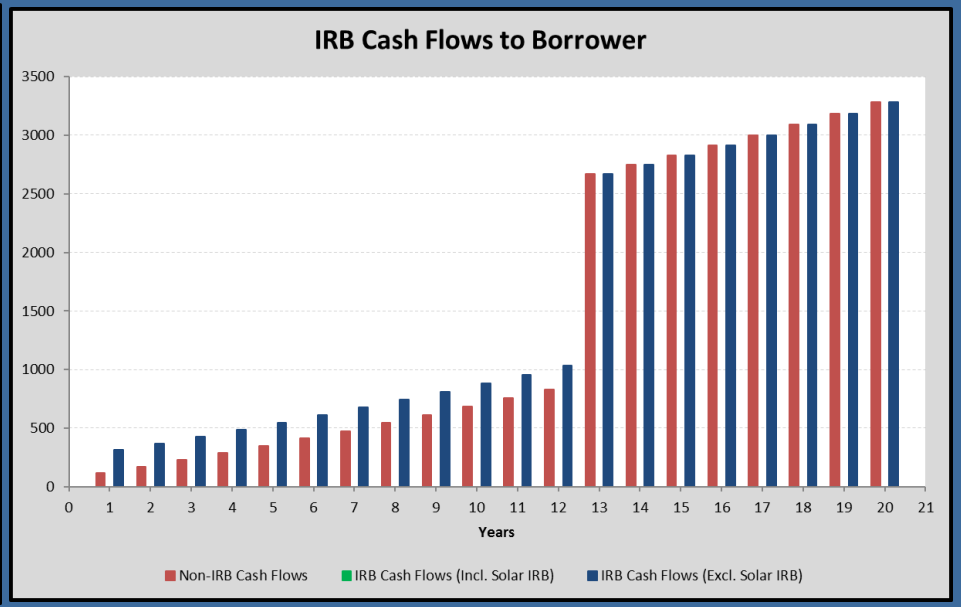
Energize CT Smart-E Loan
Residential RTT Retrofit

1st Example
12-Year at 6.49% Interest Rate
and SHWS Rebate of $2,635



Solar Hot Water System

2nd Example
12-Year at 6.49% Interest Rate
and No Rebates at All



+ Air Source Heat Pump
+ Wall and Ceiling Insulation
+ Air Sealing

REFERENCES

1st example of a residential flat-plate 12 MMBtu/year SHWS project in Massachusetts with current heating source of natural gas ($1.40/CCF) at an installed costs of $7,000 (not including federal ITC). 2nd example includes 1st example plus air source heat pump installation ($4,250 installed cost) replacing heating oil along with wall and ceiling insulation ($4,000 installed cost) and air sealing ($1,500 installed cost) – no rebates assumed at all for all of these measures – electric price of $0.15/kWh (Eversource) and heating oil $3.30/gal.

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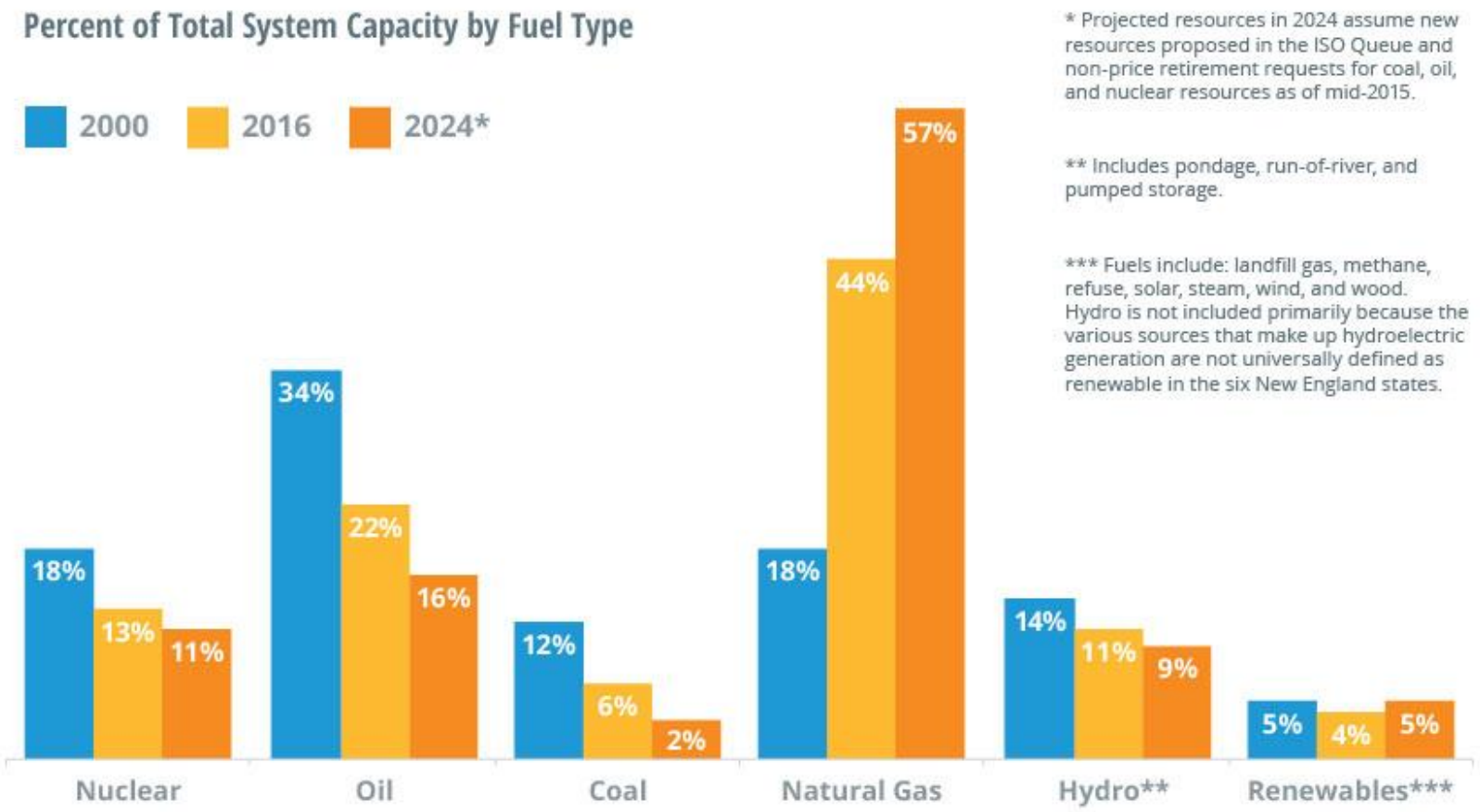
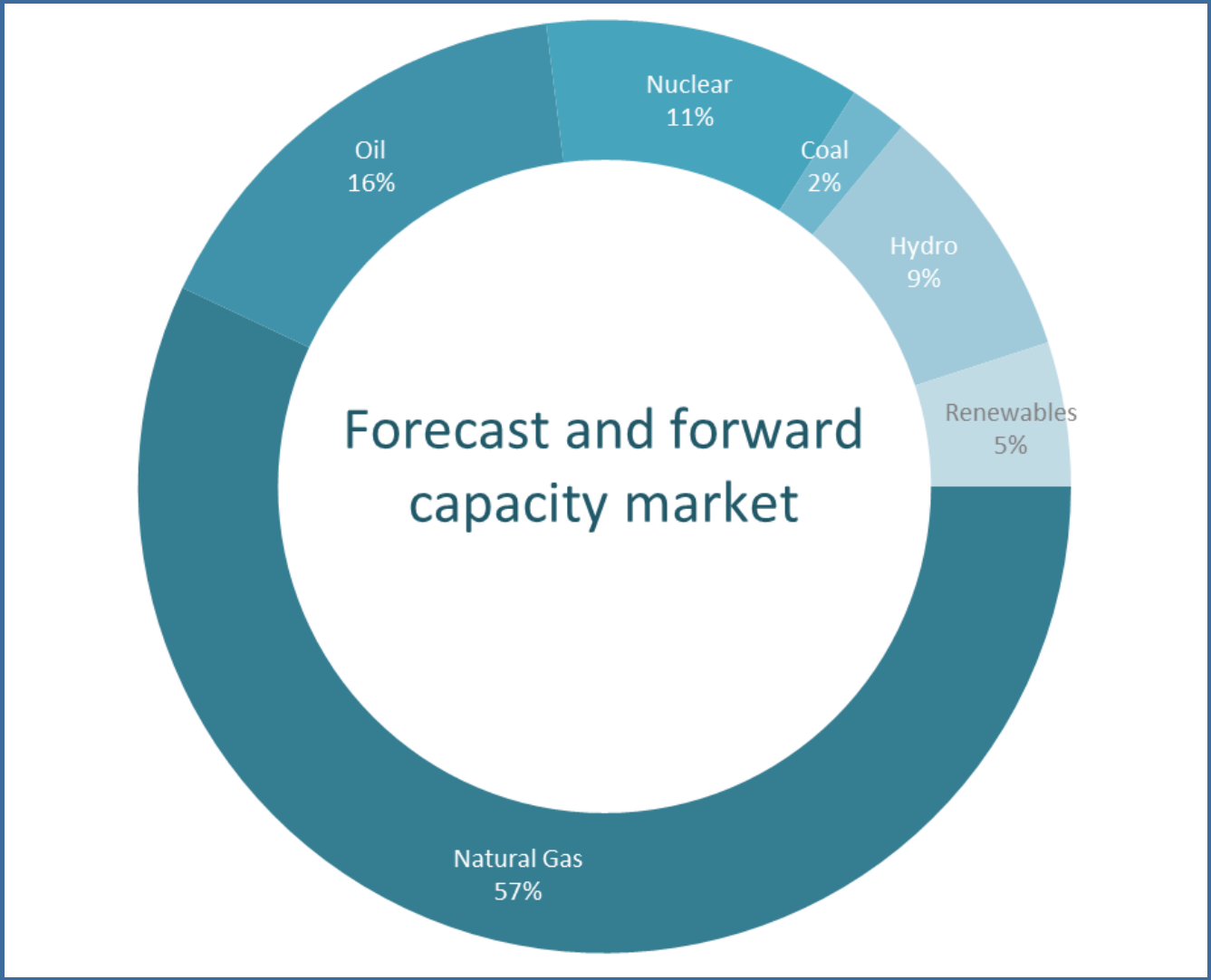
New England generation mix past, present and future



Source: ISO New England, Key Grid and Market Stats
http://www.iso-ne.com/about/key-stats/resource-mix#air-emissions

New England generation mix based on ISO 2024



With coal only projected to be 2% of generation, natural gas becomes the most carbon intensive fuel on the grid in 2024.

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