

Pathways to Deep Decarbonization in New England's Transportation Sector



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Contents

- Deep decarbonization defined
- Three pillars of deep decarbonization
- Deep decarbonization of New England's transportation sector

Definitions

Deep Decarbonization:
Transformation of the energy economy consistent with keeping global warming less than 2°C



Deep decarbonization pathways

Charting a course for climate mitigation



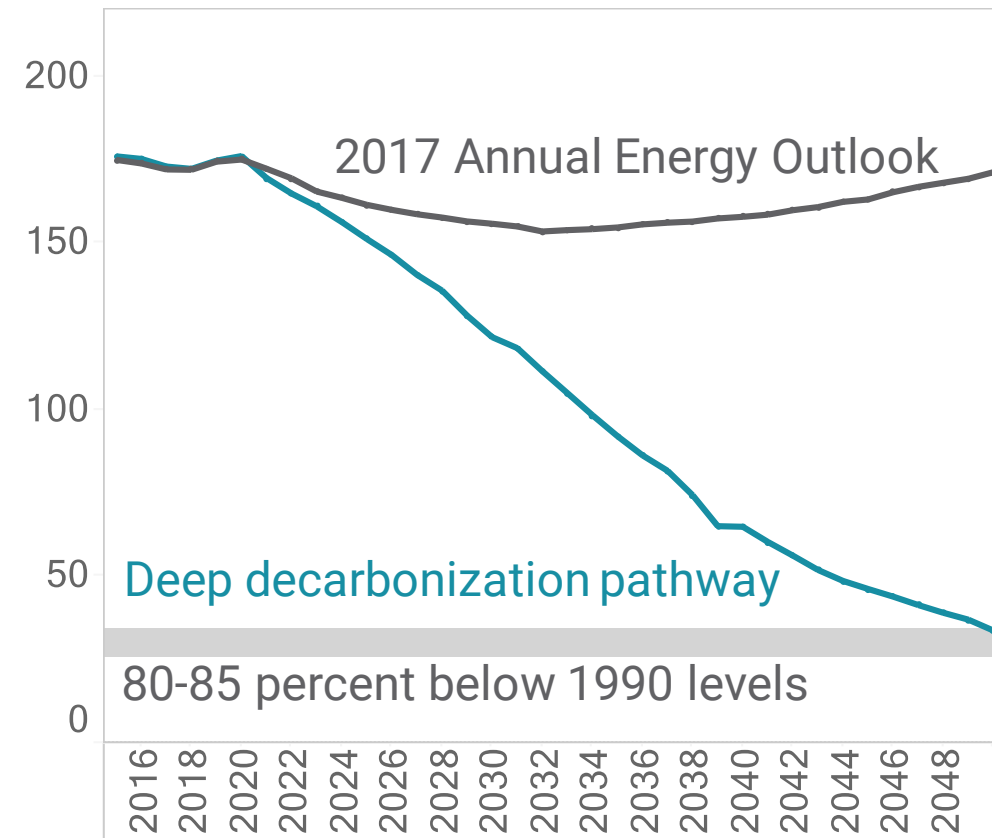
- Is deep decarbonization of the economy possible?
 - What parts of the economy can be decarbonized?
 - What are the **potential pathways** to do this?
 - What are the **best practices** in navigating the path forward?

Regional carbon emissions trajectories



- Pathways are based on analysis from a recent report on achieving 2050 greenhouse gas goals in the U.S. Northeast conducted jointly with the Sustainable Development Solutions Network.

New England
Megatonnes



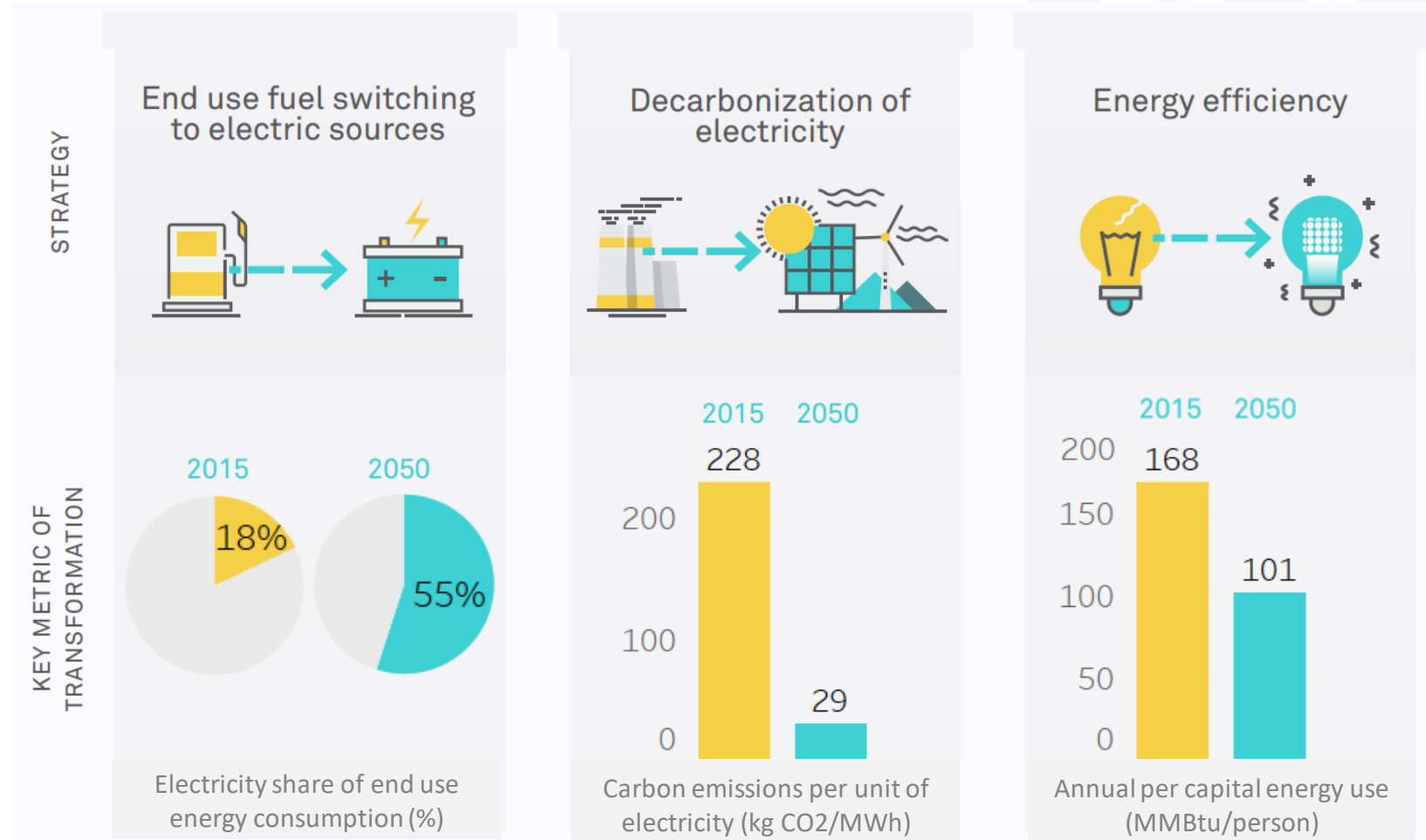
Williams, J.H., Jones, R., Kwok, G., and B. Haley, (2018). Deep Decarbonization in the Northeastern United States and Expanded Coordination with Hydro-Québec. A report of the Sustainable Development Solutions Network in cooperation with Evolved Energy Research and Hydro-Québec. April 8, 2018.

Roadmap: three pillars of deep decarbonization

New York & New England

2050 Benchmarks

- 3x increase in the share of energy from electricity
- 87% decrease in the emissions intensity of electricity generation
- 40% drop in final energy use per capita (no drop in energy services)



<http://unsdsn.org/wp-content/uploads/2018/04/2018.04.05-Northeast-Deep-Decarbonization-Pathways-Study-Final.pdf>

Three pillars

New England Transportation

Pillar: Electrification

Transition vehicles on the road from gasoline-powered internal combustion engine to battery electric and plug-in hybrid electric vehicles where possible.

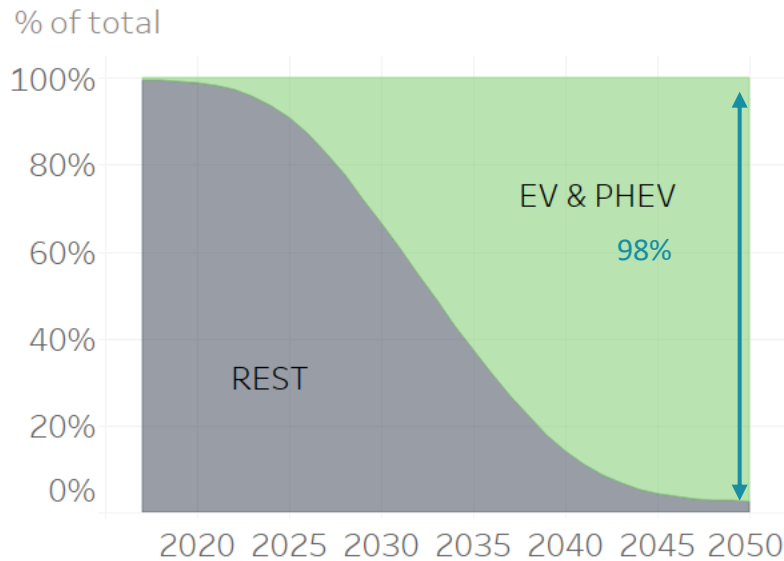
Pillar: Energy Efficiency

50 percent decrease in energy consumption due to efficient electric powertrains and high efficiency internal combustion engines.

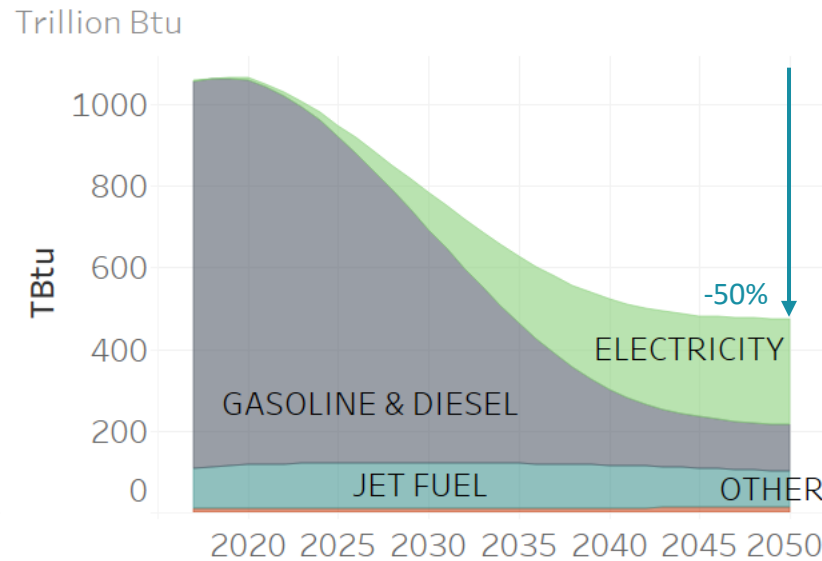
Pillar: Electricity Decarbonization

Charging electric vehicles on a low carbon electricity grid decreases overall transportation emissions by 80 percent

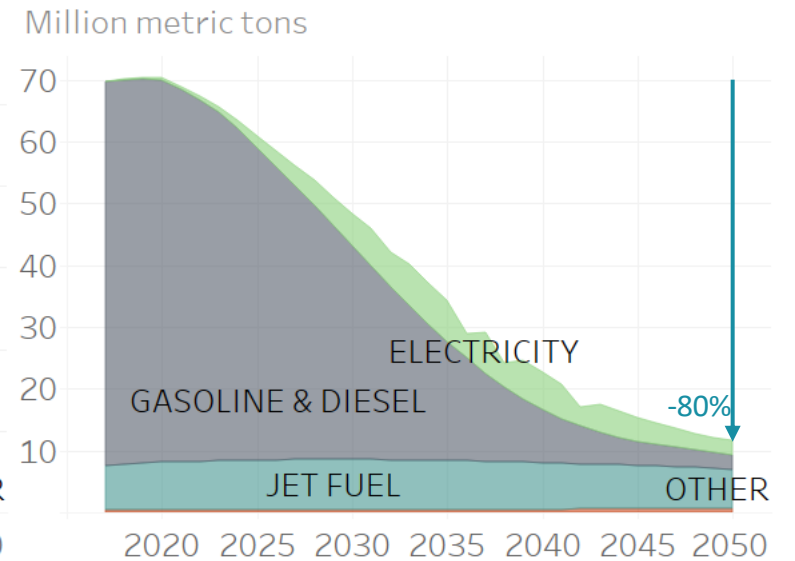
Vehicles on the Road



Final Energy Demand



Energy-related CO2 Emissions



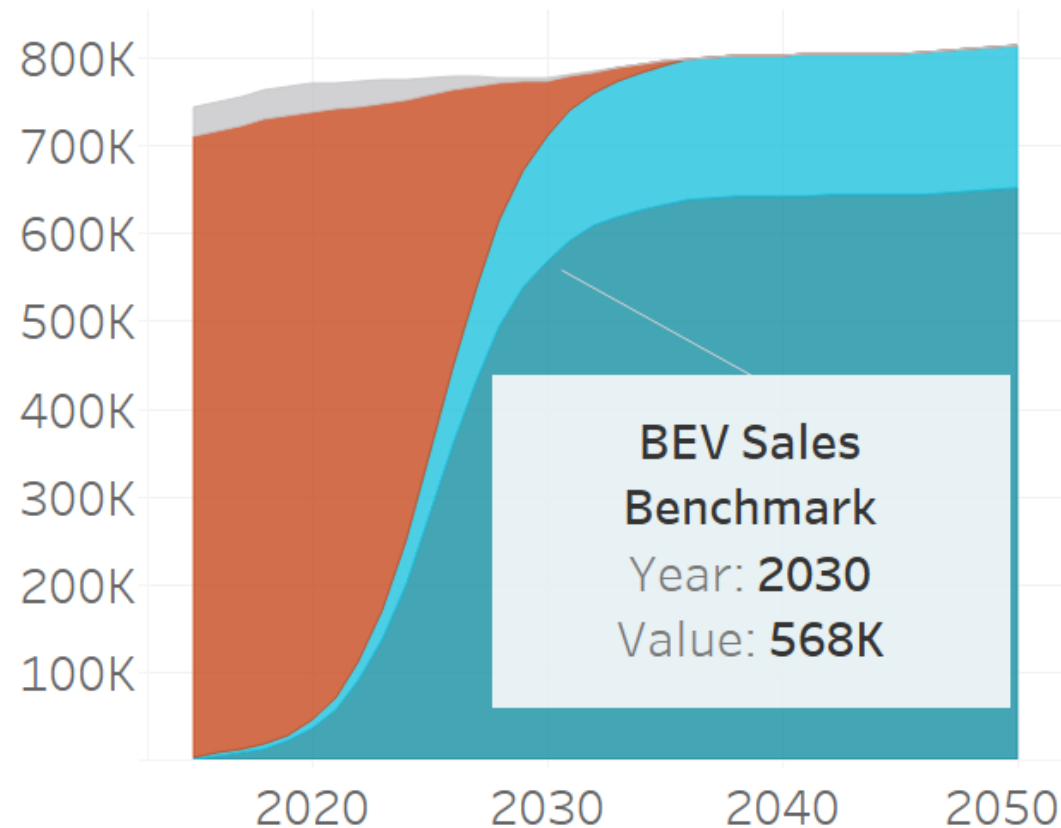
Light duty vehicle benchmarks

New England



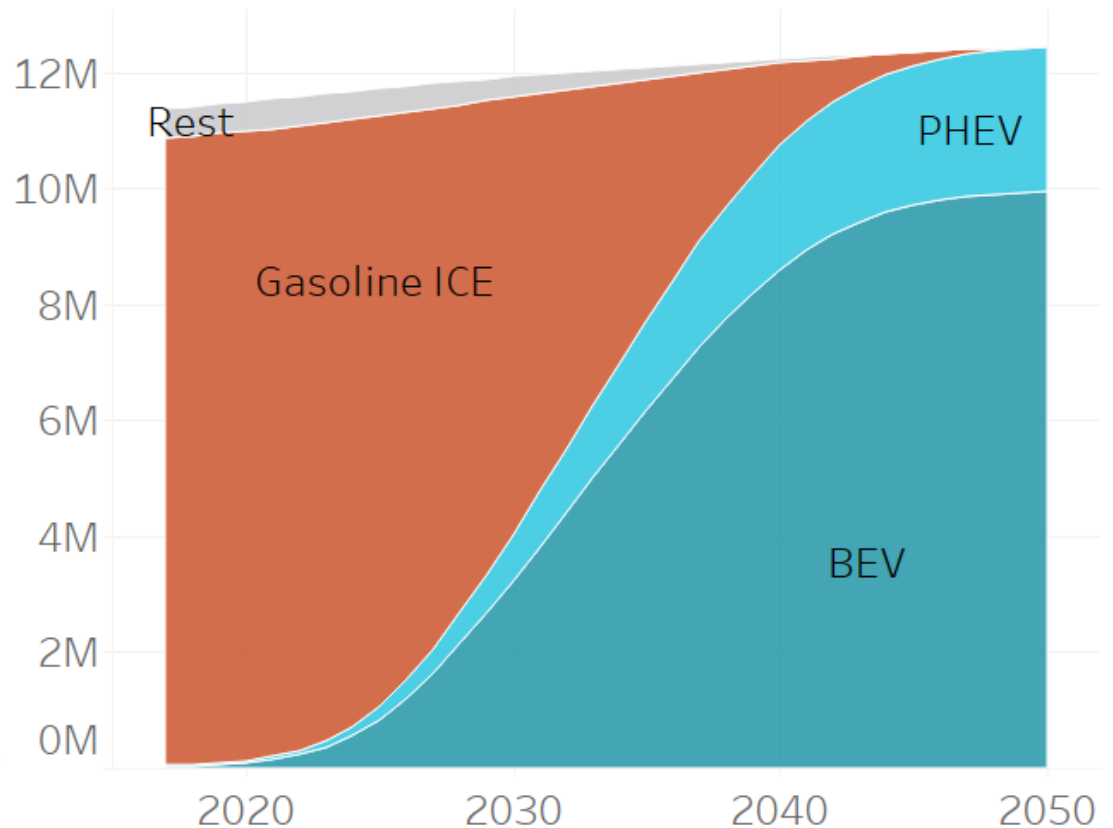
Sales

Number of vehicles



Light Duty Vehicles

Number of vehicles



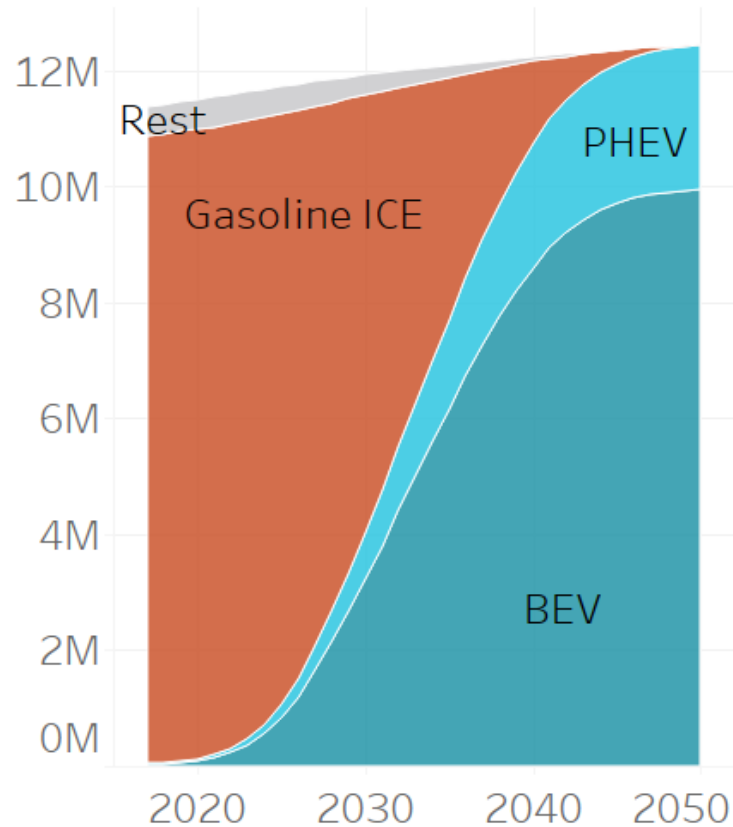
Transportation stock across vehicle weights

New England



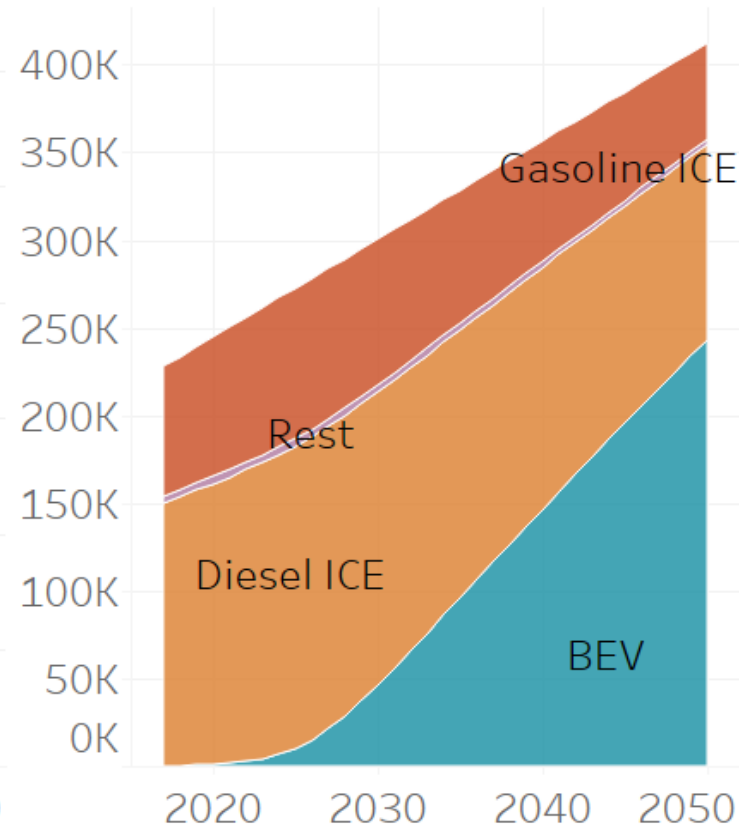
Light Duty Vehicles

Number of vehicles



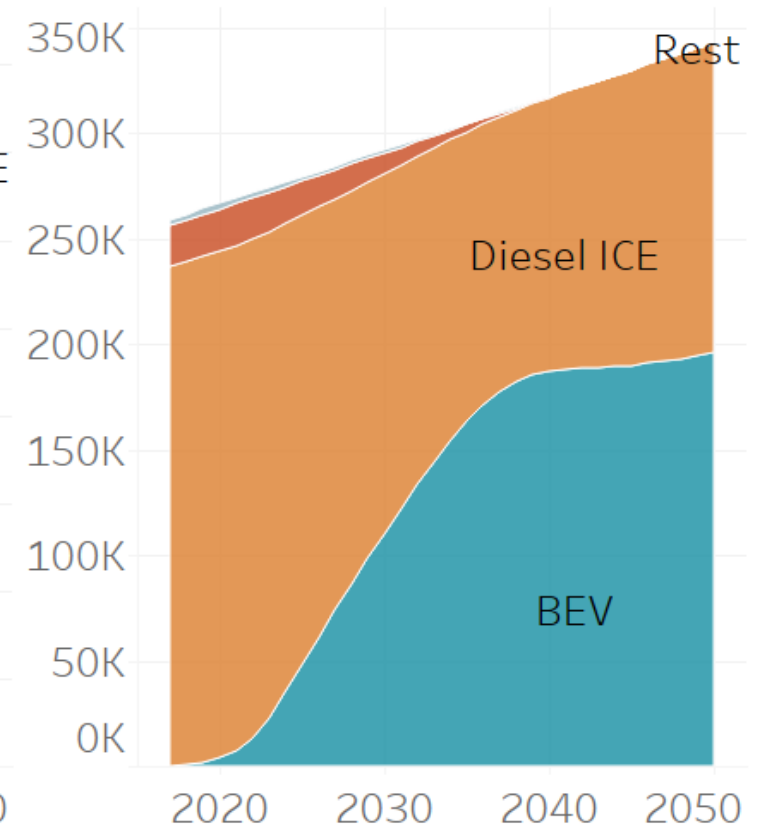
Medium Duty Vehicles

Number of vehicles



Heavy Duty Vehicles

Number of vehicles

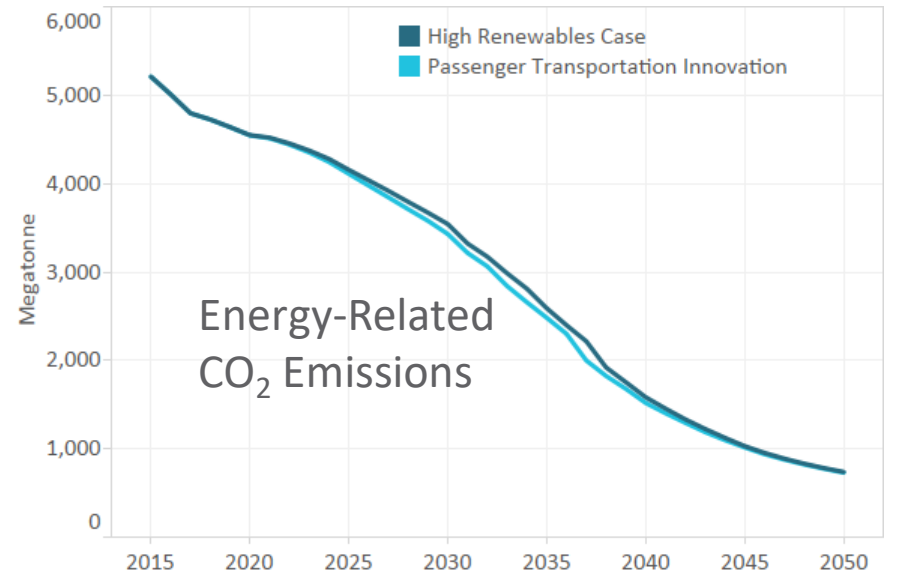
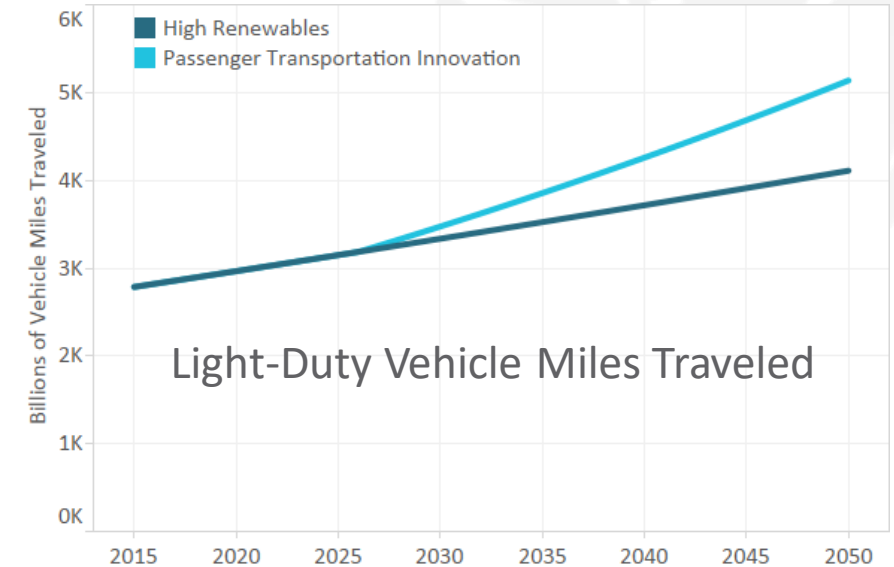
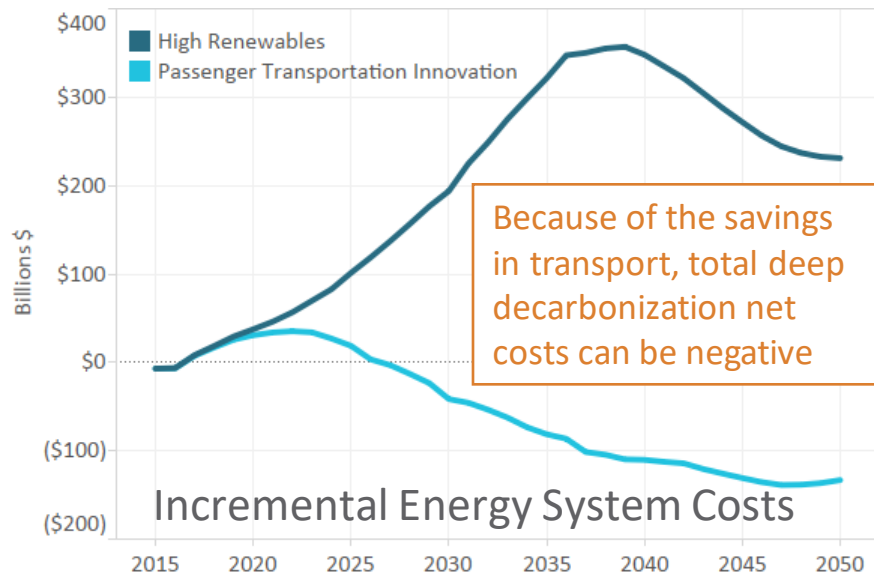


Notes on autonomous vehicles

Analysis by EER for 2016 Risky Business report (U.S. wide analysis)

Vehicle electrification can also be accomplished by fewer electric vehicles driving more

- Autonomous vehicles, especially those that are used for shared mobility, have higher utilization. Operational savings from an electric vehicle lead to more favorable economics than ICEs
- Accelerates turnover and achievement of the electrification pillar
- Achieving electricity decarbonization means any concurrent increase in VMTs has little impact on overall carbon emissions
- AEVs reduce overall costs of transportation



Final thoughts: Three Pillars Questions

New England Transportation

Electrification



How do we accelerate consumer adoption of electric technology? How will autonomous vehicles change the picture?

What strategies can we pursue in areas where electrification isn't possible?

Energy Efficiency



What is the right level of efficiency as we transition to zero-carbon energy supplies?

How does demand reduction fit into this pillar?


Electricity Decarbonization




How can electrified transportation address electricity balancing challenges inherent in low-carbon electricity systems?

Will load growth from electrifying transportation mean the region exceeds available renewable resources?

THANK YOU

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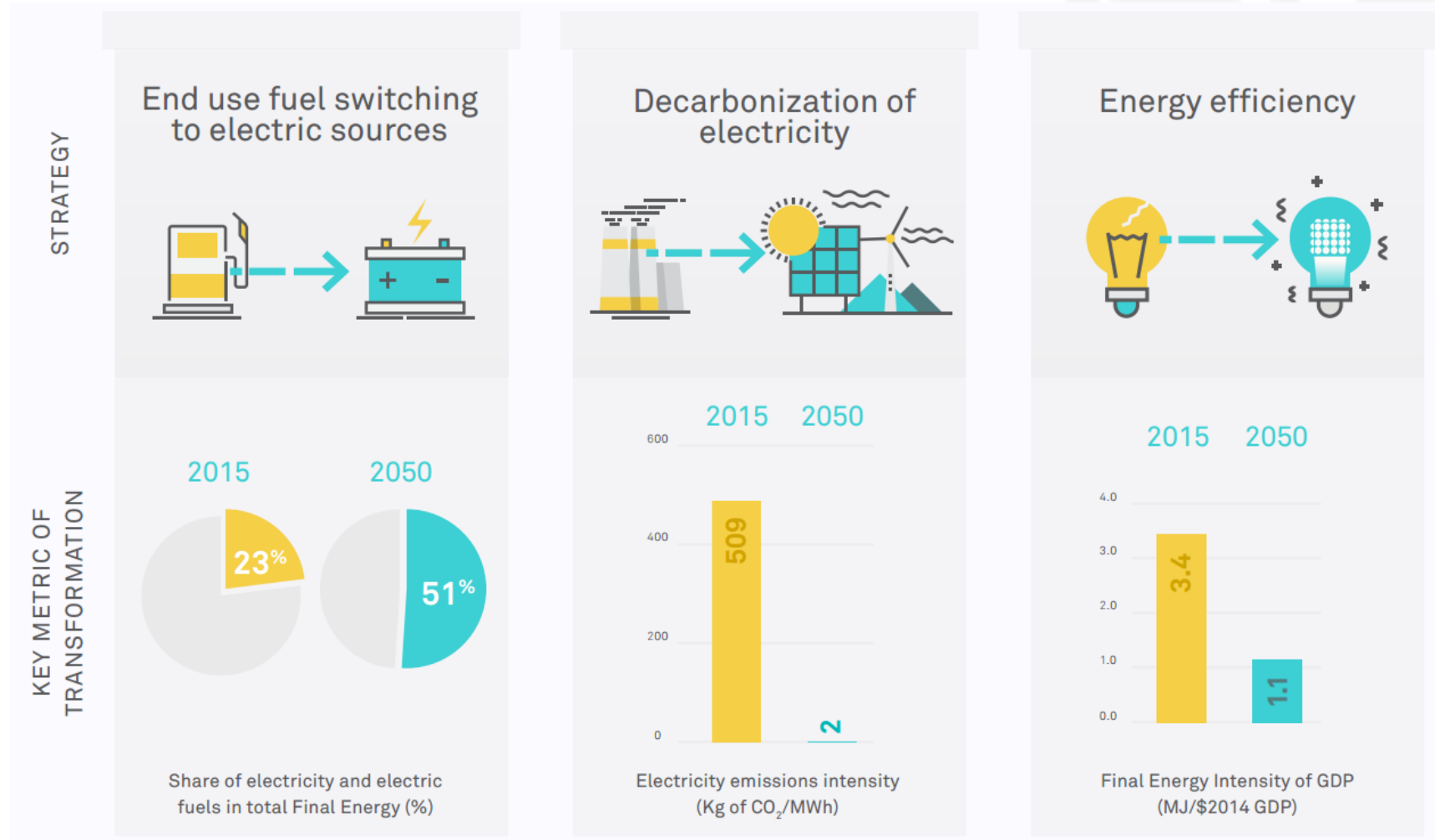
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Three Pillars in Practice

United States

2050 U.S. Benchmarks

- 2x increase in the share of energy from electricity or electrically derived fuels
- ~99% decrease in the emissions intensity of electricity generation
- 3x drop in energy use per unit GDP



Three Pillars in Practice

China, India and United Kingdom



China



Energy efficiency



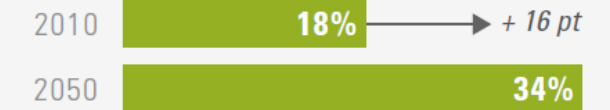
Energy intensity of GDP, MJ/\$

Decarbonization of electricity



Electricity emissions intensity, gCO₂/kWh

Electrification of end-uses



Share of electricity in total final energy, %

India



Energy efficiency



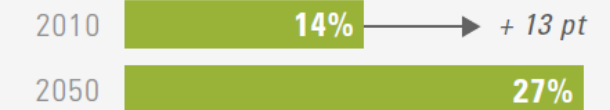
Energy Intensity of GDP, MJ/\$

Decarbonization of electricity



Electricity Emissions Intensity, gCO₂/kWh

Electrification of end-uses



Share of electricity in total final energy, %

UK



Energy efficiency



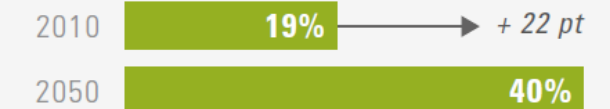
Energy intensity of GDP, MJ/\$

Decarbonization of electricity



Electricity emissions intensity, gCO₂/kWh

Electrification of end-uses



Share of electricity in total final energy, %

Source: figures from [Deep Decarbonization Pathways Project country reports](#) (2015)

Three Pillars of Deep Decarbonization



- Breadth of analyses conducted has given us a good basis to draw some high-level conclusions about what a deeply decarbonized energy system must include
- We call these the **Three Pillars** and they are:
 1. **Electrification:** Switching to electricity as final energy product for some end-uses (i.e. electric vehicles).
 2. **Energy Efficiency:** Using less energy to perform the same energy service (i.e. LED lightbulbs provide the same lighting service with less electricity)
 3. **Electricity Decarbonization:** Generating more energy from clean and renewable sources and less from fossil fuels