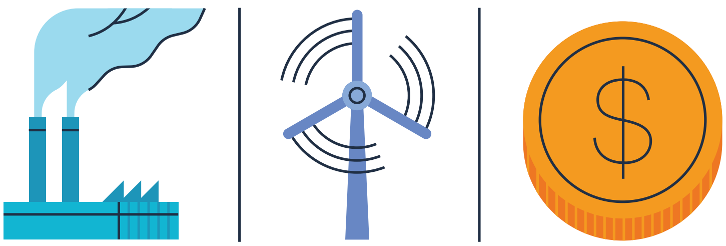
Economic Planning for the Clean Energy Transition:

ILLUMINATING THE CHALLENGES OF TOMORROW'S GRID



Overview

The Economic Planning for the Clean Energy Transition (EPCET) study explores the operational, engineering, and economic challenges the region would need to address to support the New England states' commitment to reduce carbon emissions over the next several decades. Most of the six states aim to cut emissions by 80% from 1990 levels by the year 2050 through a shift to renewable energy and electrification of heating and transportation.

EPCET identifies trends the region should consider to ensure power system reliability, progress toward state decarbonization goals, and informed decision-making about efficient spending and investment.

Economic planning studies like EPCET provide information to regional stakeholders and are not considered predictions or plans for the future system.

Timeline of Scenarios and Key Results

2019-2023

Peak demand occurs in the summer, and varies 10% between a cool and hot summer.

Early 2030s

System experiences challenging minimum load conditions.

If electrification outpaces resource additions, the system may use more stored fuels than it does today.

Variability in demand increases.

Mid 2030s

New England's peak demand shifts to winter.

Under existing power purchase agreement structures, a renewable resource built in 2035 may be unprofitable within five years.

2040

Emissions in May decrease by 95% from 2022 levels. December emissions decrease by 36%.

2045

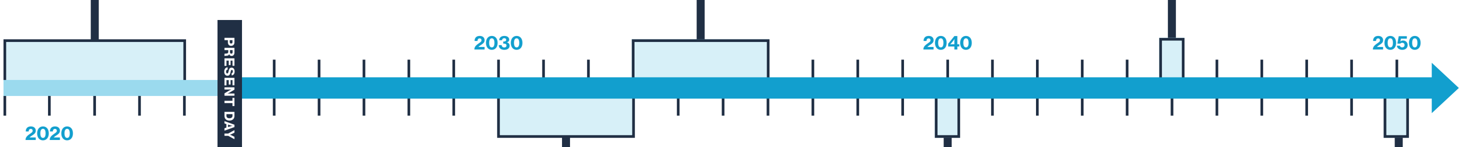
A newly added wind, solar or battery resource may run for just 10% of the year.

2050

Peak demand could vary 50% between a mild and severe winter.

Some resources required to meet peak demand may run for less than 1% of the year.

The region will need a power system that is around four times its current capacity to accomodate increased electrification, meet state emissions goals, and maintain reliability.



Read the Full Report:

Key Findings

Most paths to a low-carbon grid involve high variability in demand and supply.

Peak demand for electricity will shift from summer to winter by the mid-2030s, and peak demand could vary by up to 50% between mild and severe winters by 2050. Overall electricity supply will also become far more variable as weather-dependent wind and solar resources meet more of the region's energy needs.

Increased variability will require vastly different supply levels from year to year.

To maintain reliability, the New England power grid will need enough resources to serve peak demand for the most severe winter conditions. But most winters are likely to be milder, with significantly lower peaks. Some resources needed to maintain reliability during the harshest conditions may only run for a few days once every few years. Reducing peak demand below the high end of EPCET's projections would lessen the supply levels needed from year to year and potentially decrease the need for such resources.

Emissions reductions will be seasonal. Some months will decarbonize years before others.

Because wind and solar production is highest in spring and fall, and demand for electric heating or cooling is lower, these shoulder seasons will see the first future months without carbon emissions. Spring will be mostly decarbonized by 2040, but emissions are still projected for a small number of winter days in 2050.

Renewable-only build-outs may be vast.

A 2050 resource mix that includes current resources and adds a build-out of wind, solar, and short-term battery storage to meet emissions goals and accommodate increased electrified demand would require approximately four times the capacity of today's system.

Current revenue structures may not adequately compensate resources for their value to the future grid.

As 2050 approaches, newly built wind and solar resources will produce surplus, unused energy for increasing periods of time, especially in spring and fall, and their cost per megawatt-hour will rise. By 2035, the combined values of the capacity market and out-of-market power purchase agreements may overtake the energy market.

Firm, dispatchable, zero-carbon generation could help address challenges.

Long-duration storage may help meet high demand during shorter cold snaps, but not over more extended periods of severe winter conditions. New zero-carbon dispatchable energy technologies like synthetic natural gas and small modular nuclear reactors could ensure reliability during such times.

Challenging minimum load conditions and energy adequacy concerns may appear by the 2030s.

Though many of the challenges identified in EPCET may occur by the 2040s, some operational concerns could appear far sooner. Growth in the region's behind-the-meter solar may result in unprecedented minimum loads, which pose reliability concerns. And under certain weather conditions, the power grid of the early 2030s may need levels of stored fuels comparable to today's consumption.