London Economics International LLC

NYC building electrification: Potential impacts from proposed legislation

New York City, NY

Prepared on behalf of the New York Energy Consumers Council

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December 13, 2018

LONDON ECONOMICS

LEI is a global economic, financial and strategic advisory professional services firm

London Economics International LLC ("LEI") combines detailed understanding of specific network and commodity industries, such as electricity generation and transmission, with sophisticated analysis and a suite of proprietary quantitative models to produce reliable and comprehensible results.

LEI has extensive experience in several areas, including:

GENERATION:

- working with generation owners to forecast market conditions and evaluate future revenues
- Assessing the impact of new generation resources on capacity and energy prices

TRANSMISSION:

- Advising on tariff design and other business issues for regulated & merchant transmission
- Conducting cost-benefit analysis around proposed transmission projects

RENEWABLES:

- Working with developers to value potential revenue streams from Renewable Energy Credits ("RECs") and/or emissions offsets
- Counseling governments and regulators on creating policies which efficiently incentivize investment in renewable energy

NATURAL GAS:

- Assessing the synergies between the natural gas and electric power industries
- Examining performance-based ratemaking and total factor productivity for natural gas distribution companies

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Agenda

1	**Introduction and goals**
2	Incremental load from electrification
3	Incremental capacity and T&D costs

LEI was asked by the NYECC to estimate the potential costs for consumers of proposed legislation limiting use of fossil fuel in NYC buildings

NEW YORK ENERGY CONSUMERS COUNCIL

The New York Energy Consumers Council includes a broad spectrum of energy buyers, including hospitals, universities, financial institutions, residential and commercial property owners and managers, and energy service companies

- **What would be the impact of building electrification on consumer costs?**
  - Increased peak load, so additional costs for wholesale capacity which then trickle into consumer electricity rates
  - Increased electrical energy usage, which could increase wholesale energy market prices
  - Increased transmission buildout to serve additional load also increases rates

Intro 1745

- Introduced by city council in October 2017
- Would limit the use of fossil fuel for buildings in NYC
- Also proposes whole-building energy usage limits

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1 Introduction and goals

2 **Incremental load from electrification**

3 Incremental capacity and T&D costs

Increased peak load requires additional generation capacity to be procured through the NYISO-administered auctions

Energy [MWh] = Capacity [MW] x Time [hours]

2 MWh = 1 MW x 2h = 2 MW x 1h

NYISO is the operator of New York's electric grid and is responsible for system resource planning

- NYISO runs capacity auctions for distribution companies such as ConEd to procure sufficient generation capacity
- If the installed capacity requirement increases, so will the capacity prices thus incentivizing new resources to come online

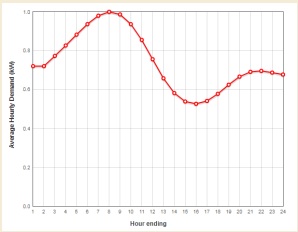
New York Control Area Installed Capacity Requirement = Peak Load + reserve margin

New York City has a Locational Capacity Requirement because of transmission constraints limiting delivery of generation from other regions

Estimate increased cost for consumers involves first calculating range of increase in peak electric demand in NYC

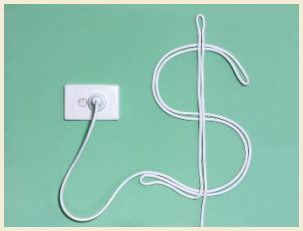
1

- **Calculate peak demand impact**
  - Establish base fossil fuel usage
  - Estimate fossil fuel energy usage converted to electricity
  - Estimate equivalent electric requirement
  - Derive peak load increase



2

- **Calculate increased capacity costs to consumers**
  - Calculate new peak demand
  - Calculate incremental cost of capacity in NYSIO's market

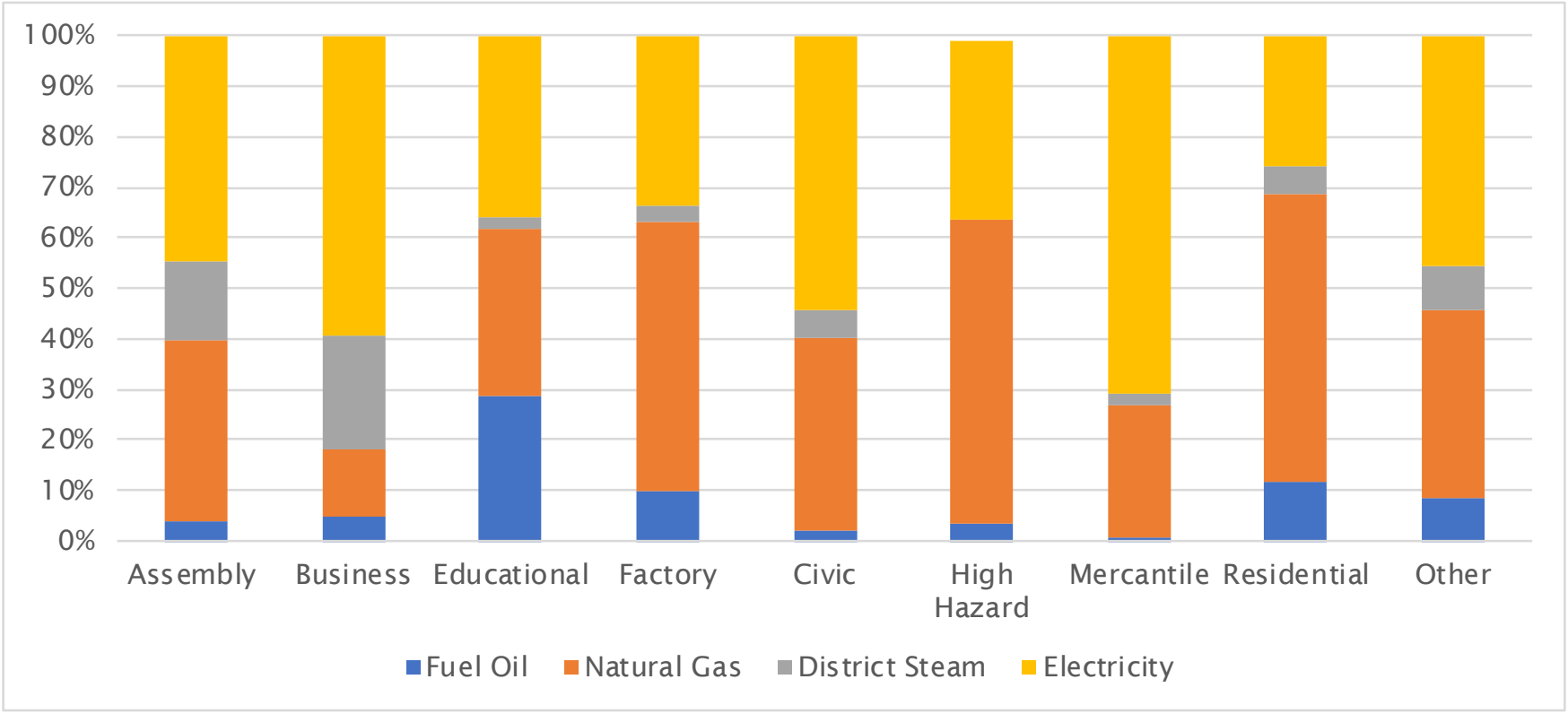


3

- **Calculate increased T&D costs to consumers**
  - Calculate additional T&D infrastructure required
  - Calculate incremental T&D cost

Base fossil fuel usage comes from an extensive database of NYC buildings

Average energy source mix in NYC by building primary use

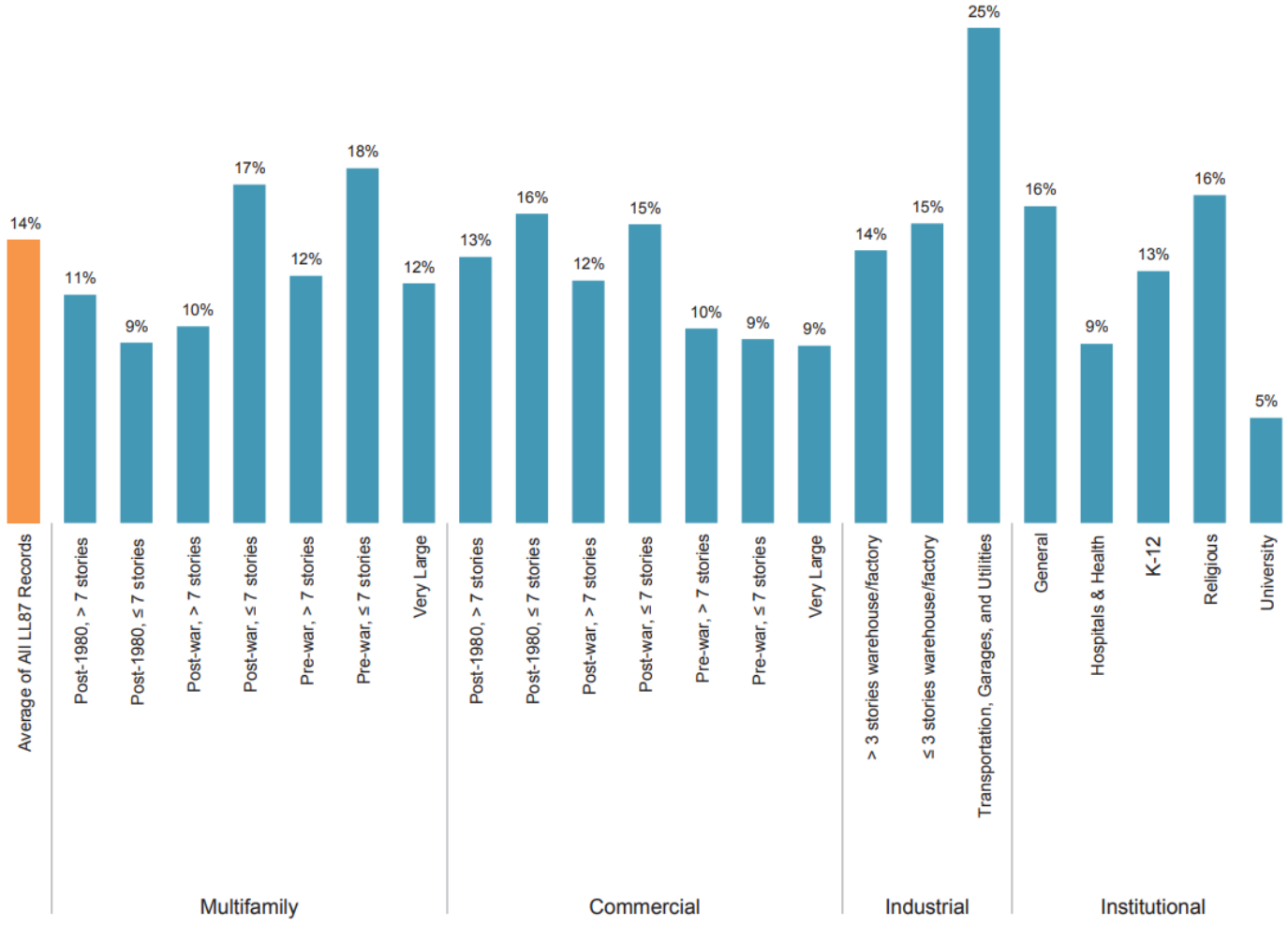


Source: 2016 Local Law 84 data; LEI

Note: generally includes buildings 50,000 sf and above that submitted data; LEI modified original data source to account for outliers

Before converting to electricity, LEI assumes that building owners would reduce fossil fuel usage through energy efficiency measures

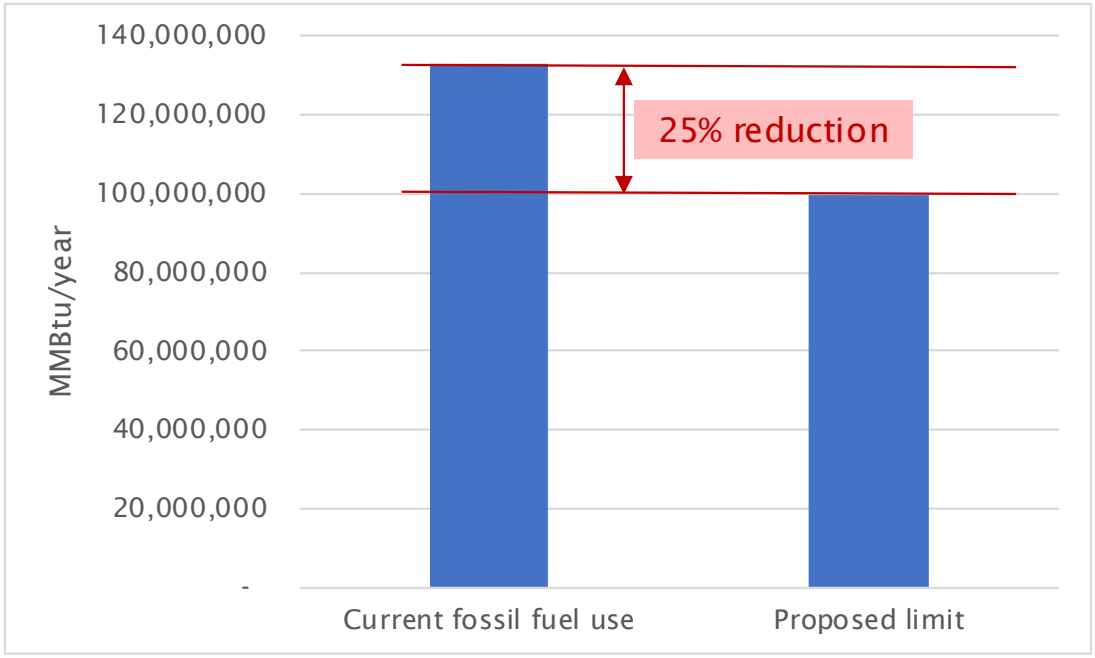
Average energy savings as percentage of building consumption



Source: NYC Buildings Technical Working Group

Proposed fossil fuel limits would result in a reduction of approximately 25% in fossil fuel usage for NYC buildings above 25,000 square feet

Proposed limits vs current fossil fuel consumption (annual total)



LEI assumes that buildings that are not compliant would first implement energy efficiency measures, and if not sufficient proceed to convert building systems to electricity

Source: NYC Buildings Technical Working Group, proposed legislation

But wait – One Btu of fossil fuel does not necessarily provide same heating content as 1 Btu of electricity

- **Oil, natural gas, and electricity do not have same efficiency for space heating or water heating**

Comparison of efficiency of fuel types for space heating

Fuel Type	Fuel utilization efficiency
Fuel Oil	70%
Diesel	70%
Natural Gas	80%
Air-source heat pump	250%

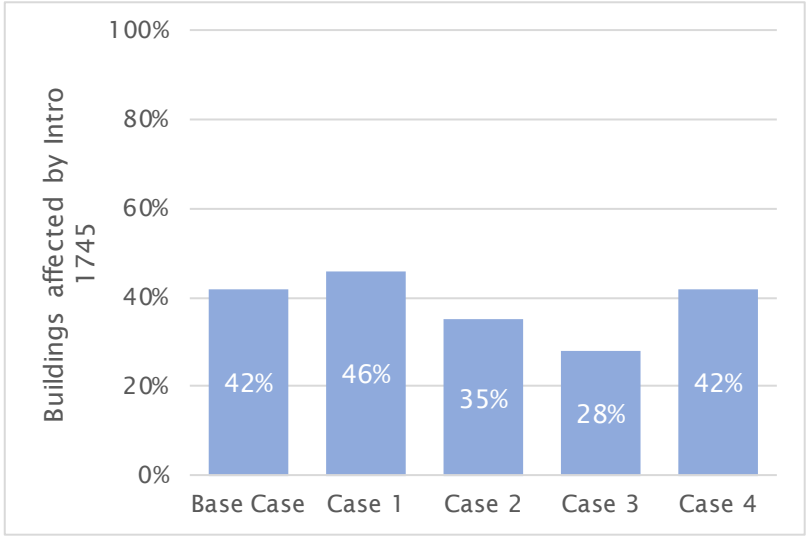
So 1 Btu of natural gas ➔ 0.80 Btu of heat ➔ 0.32 Btu of electricity

Source: DOE, EIA, NREL

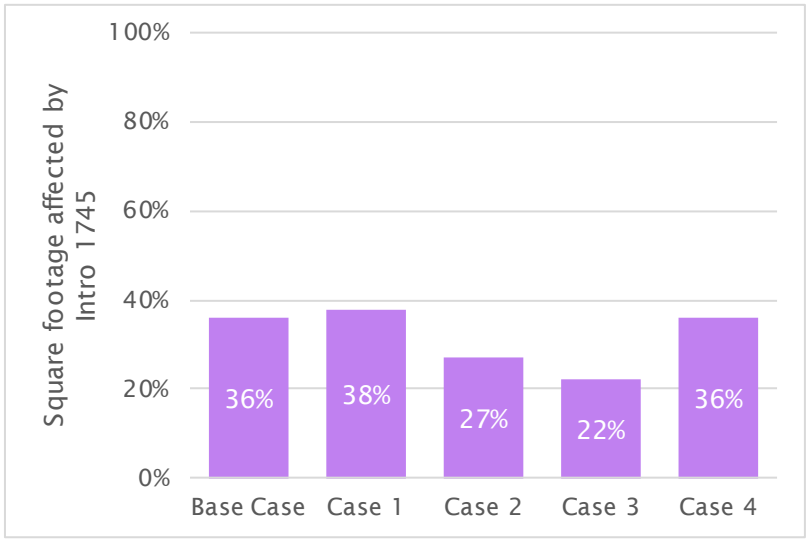
LEI's various scenarios show that a significant number of buildings would need to electrify in all scenarios

Modeling scenario	10% offset from green energy	Energy efficiency gains from energy audit	Efficiency rates for electric space & water heating	Compliance action
Base Case		50%	As forecast	Convert building systems to electricity if still over limit
Case 1		20%	As forecast	
Case 2		100%	As forecast	
Case 3		150%	As forecast	
Case 4		50%	50% of forecast	

Buildings converting to electricity (number)



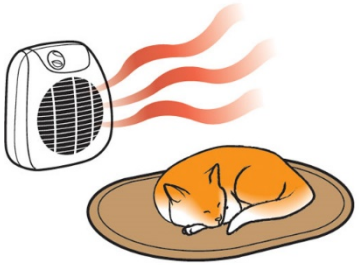
Buildings converting to electricity (SF)

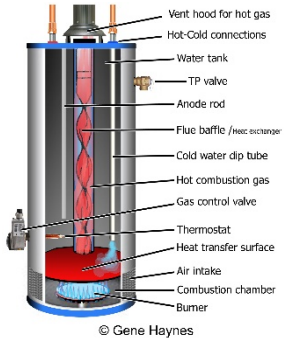


Consumption is not flat – so estimation of peak load requires monthly and seasonal shaping

We can't assume current NYC electric load shape for additional electric load from building electrification

- **What are major uses for fossil fuel?**





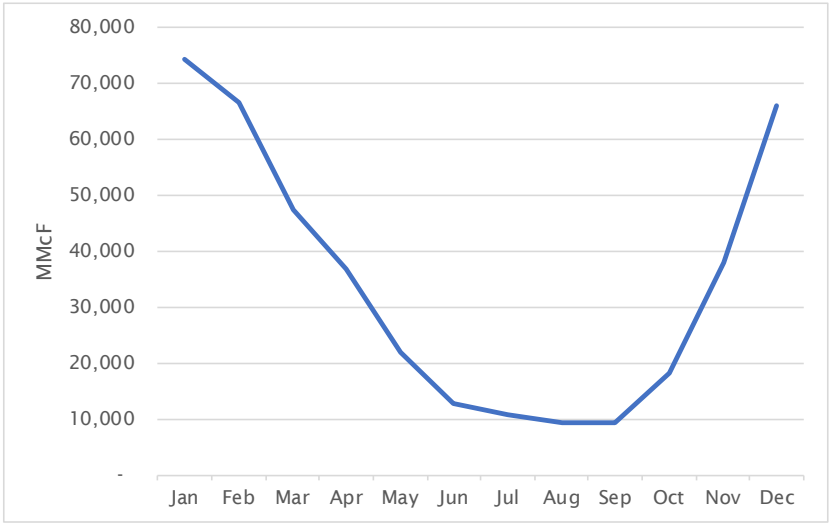
- **When does that happen?**

- **Assumption: additional electric load will have shape similar to current natural gas consumption shape**

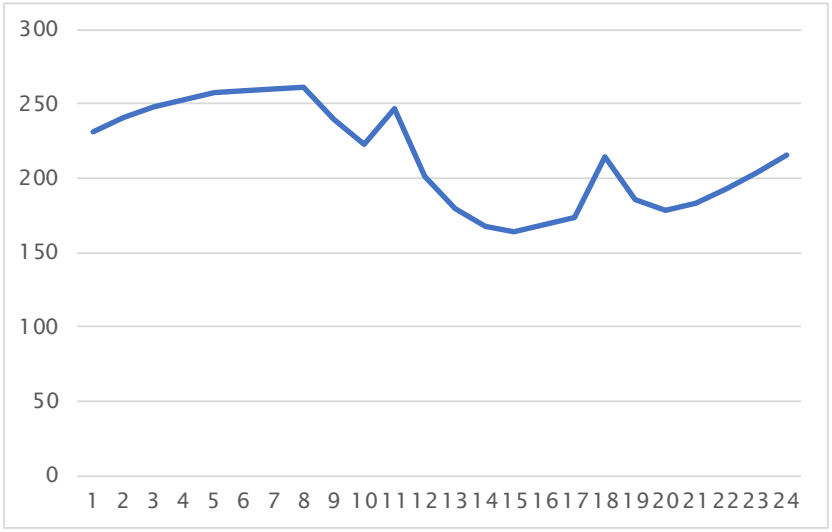
As expected gas consumption is higher in winter, and daily peaks are in the mornings and evenings

Typical NY residential natural gas consumption

Seasonal



Hourly



Shapes are different for residential, commercial, or industrial buildings

Source: DOE, EIA

Building electrification increases NYC's winter peak load such that the City becomes winter-peaking

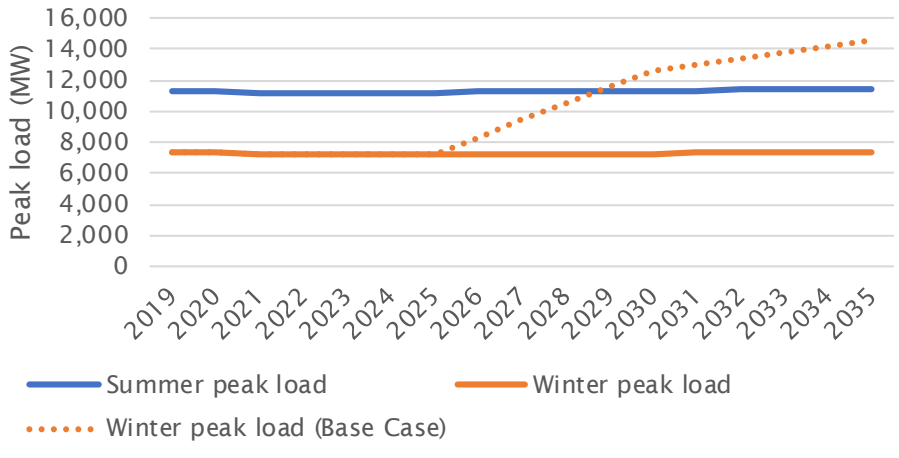
Scenario	Incremental Winter Peak Load (2035)
Base Case	7,210 MW
Case 1	7,794 MW
Case 2	5,870 MW
Case 3	4,826 MW
Case 4	14,420 MW

Baseline 2035 NYC peak load forecast	
Summer	11,458 MW
Winter	7,396 MW

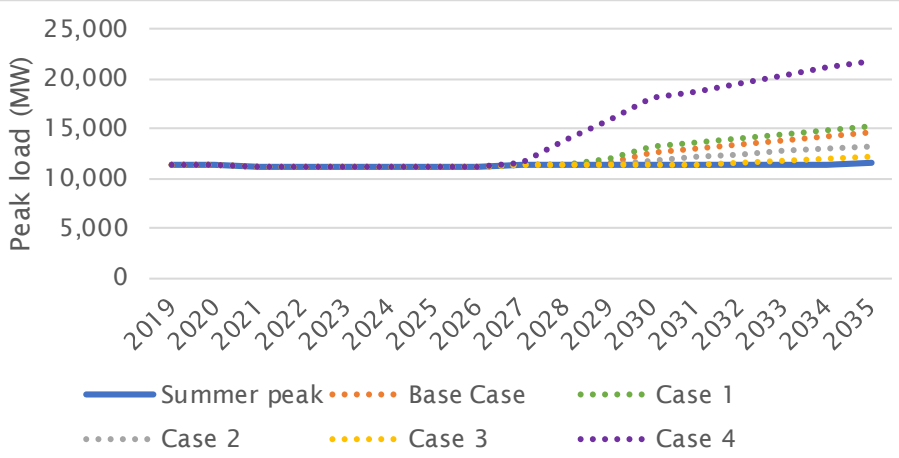
- As a result of building electrification, NYC becomes winter peaking
- Winter peak load surpasses Summer peak in between 2027-2029 in various scenarios

Source: NYISO 2018 Load and Capacity Data Report; LEI

NYC summer and winter peak load with impact from Base Case incremental peak load



NYC summer and winter peak load with impact from Base Case incremental peak load



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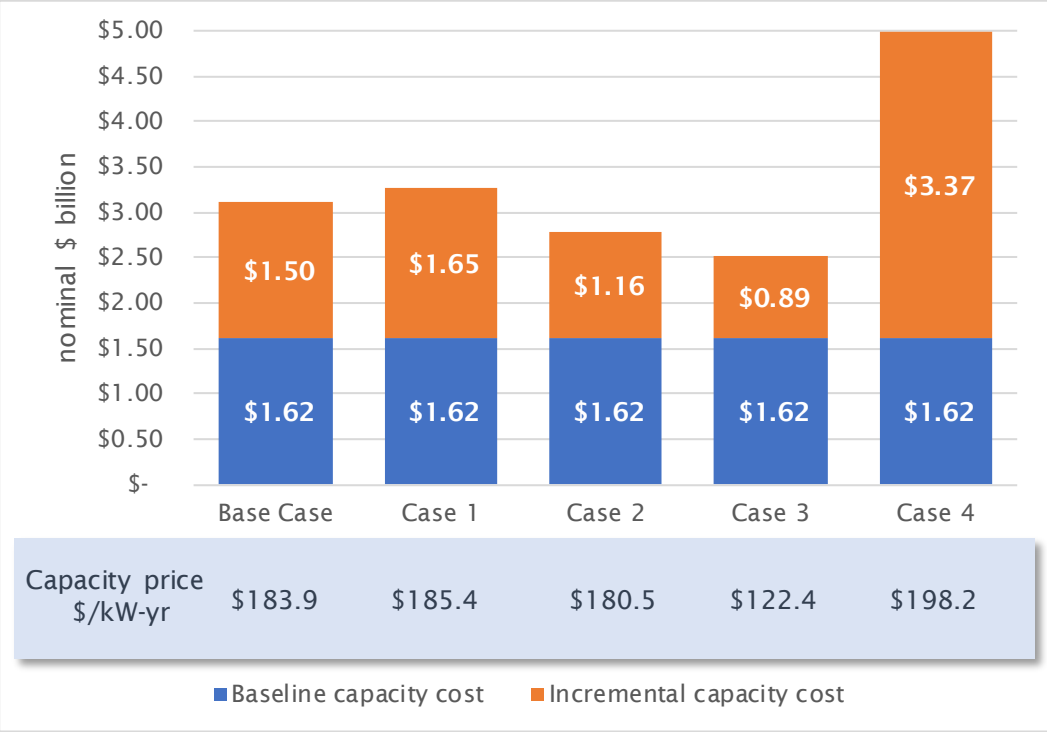
3 **Incremental capacity and T&D costs**

Building electrification could cause an almost twofold increase in capacity costs by 2035 in the Base Case, and threefold in worst scenario

- LEI prepared a forecast of NYC capacity market prices under baseline conditions
- As peak load and installed capacity requirement increase in NYC, the design of NYISO's capacity market results in higher prices for capacity

2035 NYC capacity costs under various scenarios



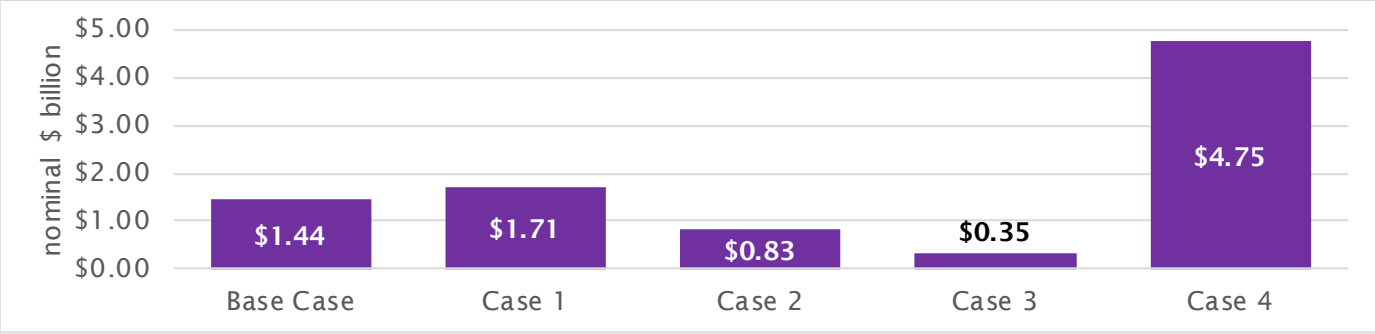
Source: LEI

Significant investments in ConEd's T&D grids are necessary to accommodate the higher peak loads

- Based on previous ConEd long-range transmission planning documents, LEI estimated that every megawatt of additional peak demand in NYC translates to $3.5 million in additional T&D investments
- LEI then calculated an indicative total infrastructure investment cost required to meet the increased peak load from building electrification

	Base Case	Case 1	Case 2	Case 3	Case 4
Net NYC incremental peak load	3,148 MW	3,732 MW	1,808 MW	764 MW	10,358 MW
Incremental total T&D investment [$ billion]	$11.11	$13.17	$6.38	$2.70	$36.55

2035 incremental NYC T&D costs under various scenarios



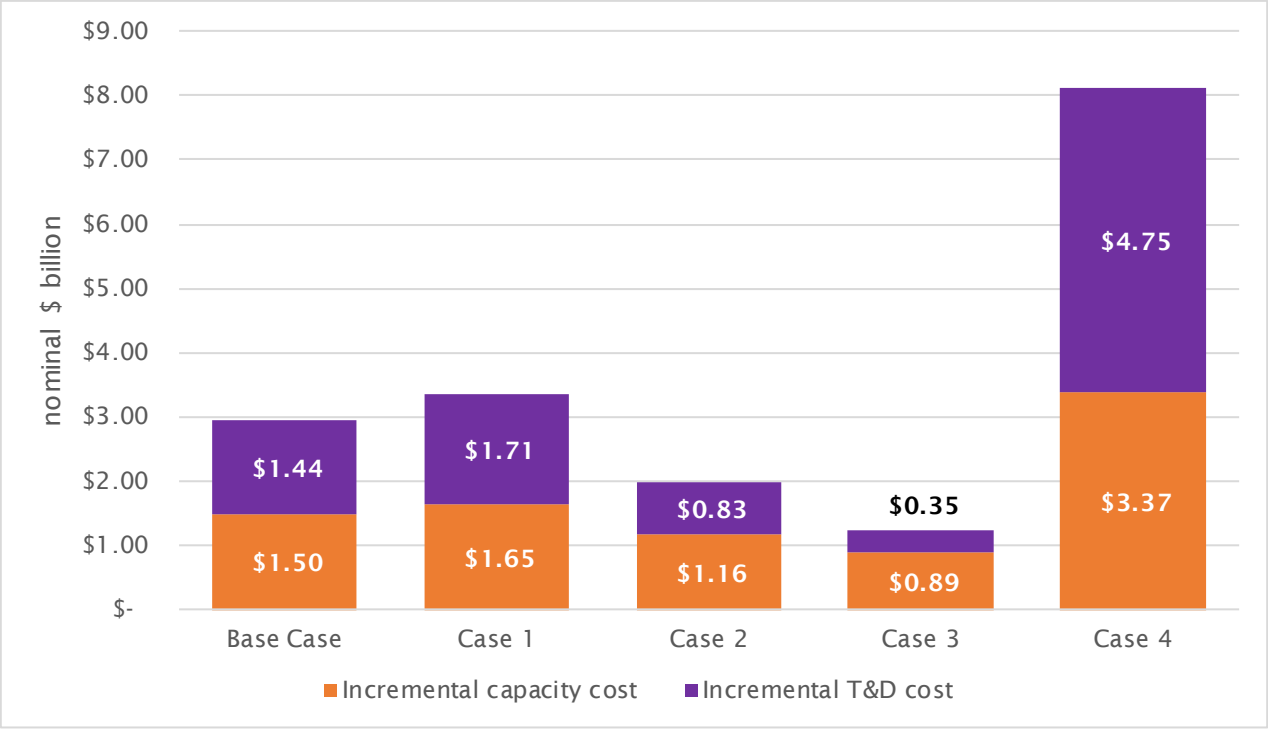
LEI annualized the T&D investment costs using a generic 13% factor, which is meant to cover financing costs as well as O&M costs for the transmission investment

Source: ConEd 20-year Integrated Long Range Plan, LEI

Building electrification could result in incremental annual capacity and T&D costs for NYC consumers between $1.25 and $8.00 billion by 2035

- Costs would gradually increase over a period of years leading to 2035 as buildings complete electrification
- Incremental transmission costs are expected to persist over the economic life of the T&D assets
- Incremental capacity costs would slowly decrease over time as equilibrium between installed capacity and locational capacity requirement in NYC is reached

2035 NYC total incremental costs under various scenarios



Source: LEI