

**RGGI Preliminary**  
**Electricity Sector Modeling Results**  
*Carbon Policy Scenarios and*  
*Sensitivities*

**RGGI Stakeholders' Meeting**  
**February 16, 2005**

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# Outline

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- Reference Case Overview
- Initial Carbon Policy Cases and Sensitivities
  - Emissions Reduction Cases
    - 5% reduction below 1990 levels
    - 10% reduction
    - 15% reduction
    - 25% reduction
  - Sensitivity Cases
- Key Observations and Caveats
- Next Steps
- Appendix: Related Reference Case Sensitivities
  - High Demand
  - High Gas Prices
  - Canadian Carbon Policy

# **Reference Case Overview**

# Assumptions – and changes since previous iterations

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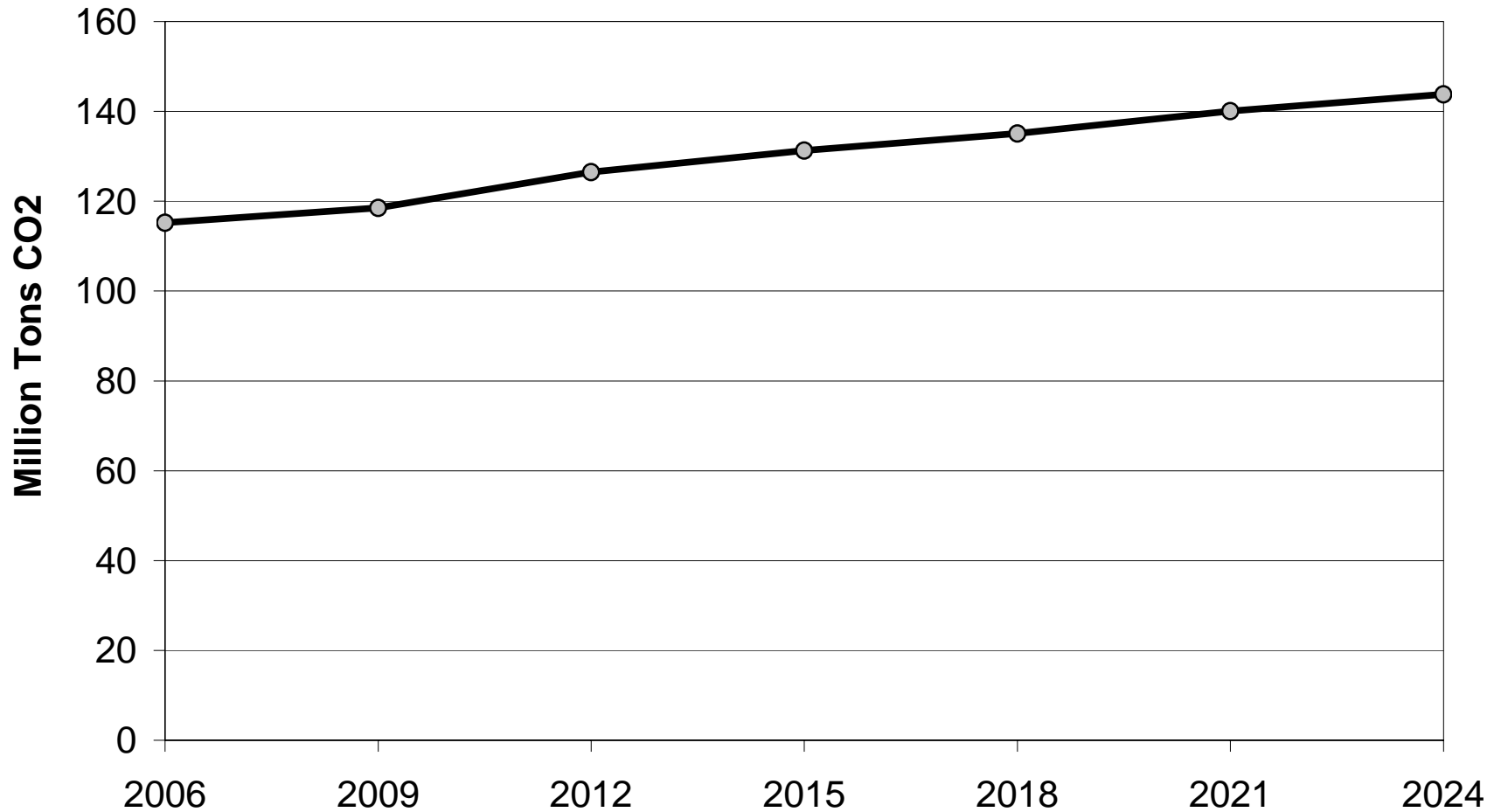
## ➤ Major Assumptions

- Competitive markets
- 3-P national policy + state policies
- RPS requirements met
- No coal-builds in RGGI or Canada
- ISO demand forecasts
- No new transmission beyond RTEPs
- No gas transmission constraints

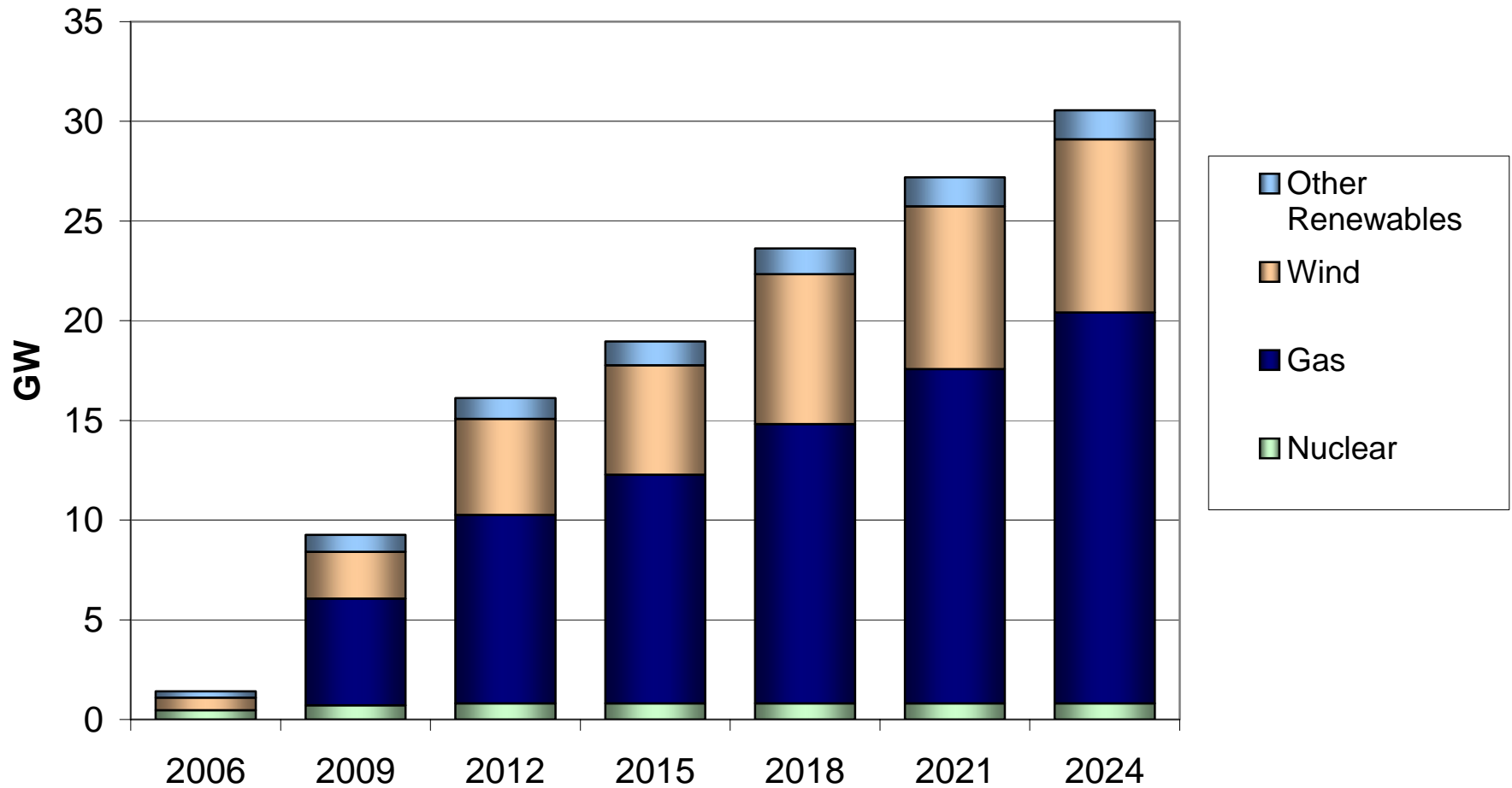
## ➤ Changes since previous runs

- Phase-in of renewables
- Implementation of NRG and AES settlements in NY
- Adjusted NY hydro generation to match more recent years
- Reporting of emissions along state lines, not model plant location
- Disallowance of new coal builds in Canada and corrected transmission charges
- Added PJM-W to New Jersey direct line

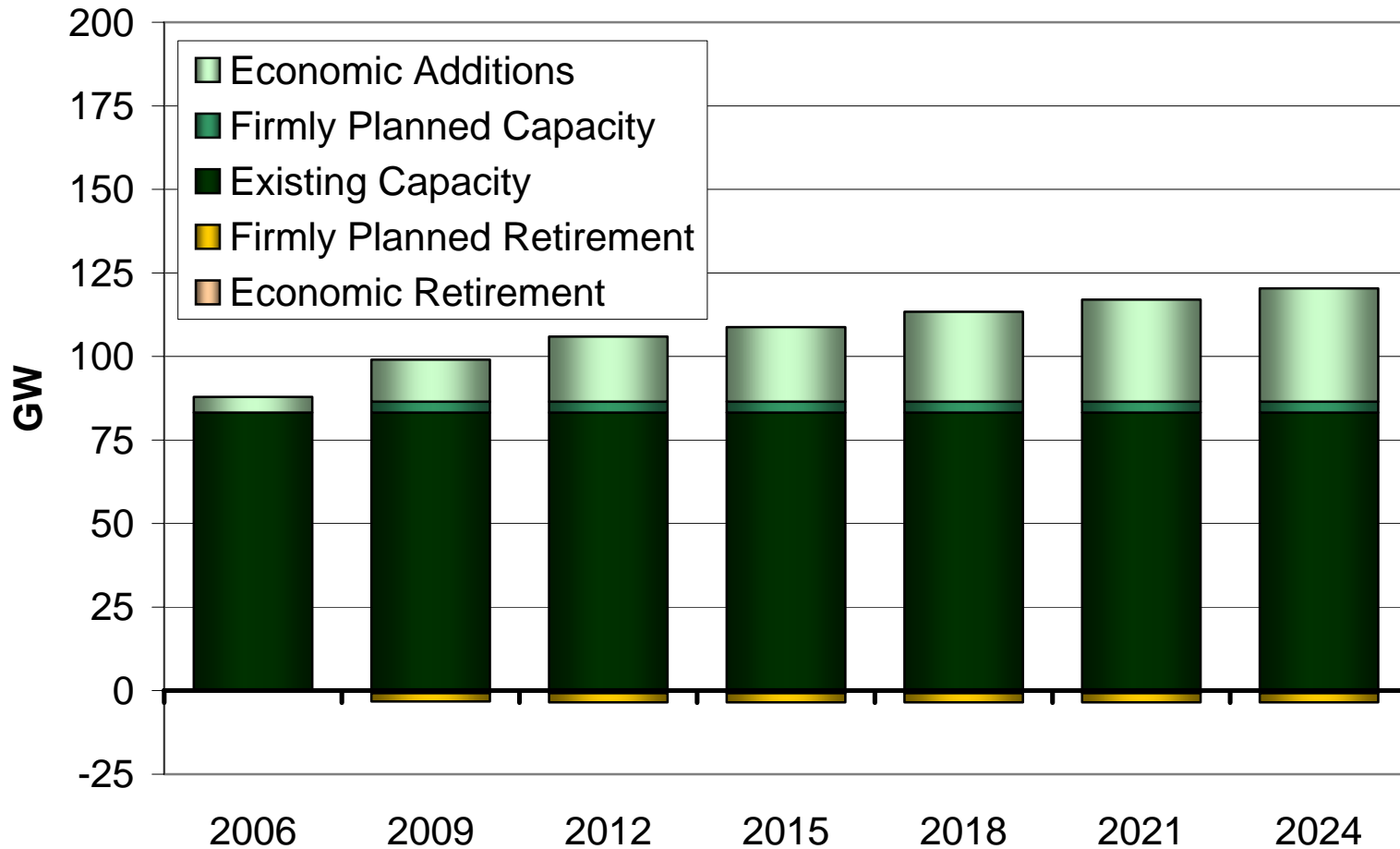
# What is the expected growth in CO<sub>2</sub> emissions in RGGI states (without RGGI)?



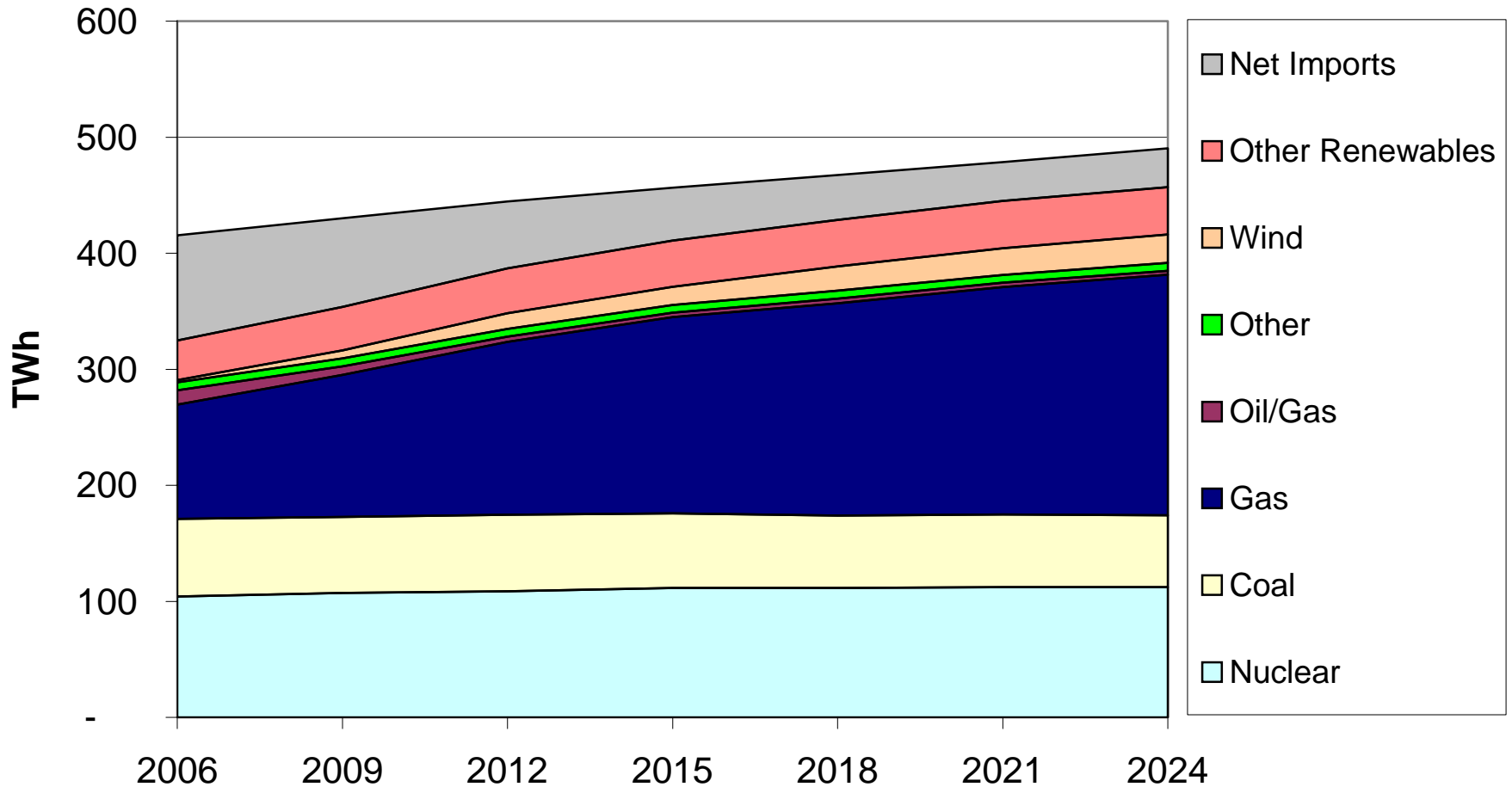
# What units are projected to be built (without RGGI)?



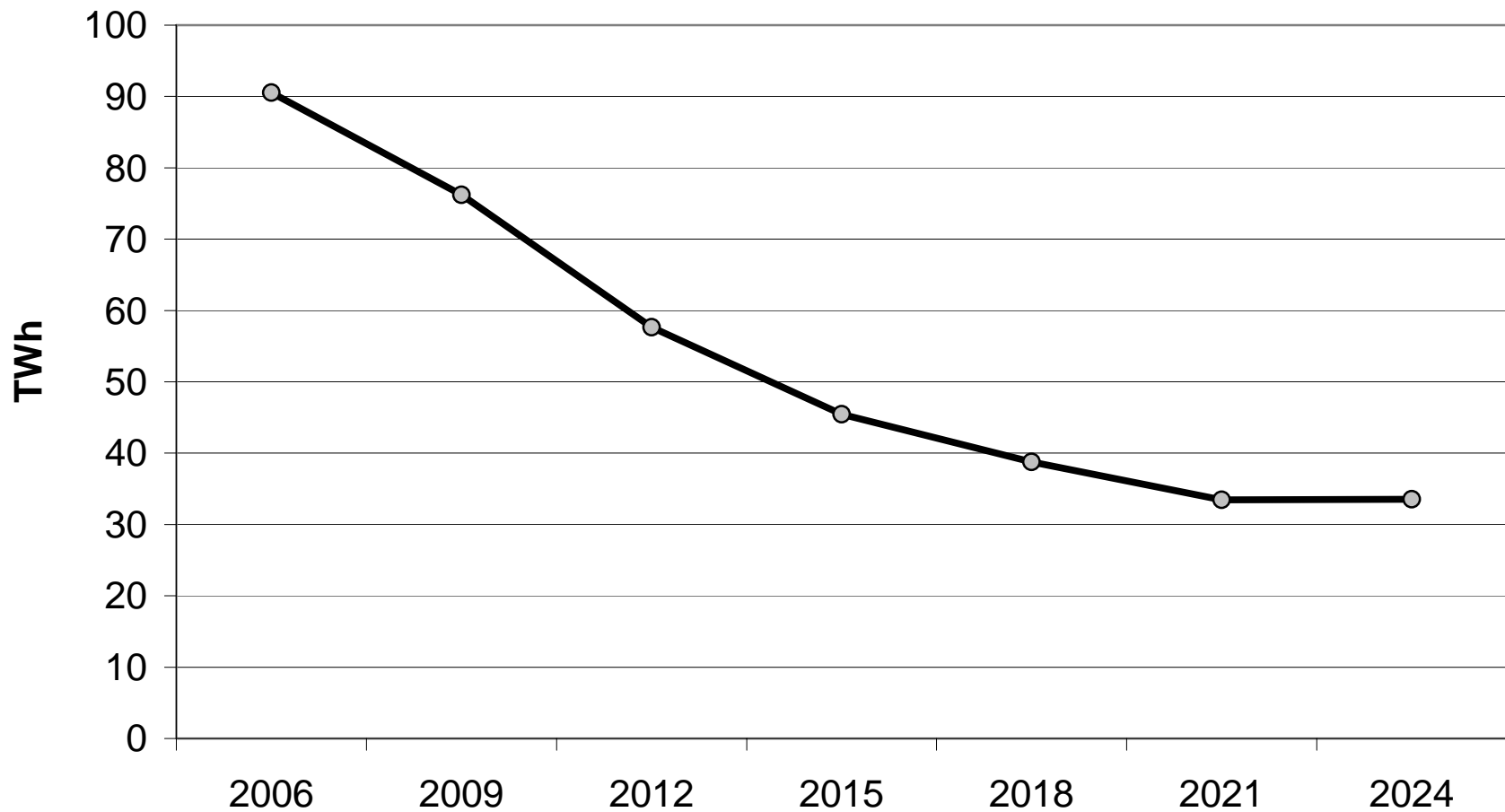
# Projected Capacity Additions v. Installed Capacity (without RGGI)



# What is the expected regional generation mix (without RGGI)?



# What are the projected imports of electricity into the RGGI states (without RGGI)?



# **Carbon Policy Scenarios and Sensitivities**

# Initial Carbon Policy Cases

➤ Emissions reduction cases:

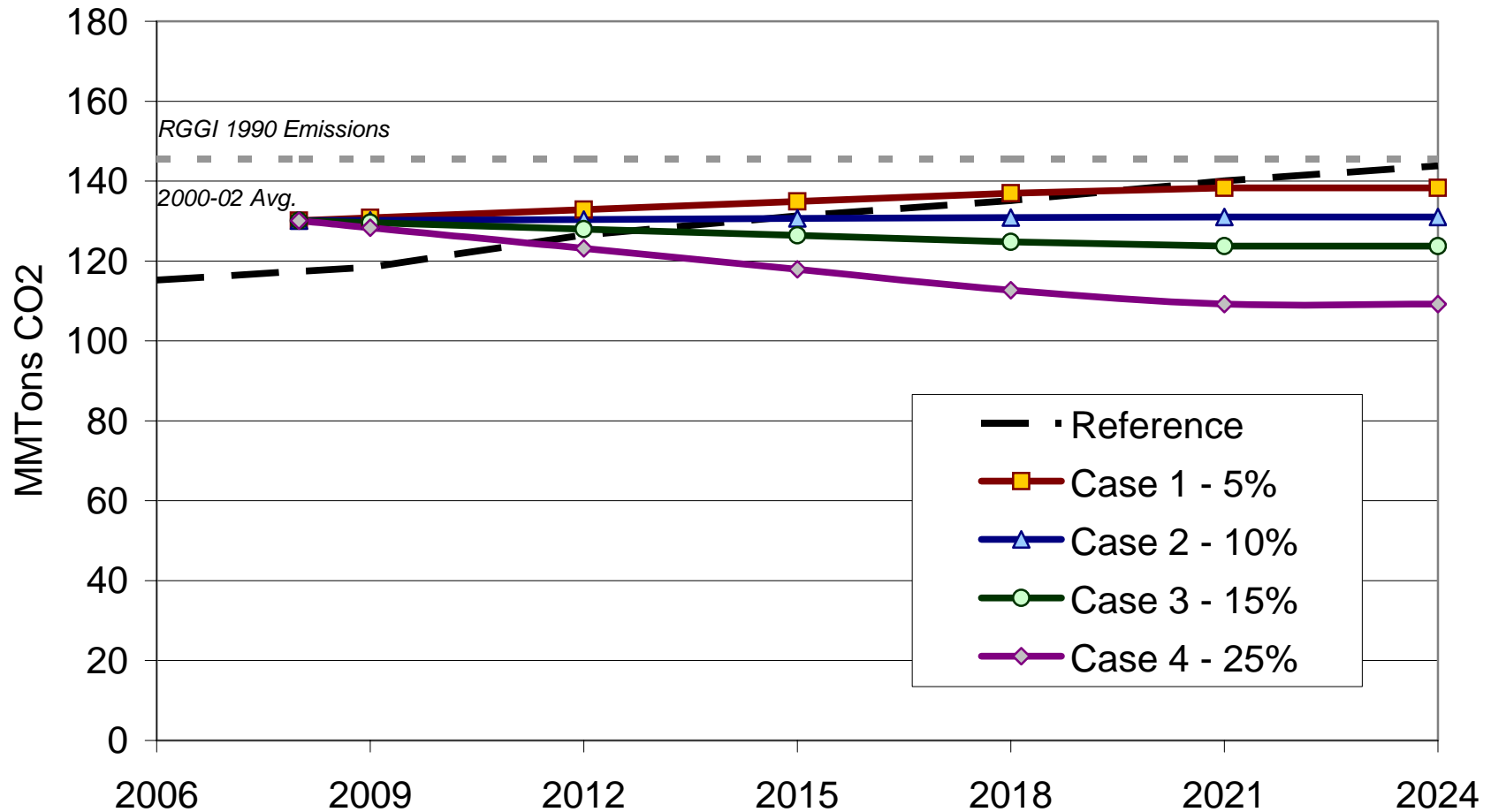
- ✓ 5% reduction below 1990 levels by 2020
- ✓ 10% below
- ✓ 15% below
- ✓ 25% below

➤ 15% Emission reduction sensitivities

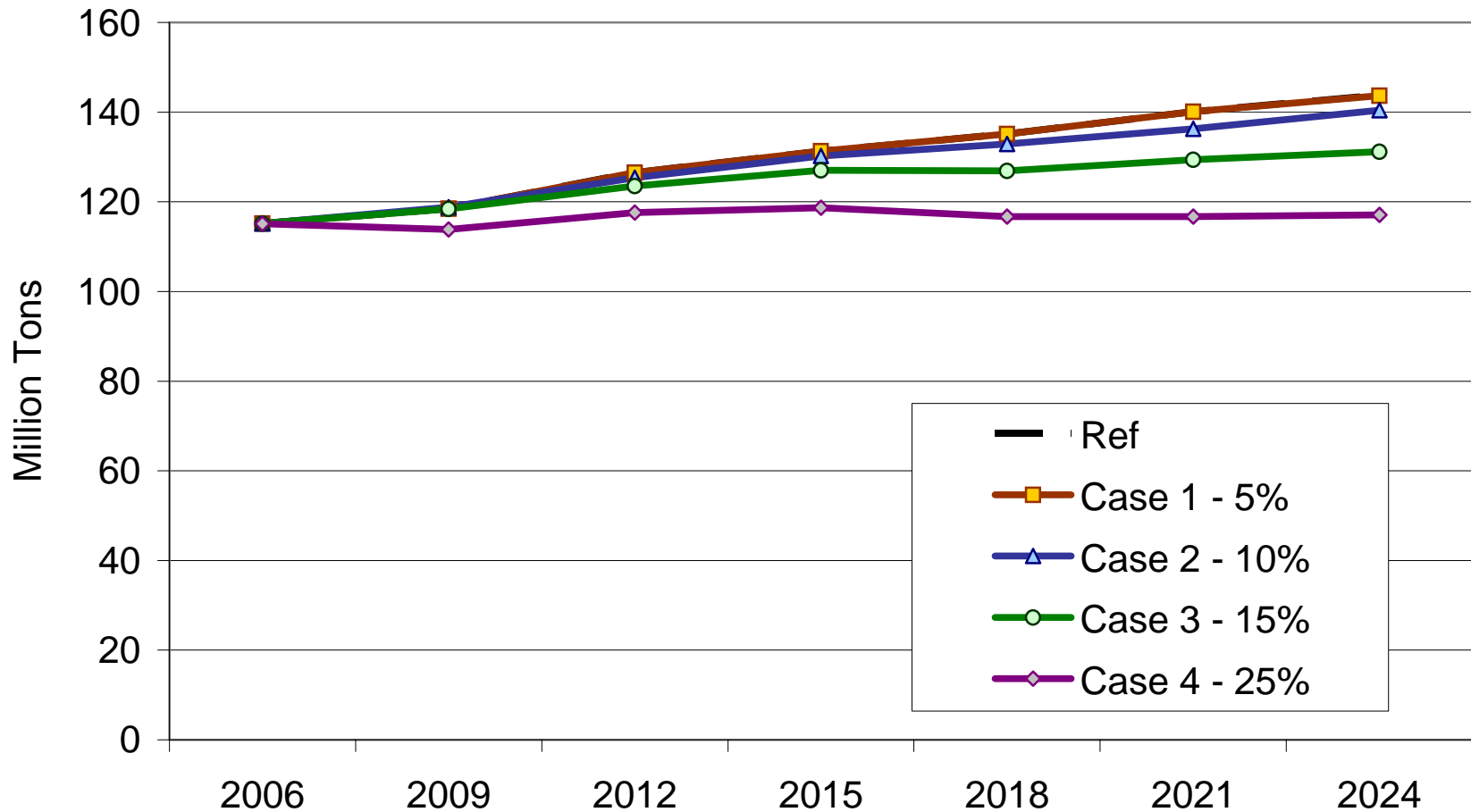
- Low Demand
- “Rest of US”/Canada Action Case

	2008 Cap (Million Tons)	2020 Cap (Million Tons)
5% Case	130.1	138.3
10% Case		131.0
15% Case		123.8
25% Case		109.2

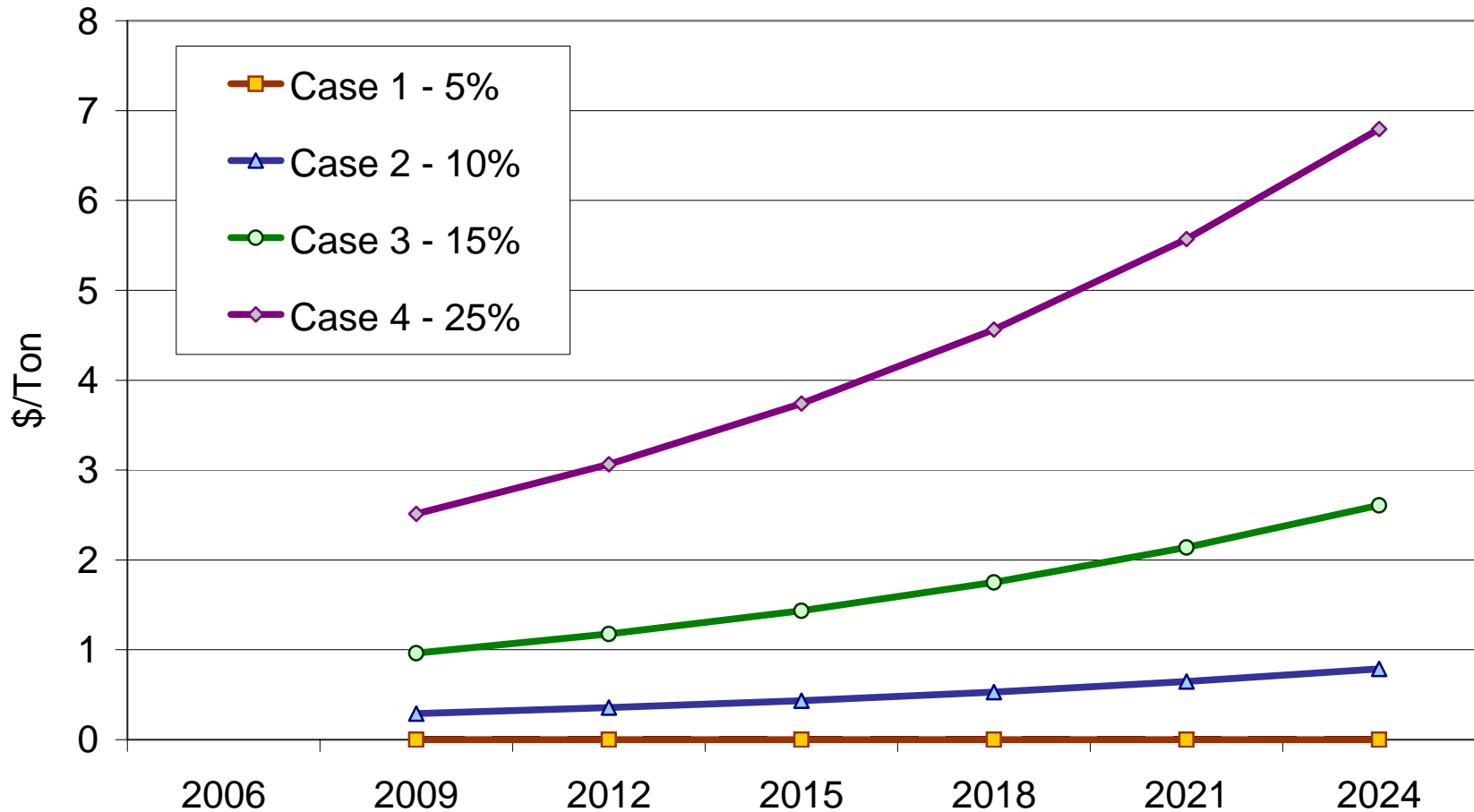
# What caps were modeled?



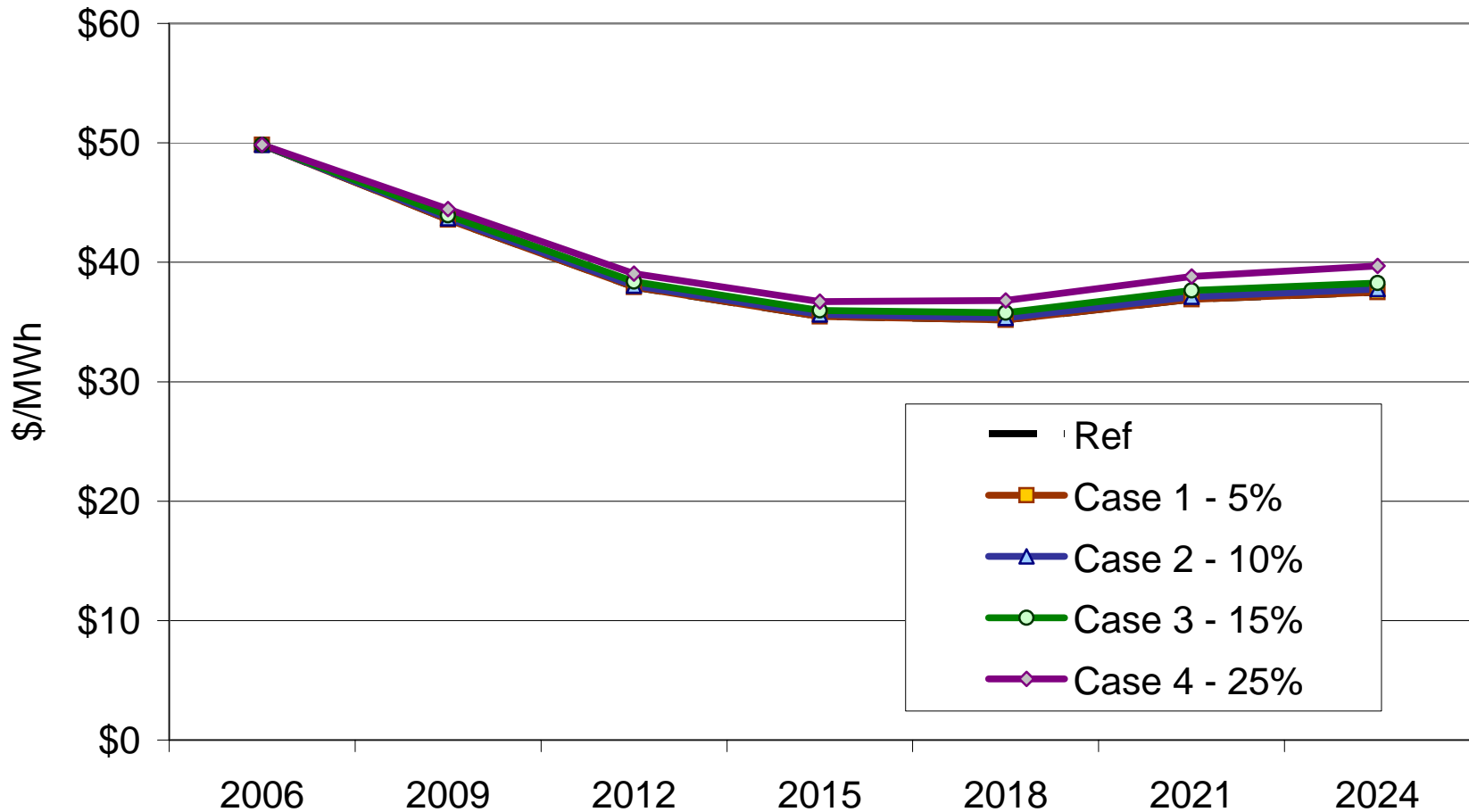
# What are the CO<sub>2</sub> emissions in the RGGI region when banking is allowed?



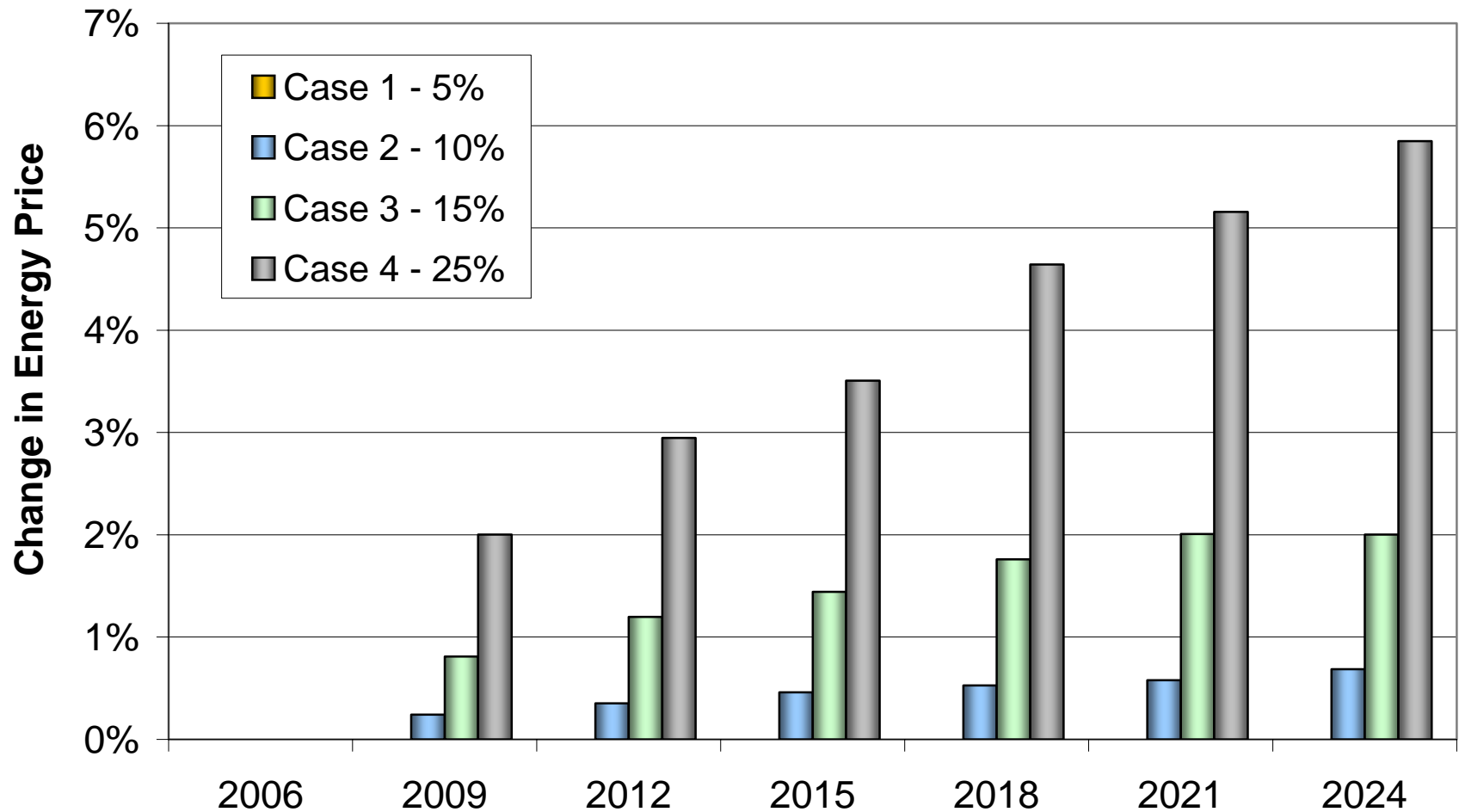
# What are the CO<sub>2</sub> allowance prices in the RGGI region when banking is allowed?



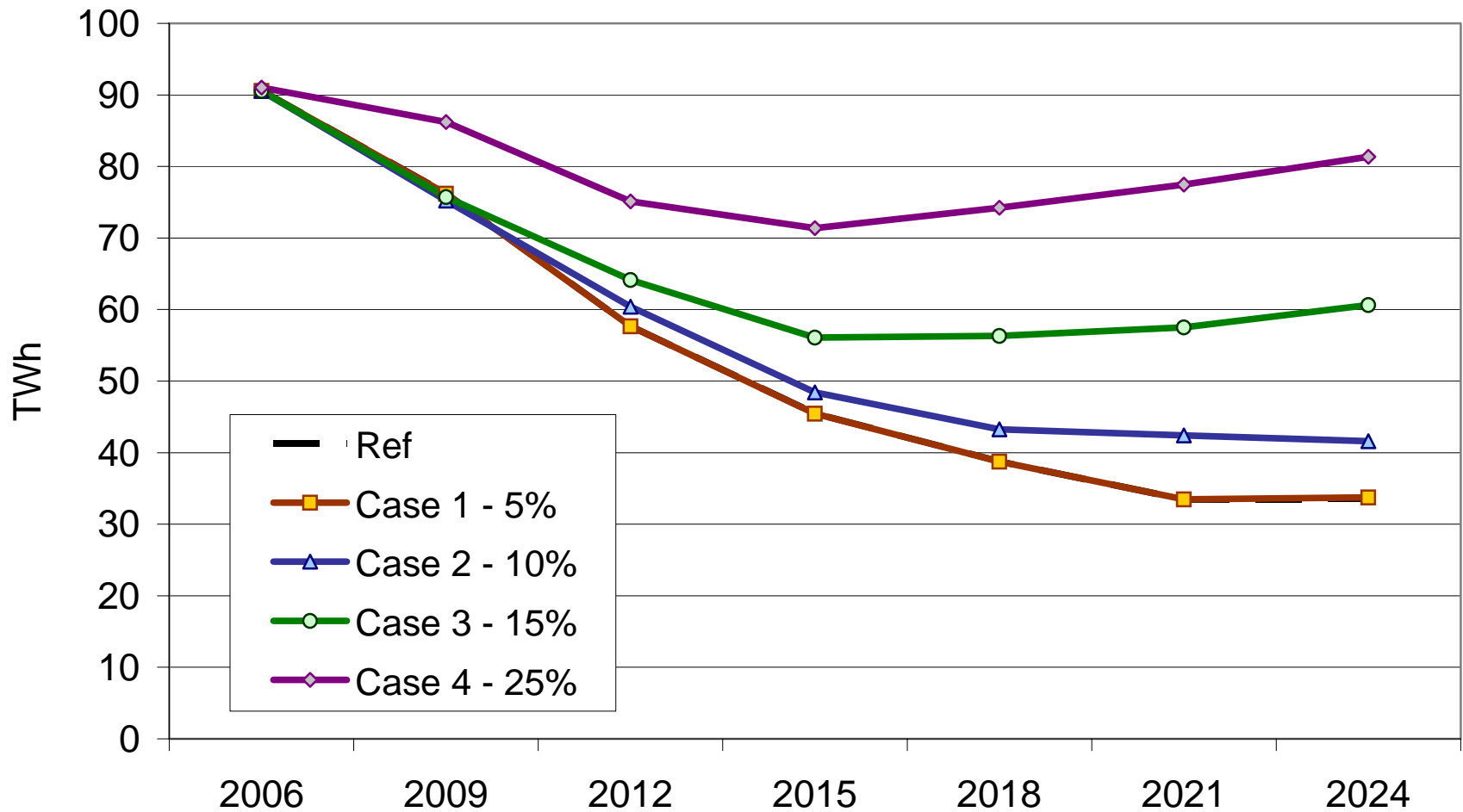
# What happens to regional wholesale energy prices?



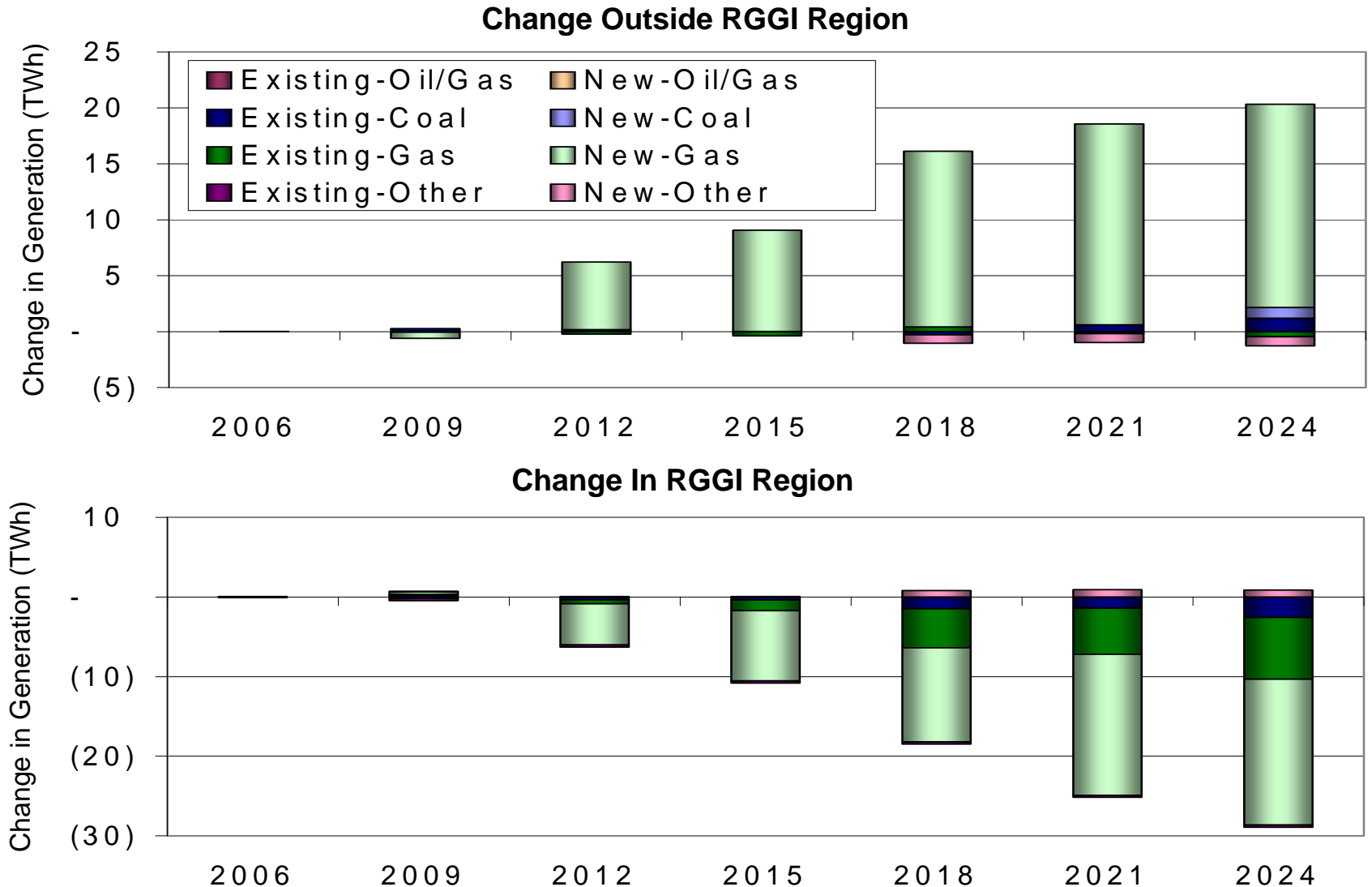
# What is the change in wholesale energy price?



# What is the change in RGGI net imports?

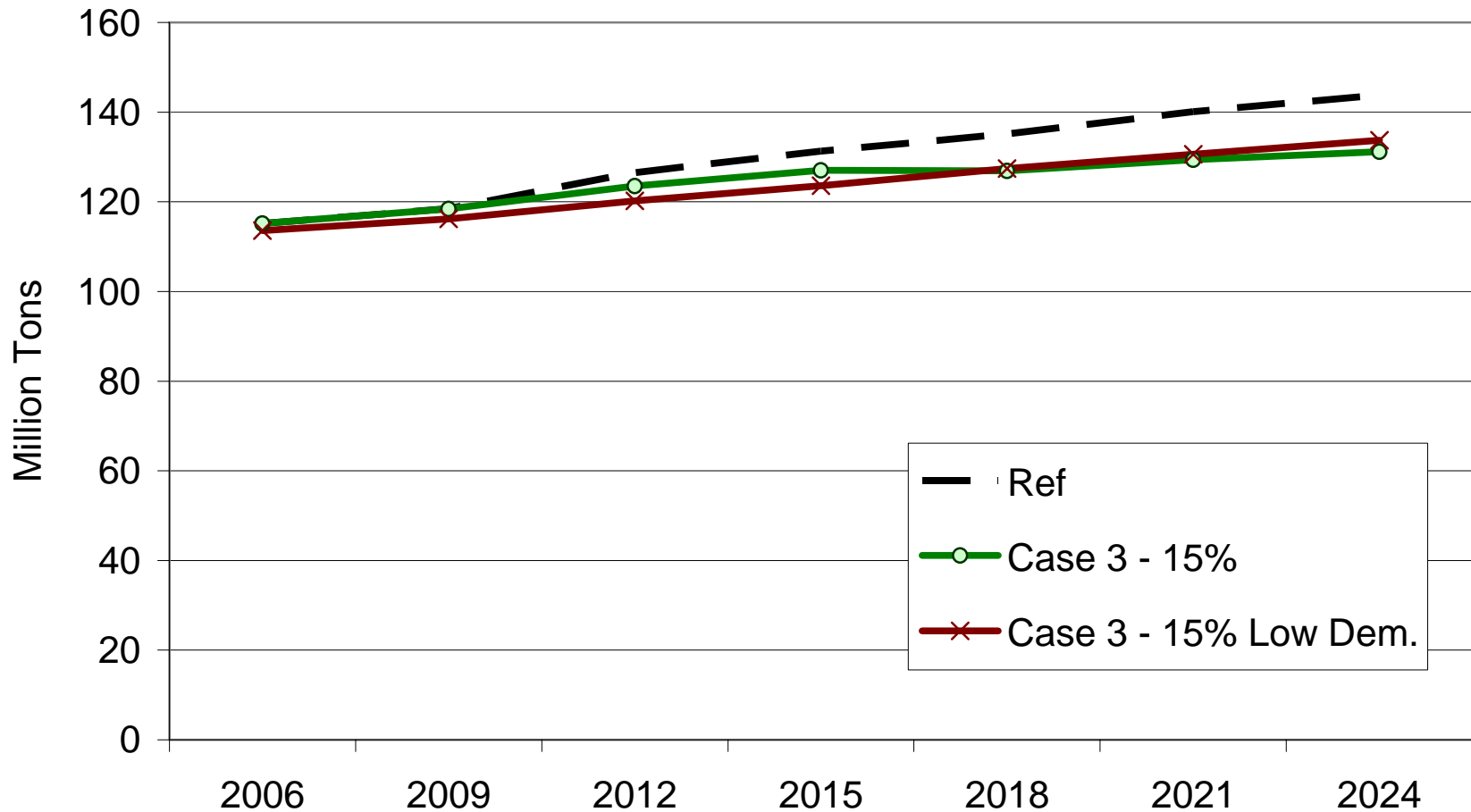


# What is the incremental mix from a 15% RGGI cap?

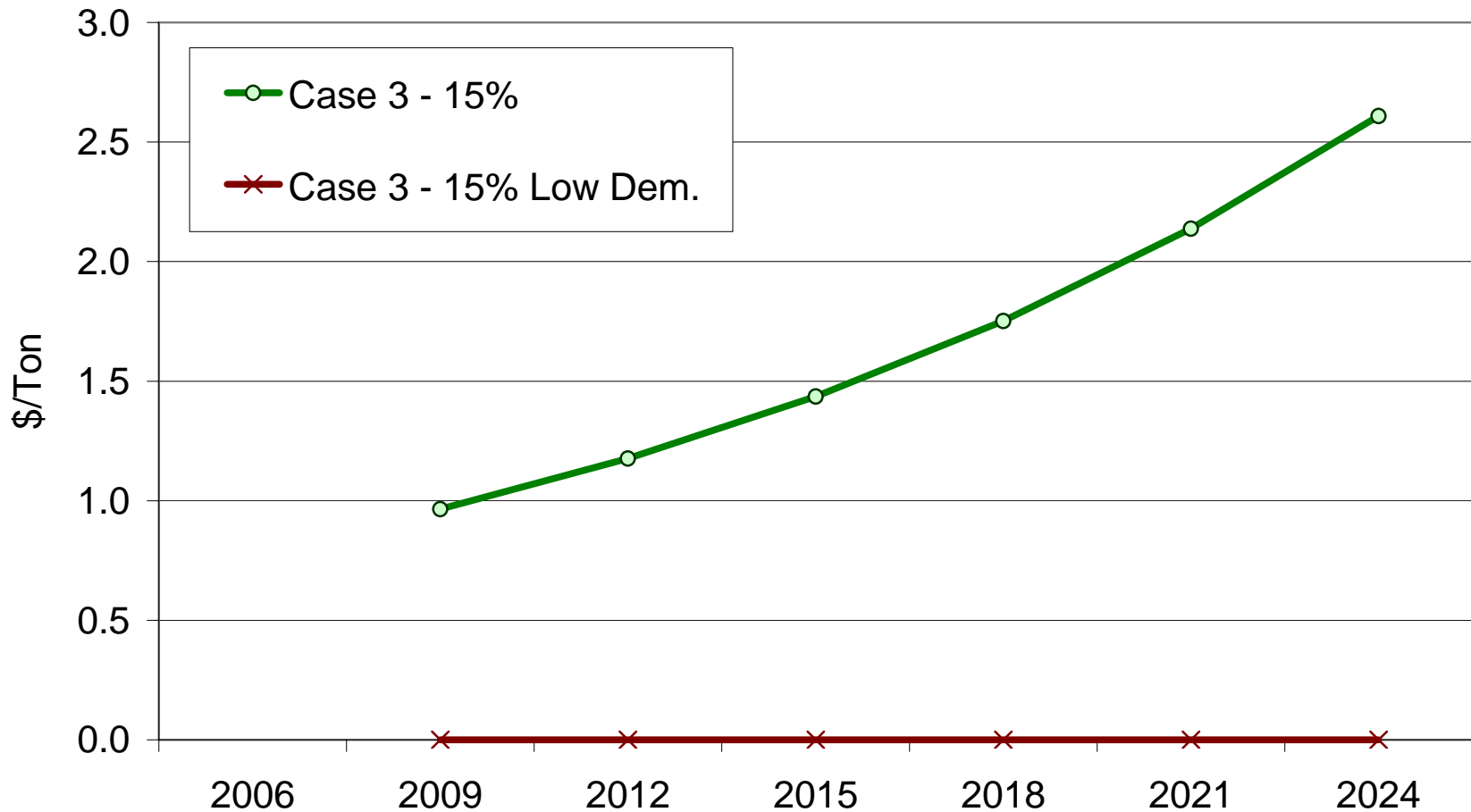


**Carbon Policy Sensitivity:  
Low Demand Case**

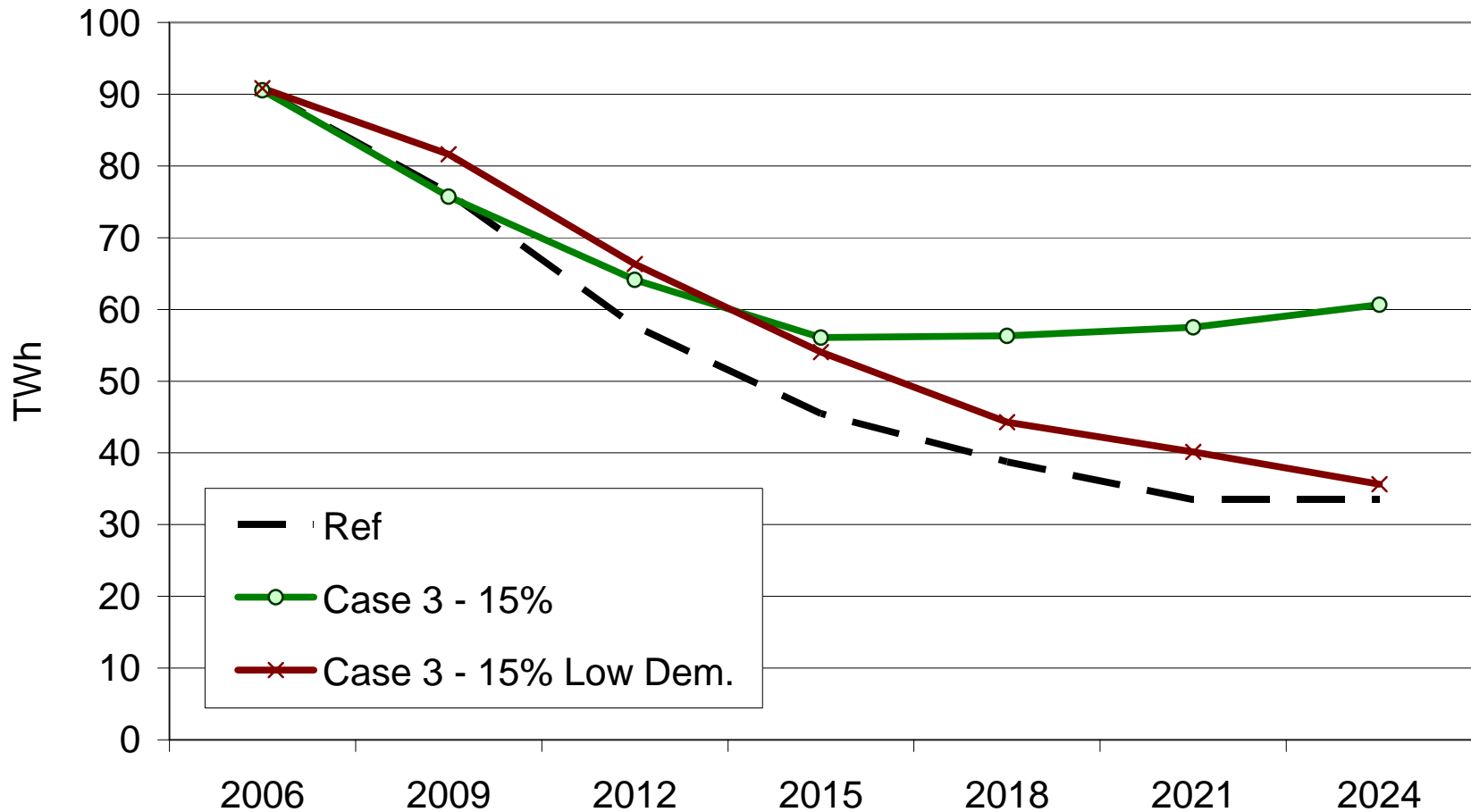
# What are the regional emissions when demand growth is reduced by 30% and emissions are capped?



# What is the allowance price under the reduced demand growth case with a 15% cap?



# What effect does the reduced demand growth have on RGGI net imports?



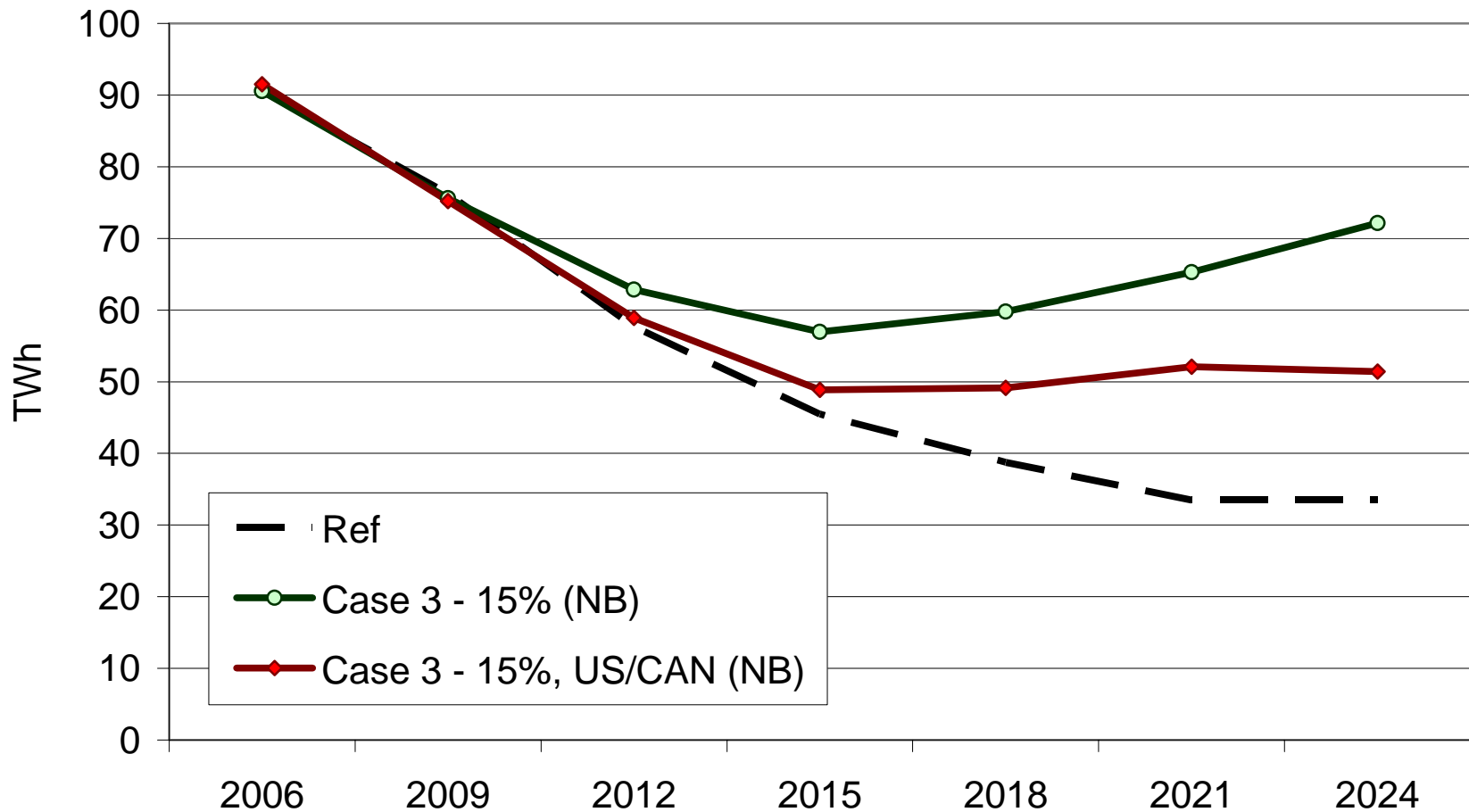
**Carbon Policy Sensitivity:  
U.S. and Canada Carbon Policy Case**

# Modeling US and Canadian Policies

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- To evaluate widespread expectations of US climate carbon policy, as well as modeling current Canadian Kyoto obligations, we developed conservative carbon policy proxies:
  - *Canada*: capped emissions at 2008 levels with CO<sub>2</sub> allowance price capped at US\$10/ton CO<sub>2</sub>
  - *US* : emissions are capped at 2015 levels starting 2015

# What impact do these policies have on imports?



# **Key Observations**

# Key observations

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- Over 20-year modeling horizon, RGGI reference case projects :
  - Increasing CO<sub>2</sub> emissions reaching 143 million tons by 2024
  - Declining wholesale electricity prices due to lower natural gas prices
  - Declining imports from outside RGGI region
  - Increase in natural gas generation and relatively steady coal generation
  - Increase in nuclear (uprates) and renewable generation (RPS)

## Key observations (2)

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### ➤ *Initial Carbon Policy Scenarios:*

- Allowance prices ranging from 0 to \$7/ton (25% scenario),
- Electricity price increases from 0 to almost 6% (25% scenario)
- Imports decline less than in reference case due to leakage primarily in the form of new combined cycle gas builds outside RGGI region

### ➤ Comparisons with additional policies suggest differences to simplistic carbon scenarios:

- *“Energy efficiency” proxy case (reduced demand growth case):* emissions trajectory lower, lower allowance price, and decreased imports
- *US and Canadian carbon policy proxy (NB)* imports decline to Reference Case levels, allowance prices rise

# Caveats – The challenge of forecasting

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- Part of the nature of forecasting is the need to address inherently uncertain issues that have definitive impacts on the future operation of the power system.
- No forecast is going to be “right” due to the fact that no one has a crystal ball regarding many of the key underlying issues, but it is extremely useful in determining directionality and cause and effect.
- Policy analysis requires two things:
  - A Reference Case on which to base comparisons; and
  - Scenarios that examine the impact of changing policy, technical and market parameters.
- The purpose of a Reference Case is twofold: 1) to understand system operations under existing – or expected – regulations and 2) to establish points of comparison for policy analysis.
- When comparing policy/technology/market scenarios to the Reference Case, the goal should be to understand the impacts of the variables being examined. In order to understand what changes are being driven by, it is often best to change one thing at a time (isolate the variables).

# Next Steps

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- Finalize Reference Case
- Examine other policy and sensitivity cases
  - CO2 abatement
  - Revised high demand
  - Energy efficiency resources
  - Offsets
  - Other

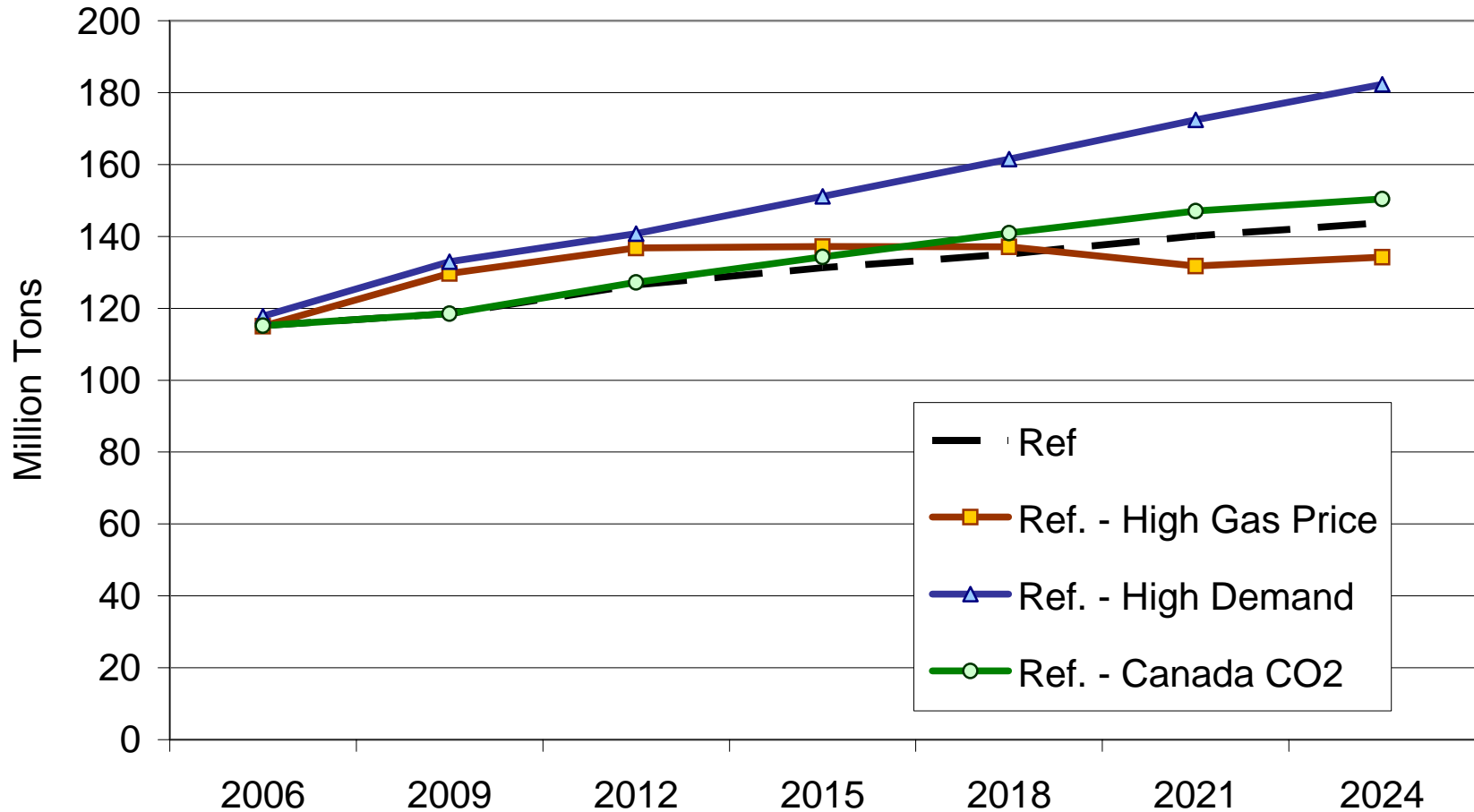
# **Appendix: Reference Case Sensitivities**

# Reference Case Sensitivities

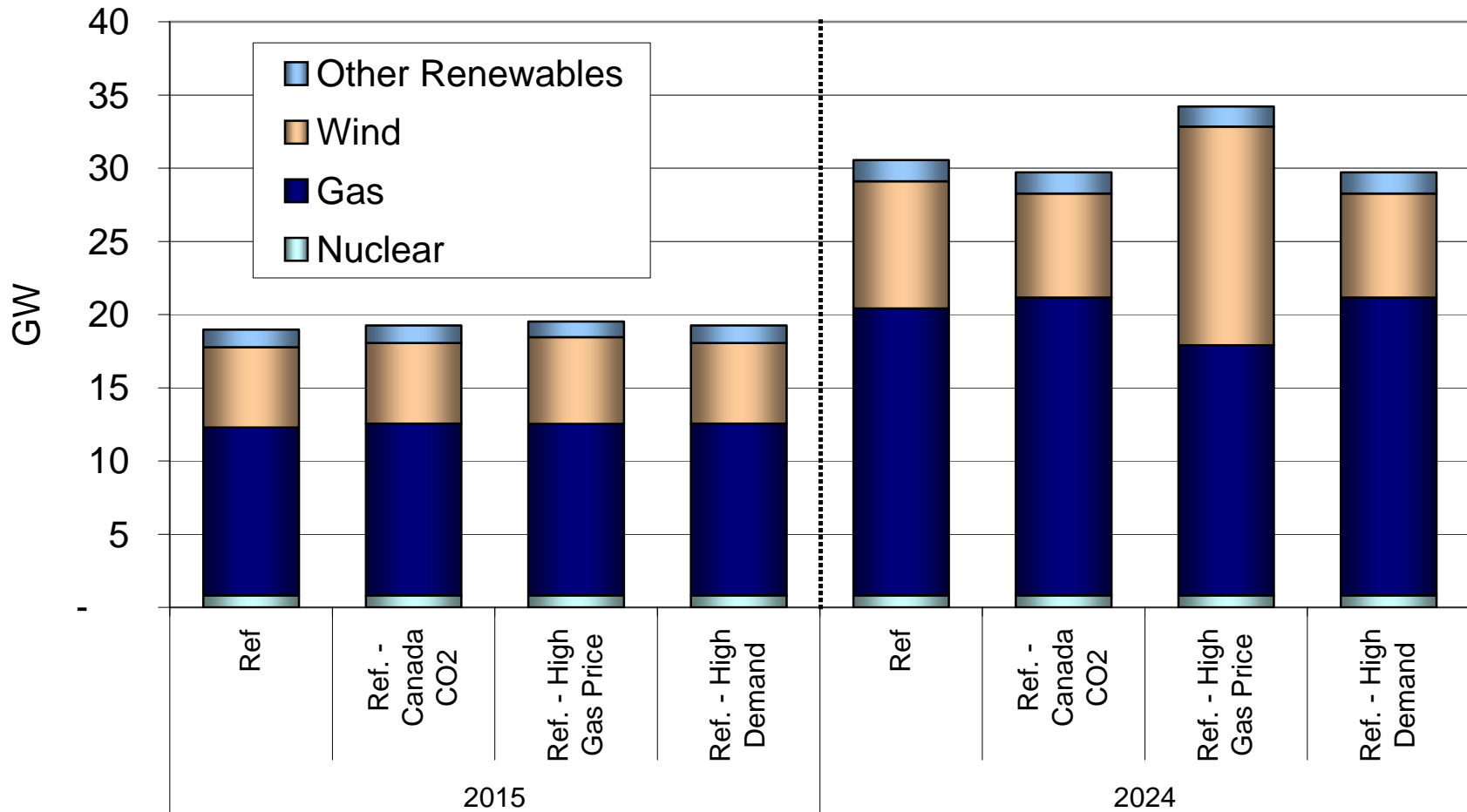
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- High Gas Prices
- High Demand
- Canadian Carbon Policy

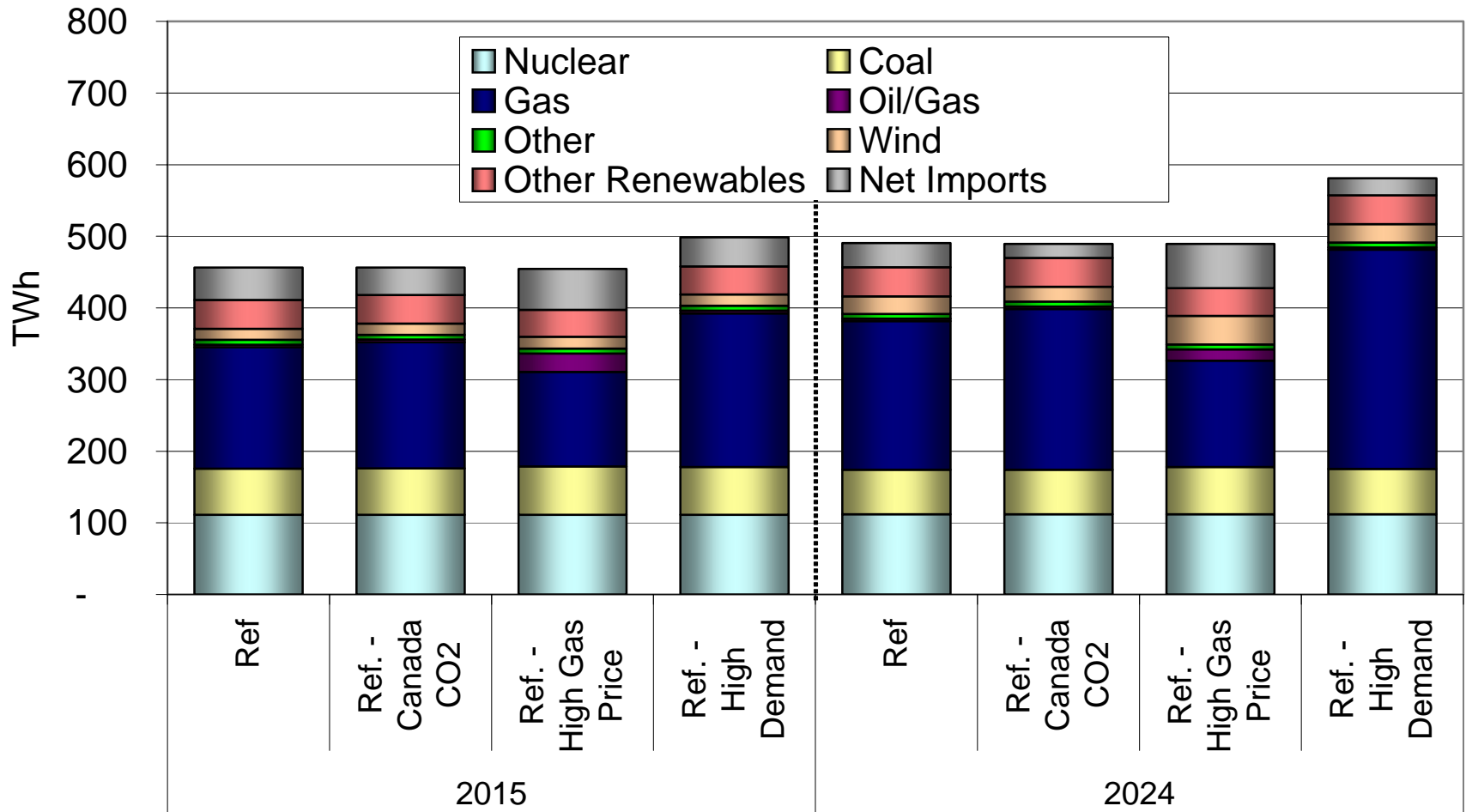
# What is the projected change in CO<sub>2</sub> emissions in RGGI states under various scenarios?



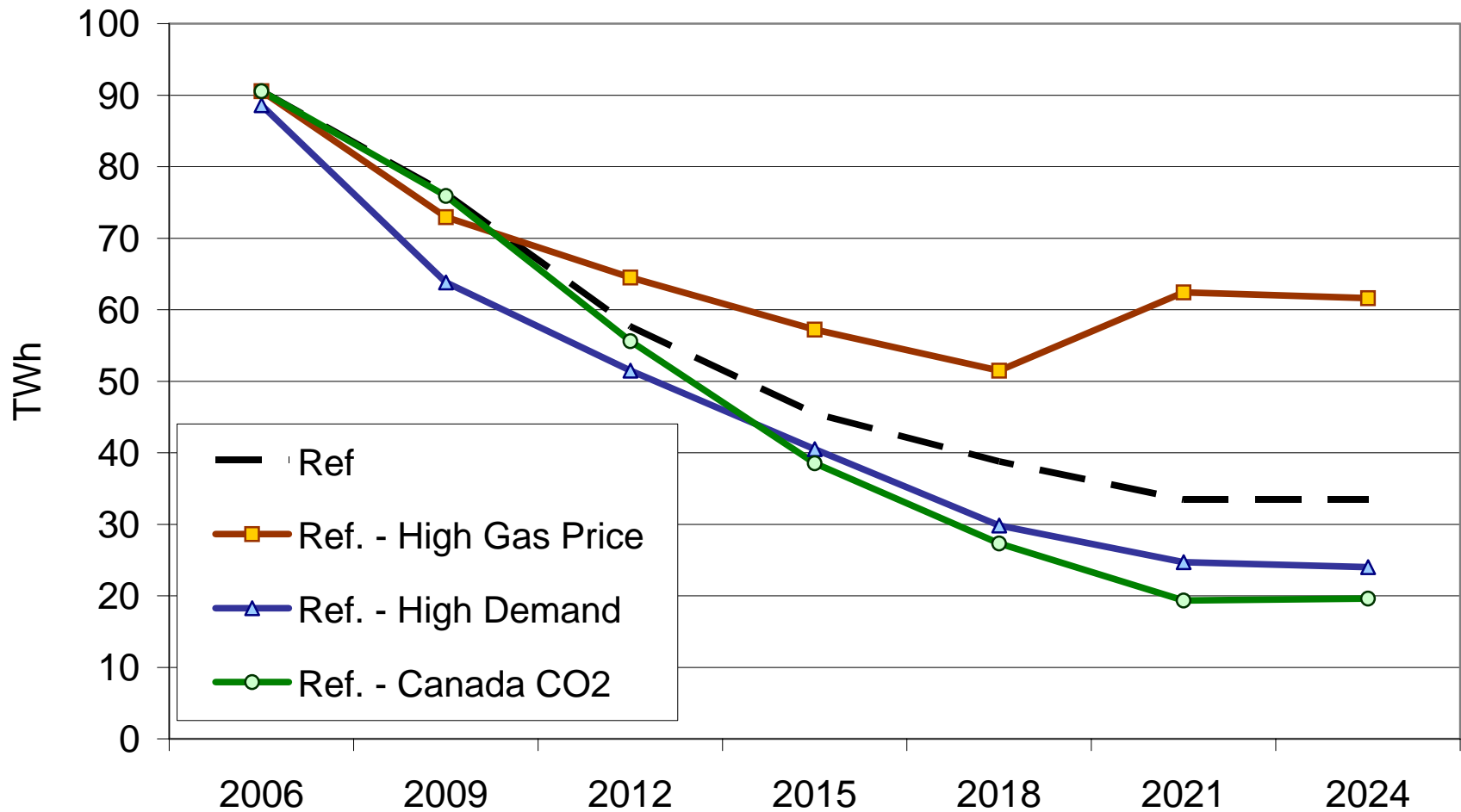
# What new electricity generating capacity is projected to be built in RGGI states?



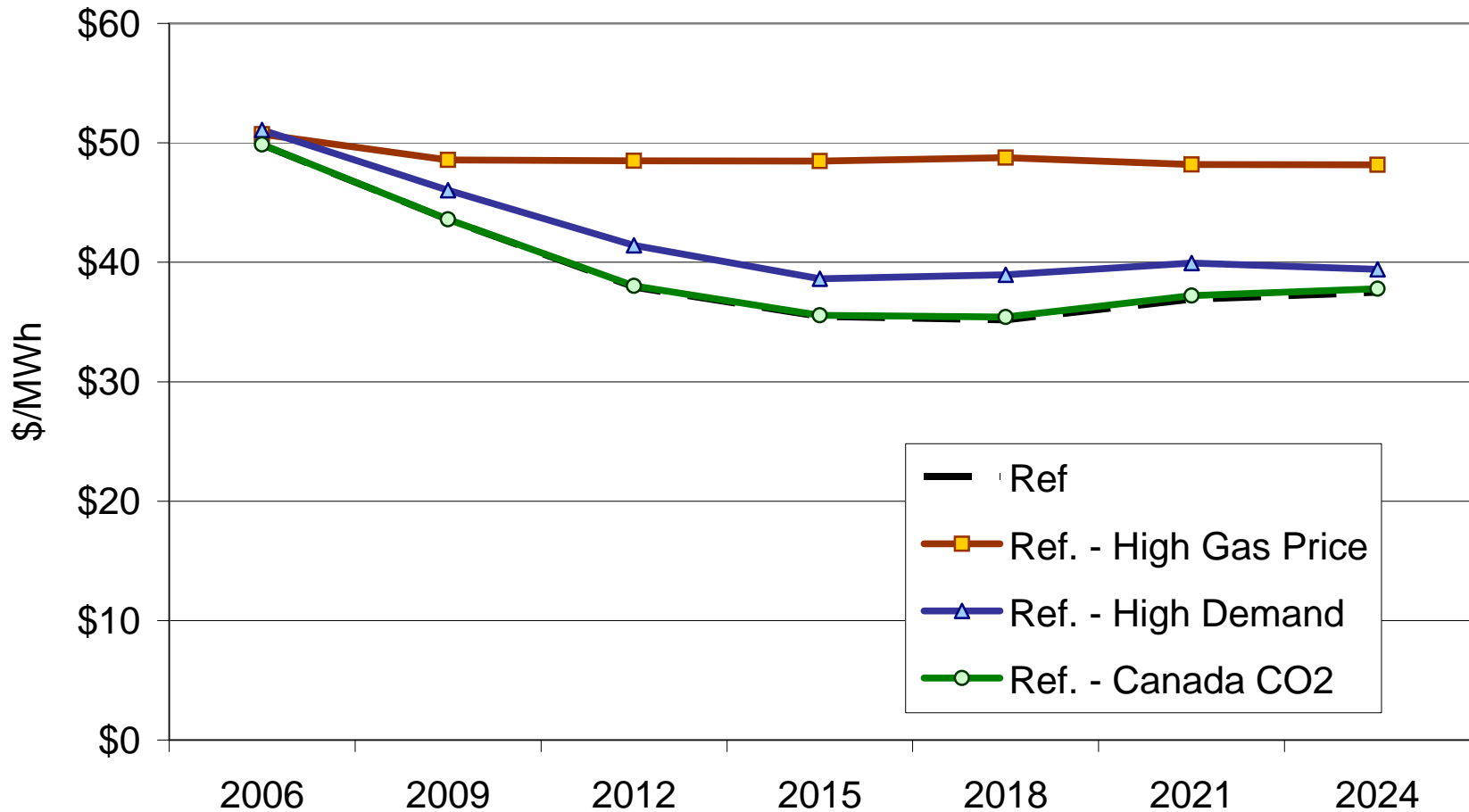
# What is the total mix of electricity generation projected in RGGI states?



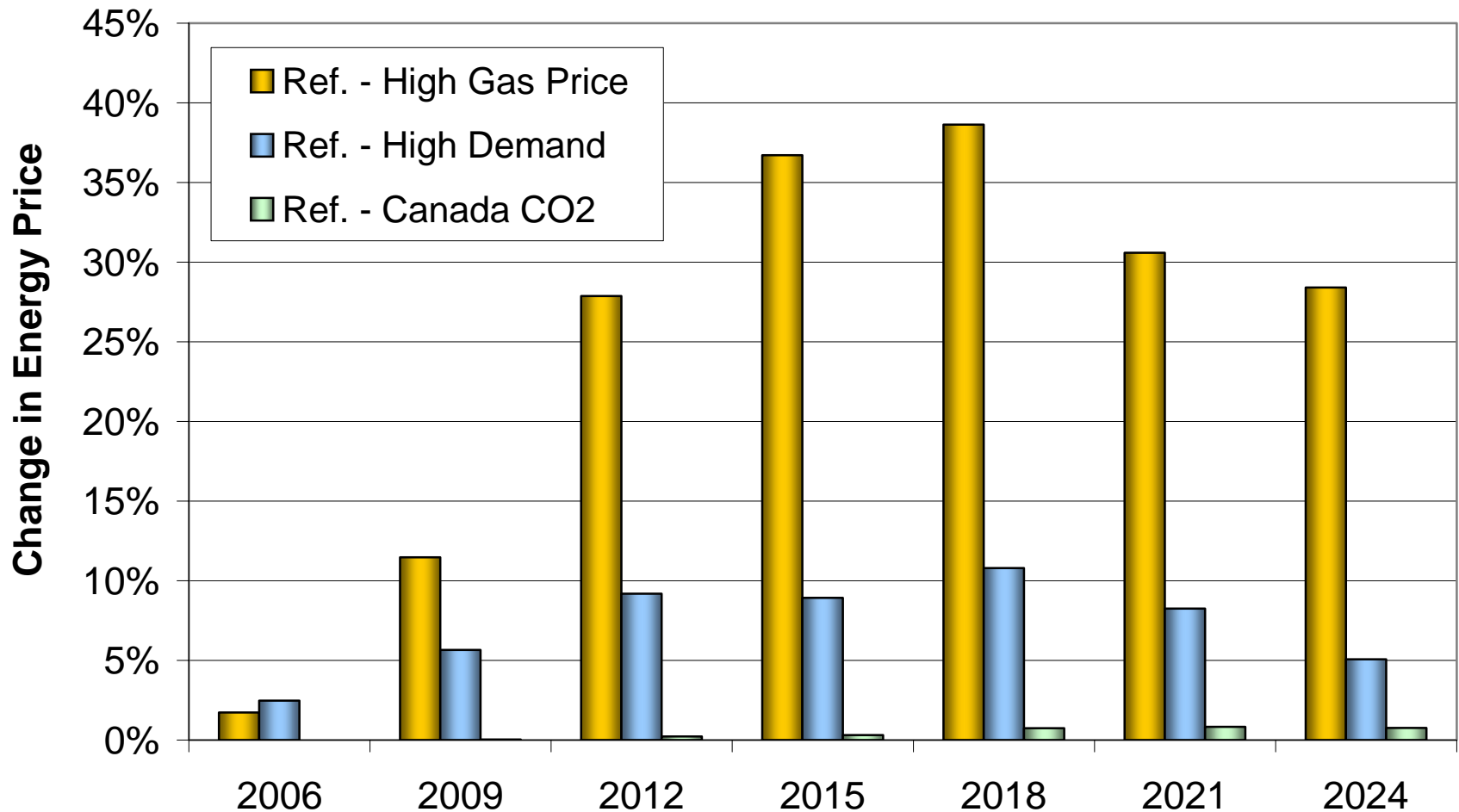
# What are the total net imports into the RGGI region under various scenarios?



# How do projected wholesale electricity prices in RGGI states change under various scenarios?



# How do projected wholesale electricity prices in RGGI states change under various scenarios?



# Key Observations – Reference Case Sensitivities

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- Initial sensitivity runs on reference case show:
  - *High electricity demand scenario* : increased emissions, significantly reduced imports, energy prices unchanged from reference (and less than current levels)
  - *High gas price scenario* : lower emissions, increased renewable generation, and higher net imports, electricity price comparable to current level
  - *Canada policy scenario*: increased builds in RGGI region (along US side of Canadian border), increased emissions in RGGI region, significant decrease in imports