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Evaluating the Effects of Municipal Ordinances on Building Emission Profiles via Econometrics-Based Demand Forecasting and City-Level Modelling: A Case Study on New York City

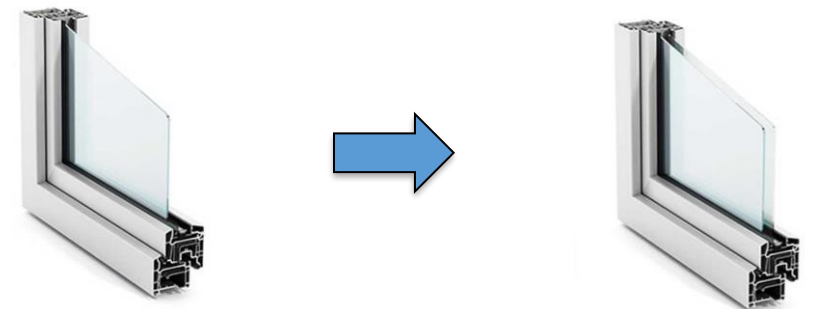
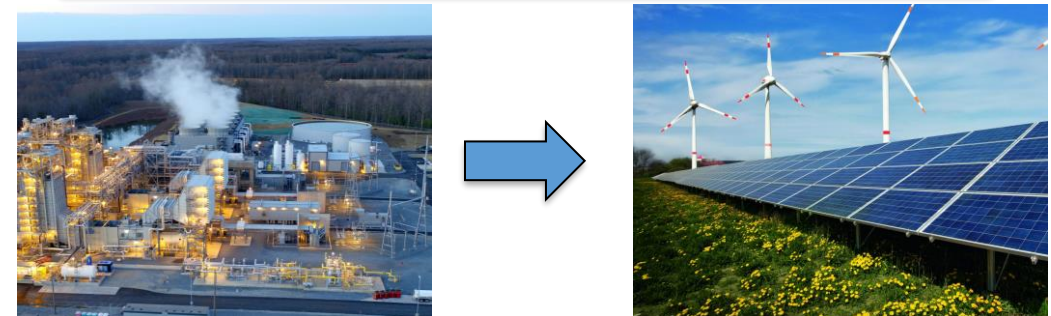
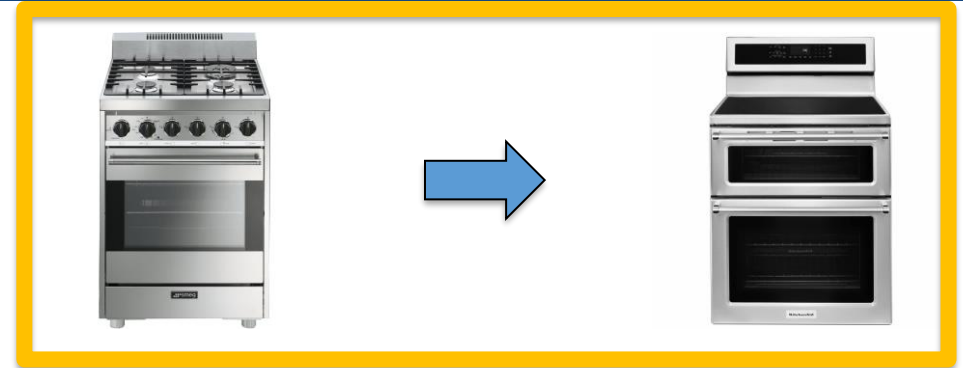
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with Advising from Dr. Benjamin Hobbs ^a, Dr. Ozge Kaplan ^b

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Building Sector Decarbonization in the U.S.

- ▶ Commercial & residential energy consumption
 - ▶ 29% of total energy use [1]
 - ▶ 35% of total GHG emissions [1]
- ▶ 3 types of building sector decarbonization
 - ▶ **End-use fuel-switching**
 - ▶ Electricity supply decarbonization
 - ▶ Efficiency improvements



New York City Ordinance on Building Emission Profiles

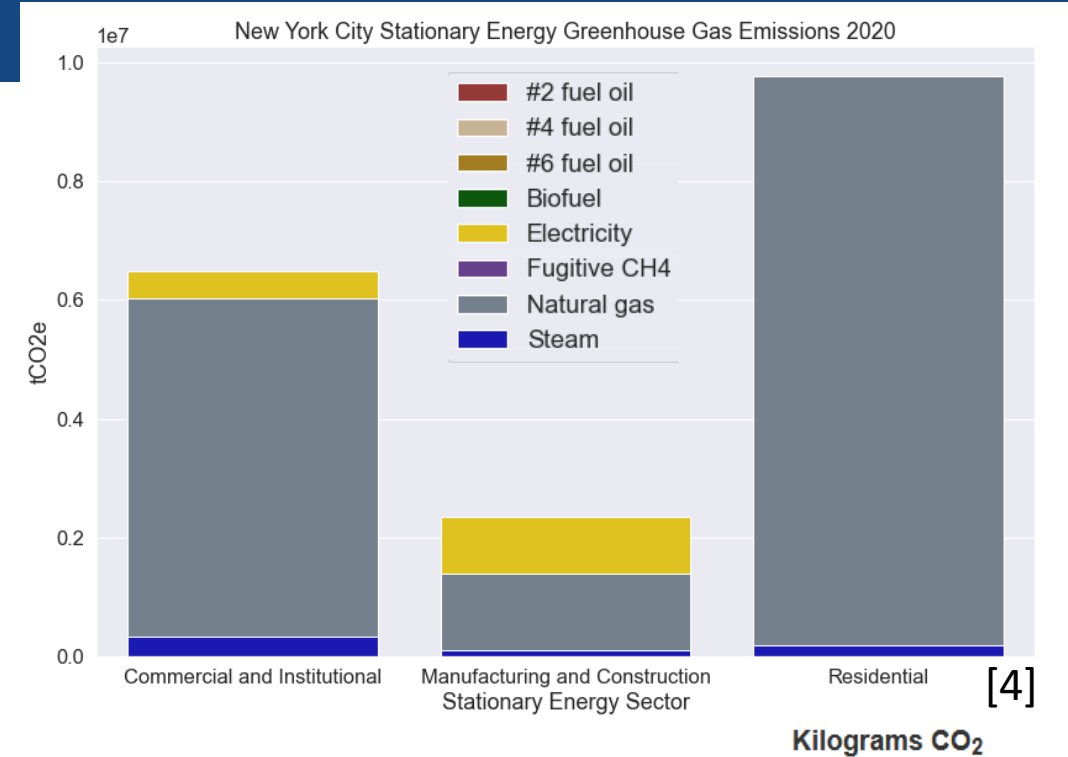
► 2021 – New York City, NYC (2317-A) [3]

NYC Council, 12/7/21

Proposed Int. No. 2317-A ARTICLE 506
EMISSION PROFILE OF BUILDINGS

§ 28-506.1 Prohibited Emissions in New Buildings. New buildings shall be subject to the emissions limits set forth in section 24-177.1. The commissioner shall not approve an application for the approval of construction documents, nor issue any permit in connection therewith, for a new building that does not comply with section 24-177.1.

b. No person shall permit the combustion of any substance that emits 25 kilograms or more of carbon dioxide per million British thermal units of energy, as determined by the United States energy information administration, within such building.



Carbon Dioxide (CO₂) Factors: [5] Per Million Btu

For homes and businesses

Propane	62.88
Diesel and Home Heating Fuel (Distillate Fuel Oil)	74.14
Kerosene	73.19
Coal (All types)	95.74
Natural Gas	52.91

[3] Proposed Int. No. 2317-A [4] Inventory of New York City Greenhouse Gas Emissions 2022 [5] US EIA Carbon Dioxide Emissions Coefficients

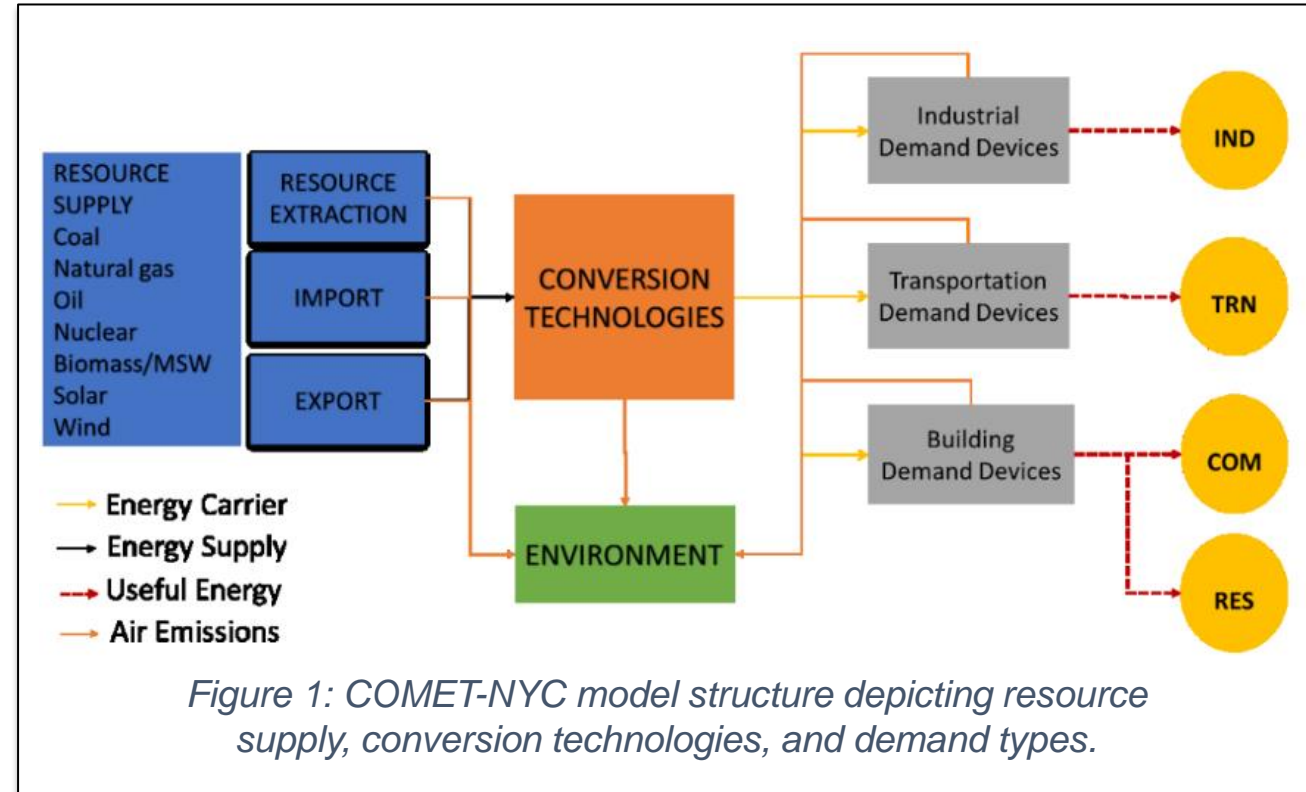
Research Questions and Model Formulation

How should NYC invest in power system & natural gas infrastructure from 2020 to 2050 given:

- GHG reduction goals
- Long-term uncertainties in prices, technologies, policies

What are the effects of Ordinance 2317-A on:

- Uses of energy sources
- Emissions
- System & consumer costs



Kaplan and Isik 2020

Issues for Feedback (1)

Balancing tradeoffs in a long-term study

▶ **Temporal resolution**

- Pipeline capacity constraints might only be captured at high temporal resolutions

▶ **Spatial resolution**

- Construction starts are spatially inhomogeneous within boroughs

Issues for Feedback (2)

Modeling Uncertainty in Standard MARKAL (two-stage)

- ▶ **Resources to Guide Implementation of Stochastic Programming in MARKAL**
- ▶ **Selecting stochastic decision variables**
 - Uncertainties in the model will include prices, technologies, and policies
- ▶ **Stochastic Programming vs. Scenario Analysis**



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Thank you!



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