

# ECRAN Workshop

## Module 4

### Transformation HAM Scenarios

Prepared By Turkish LEAP Workshop Team (MENR)

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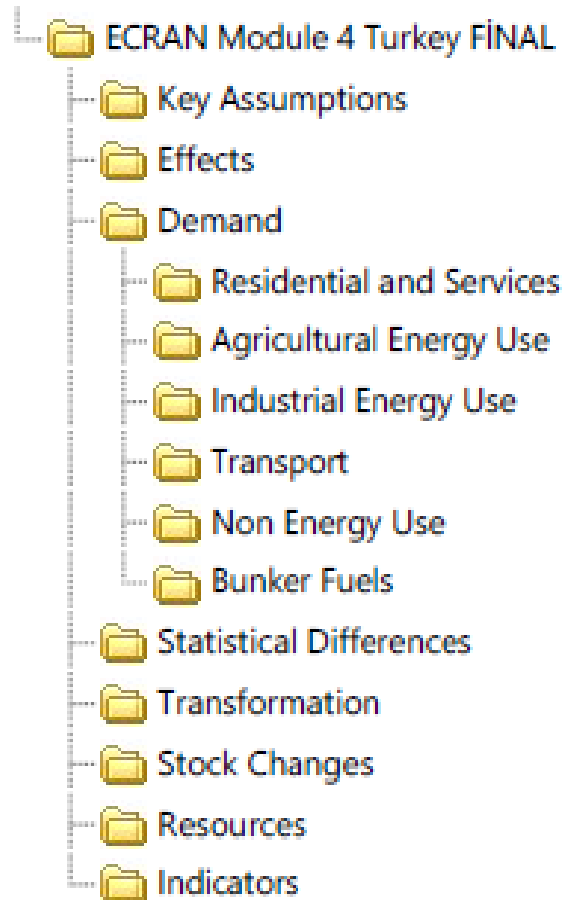
Ergün KOÇ

Pelin BUZLUK

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At the first stage, to create a model, demand , transformation data tree was constructed

Tree Structure for ECRAN Module 4 Turkey FINAL.



# Important Key Assumptions:

- GDP (TurkStat)
- Population (TurkStat)
- Absolute Value Added (TurkStat)

# Basic Parameters

- Historical Data 1990-2013, Projections 2014-2050

Basic Parameters

Scope & Scale | **Years** | Default Units | Costing | Calculations | Loads | Optimization | Stocks | Internet | Charts | Folders | Security

Base Year: 1990 (First calculated year)

First Scenario Year: 2014 (First year in which scenario expressions used)

End Year: 2050 (Last calculated year)

Results Every: 1 years (must= 1 for cost and stock turnover analyses)

Monetary Year: 2005 (Year to which all costs are discounted)

First Depletion Year: 2008 (First year in which reserves are depleted)

☒ Count Costs to End Year

Last Year to Count Costs: 2023 (costs after this year will be ignored)

Default Time-Series Years:

1. 2000 2. 2010 3. 2020 4. 2023

Close Help

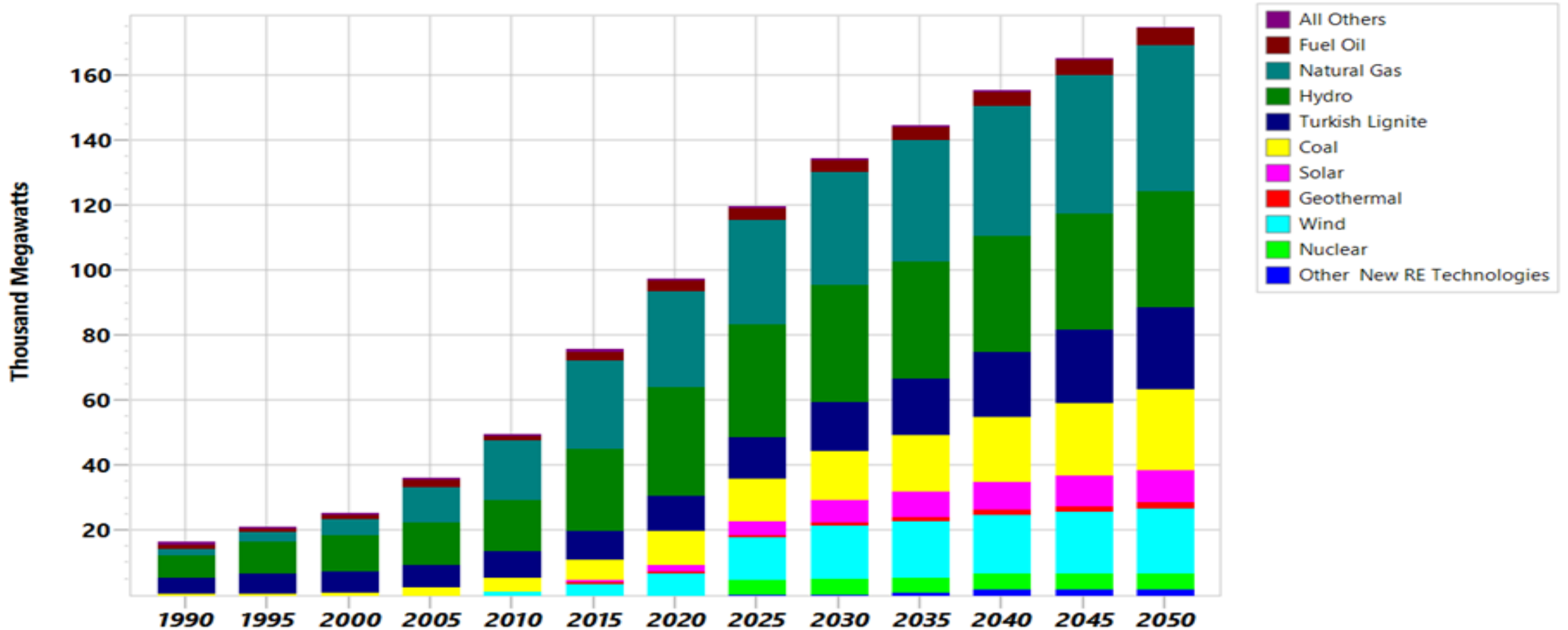
# Business As Usual Scenario

- *In BAU scenario there are also investments in RE and low carbon measures.*
- In BAU scenario most of electricity targets and policies were included;
  - ❖ A nuclear power plant up to 2030. (4800 MW )
  - ❖ Decreasing the share of NG in power sector down to 30% in 2030.
  - ❖ Electricity losses (all losses: Distribution and Tech) are decreasing to %15 in 2030, then 12% 2050.
  - ❖ Wind and solar power have been increased by 2050.
  - ❖ Full utilizing of all possible Hydro potential (considering the important environmental concerns) Appx 36.000 MW in 2050
  - ❖ Electricity exports and imports remains constant until 2050

# BAU Capacities By Sources

## Capacity

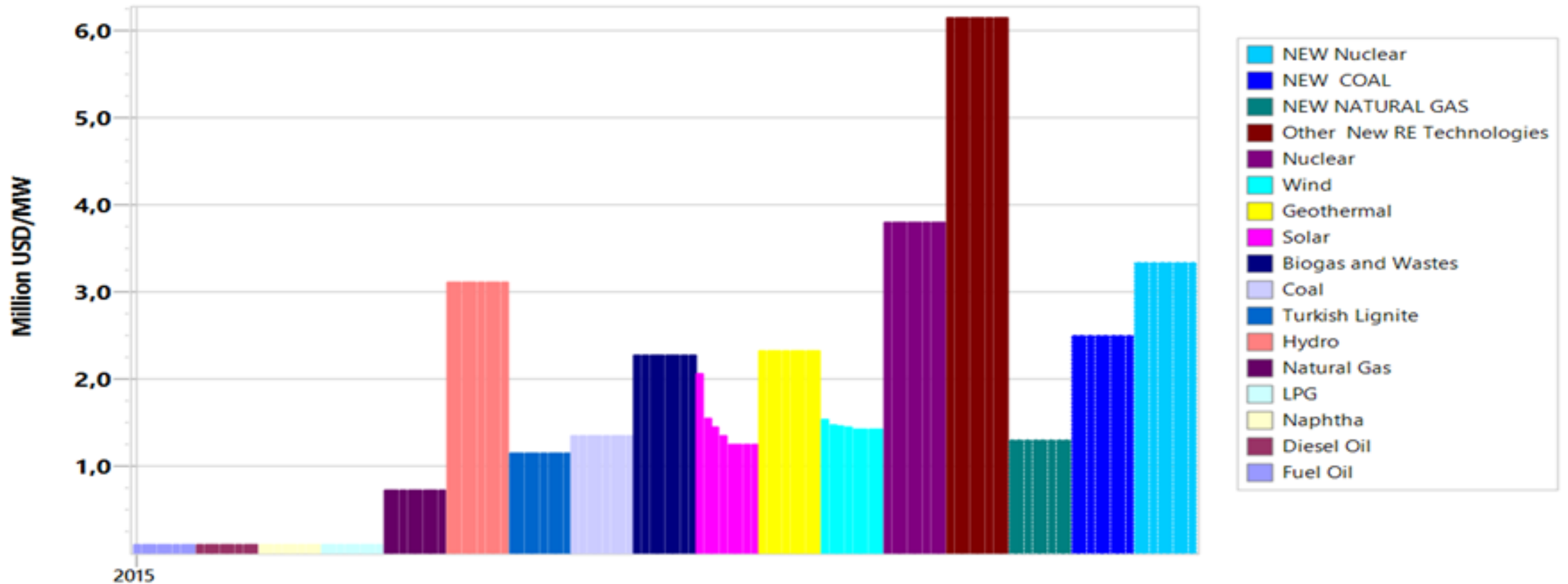
BAU (Business As Usual) Scenario, All Capacities



# Capital Costs

## Processes: Capital Cost (Million USD/MW)

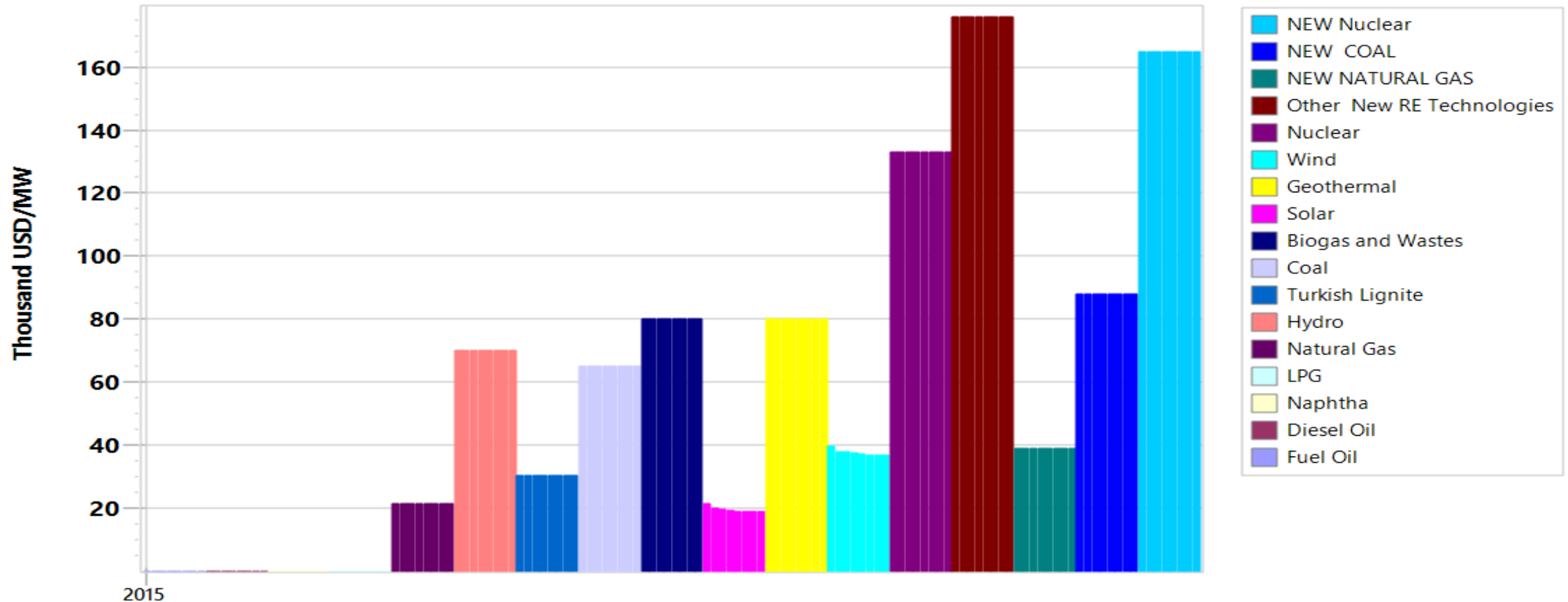
Scenario: BAU (Business As Usual), Region: All Turkey\_2.0



# Fixed O&M costs

## Processes: Fixed OM Cost (Thousand USD/MW)

Scenario: BAU (Business As Usual), Region: All Turkey\_2.0





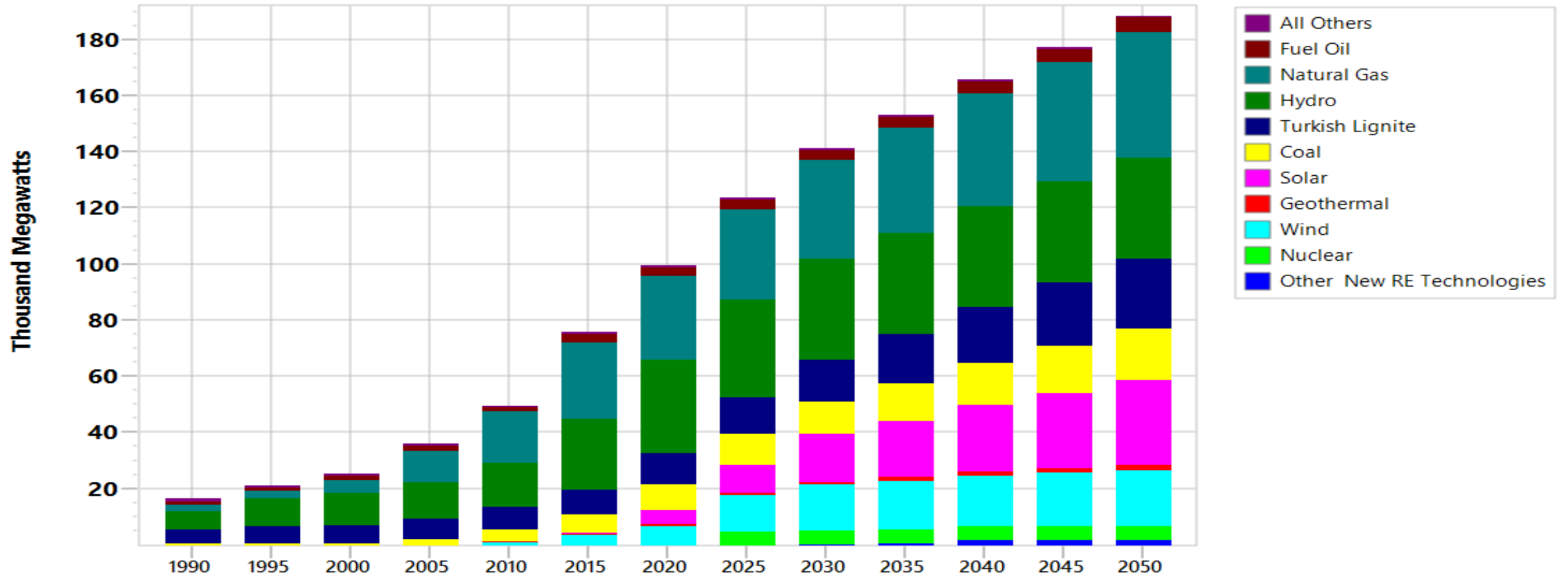
# Mitigation and HAM Scenarios

1. Max Solar P.P Scenario
2. Max Wind P.P Scenario
3. Process Efficiency Scenario (Best Available Technology)
  - a) High Efficient NG –Avg.Pro. Ef. %84 CCGT-CHP
  - b) High Efficient (imported )Coal-Avg. Pro. Ef. 47% IGCC (Integrated Gasification Combined Cycle) Data: World Energy Investment Outlook [WEIO2014PGAAssumptions \(2\).xlsx](#)
4. High Nuclear Power Plant Scenario (Nuc+4)
5. HAM TR Scenario

# Max Solar Scenario

## Capacity

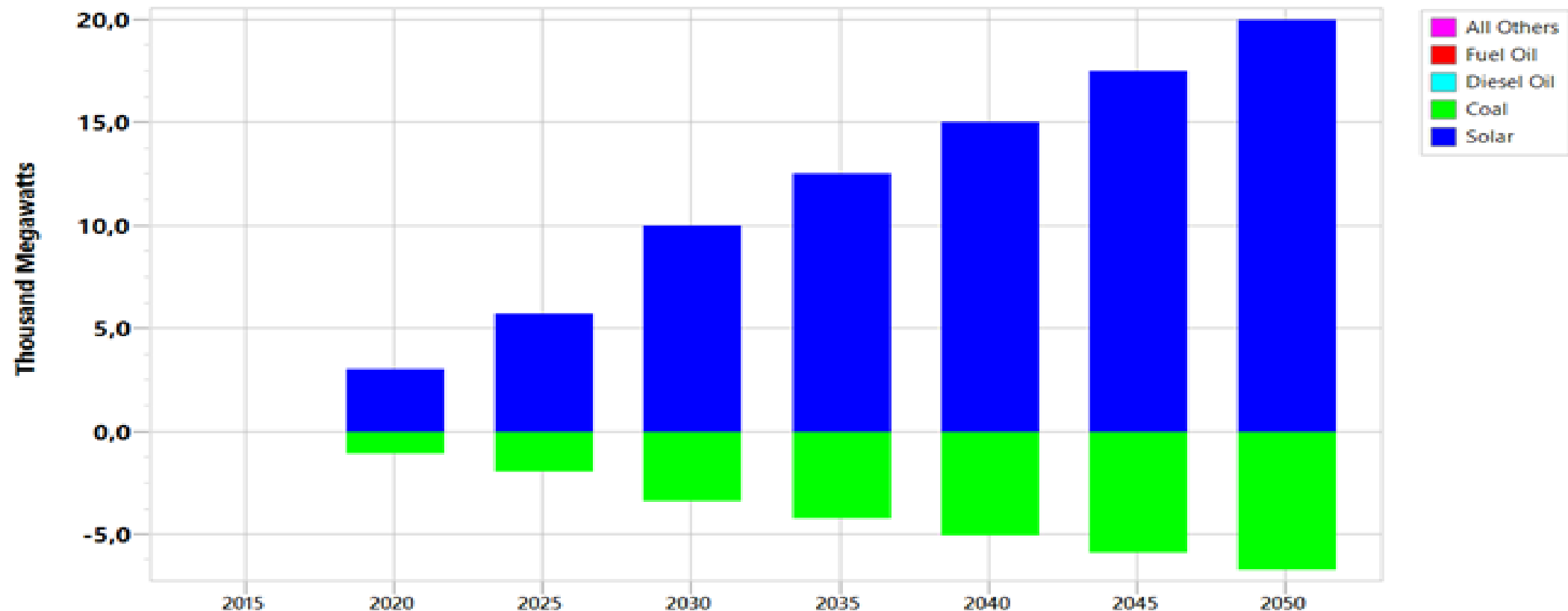
Max Solar PP. Scenario, All Capacities



# Differences Compared to BAU

## Capacity

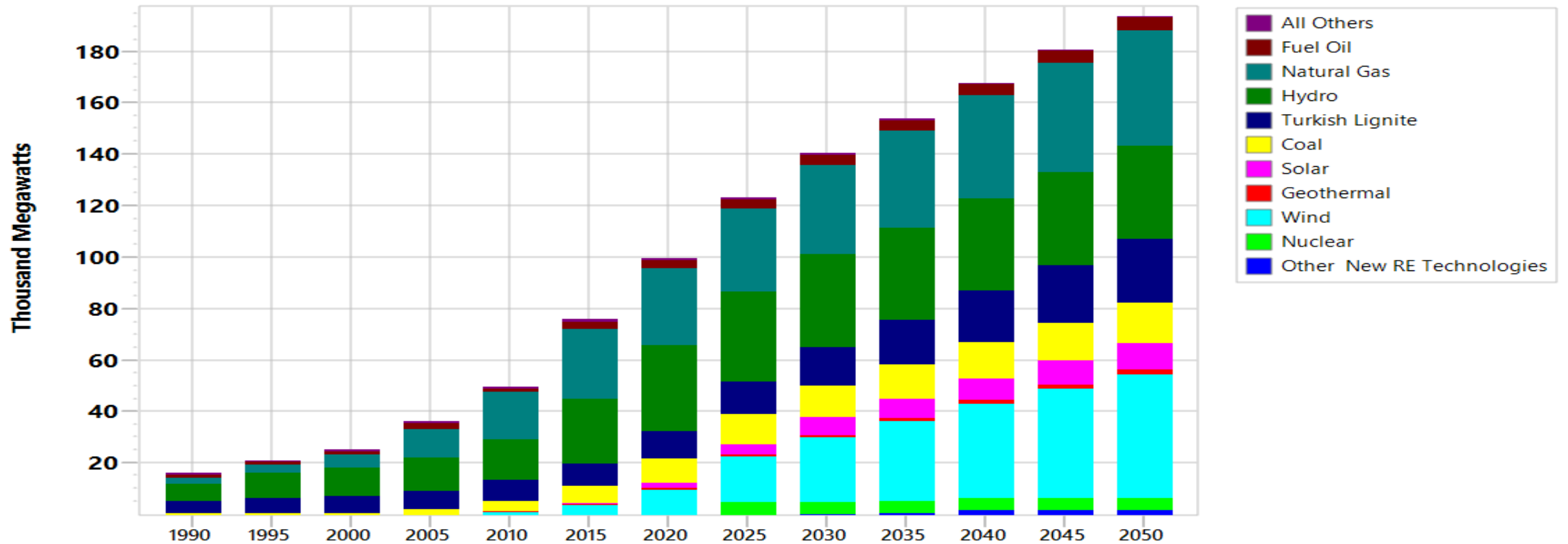
Max Solar PP. Scenario Differences vs. BAU (Business As Usual), All Capacities



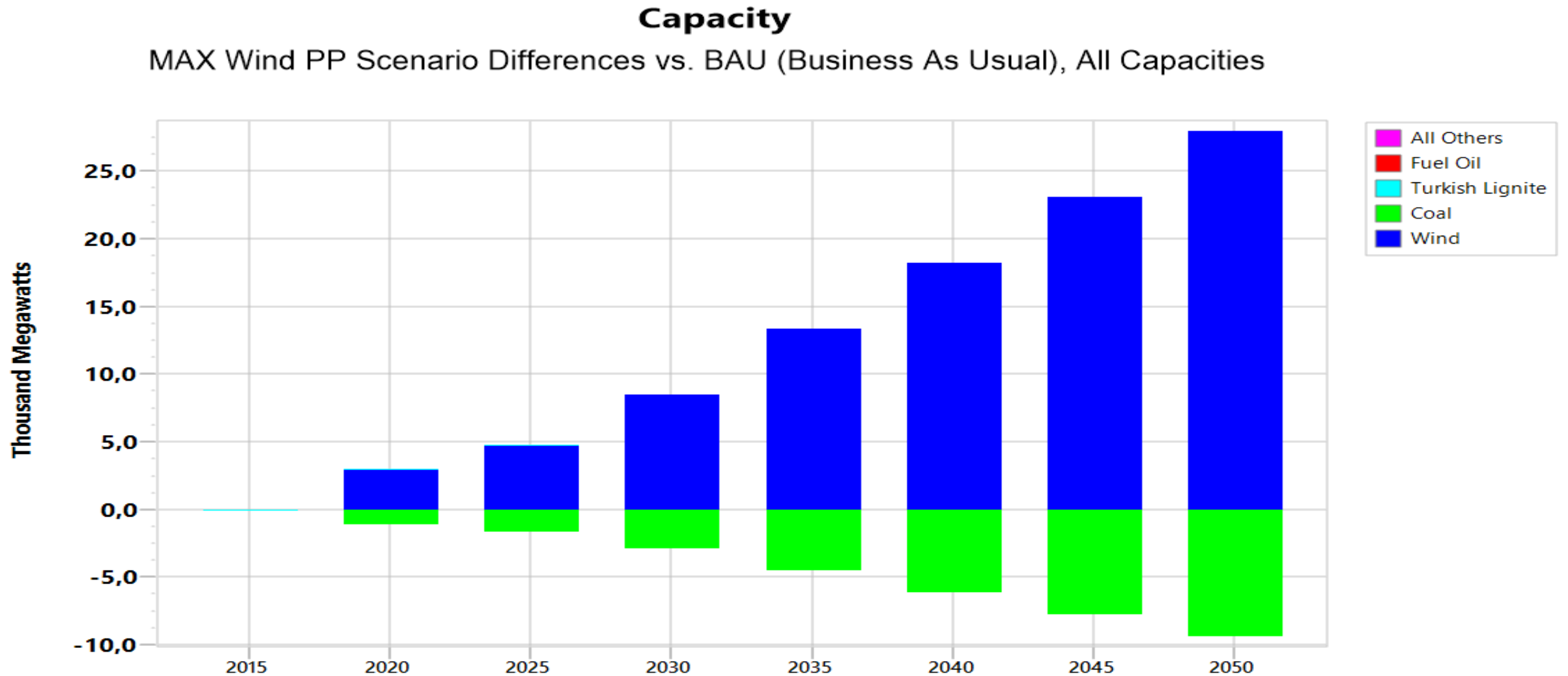
# Max Wind Scenario

## Capacity

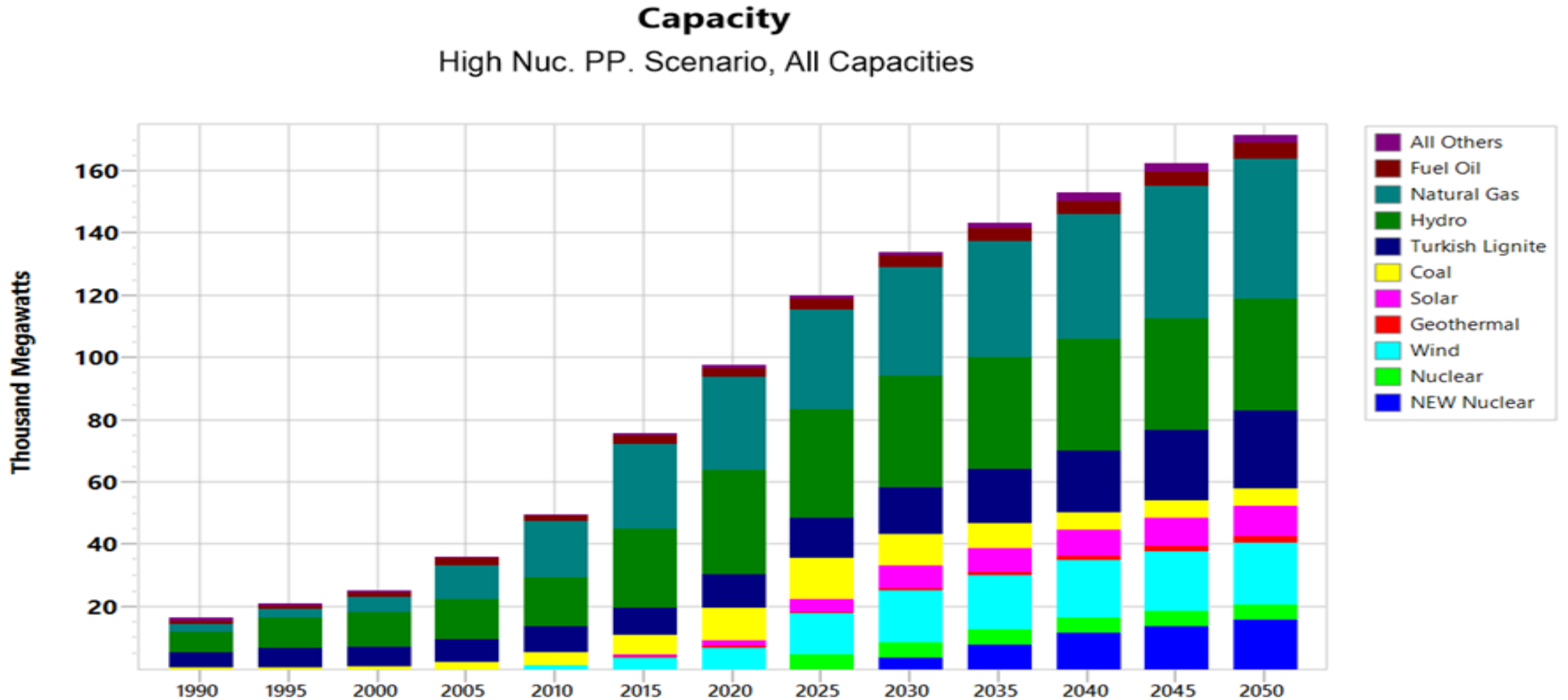
MAX Wind PP Scenario, All Capacities



# Wind Scenario Differences with BAU



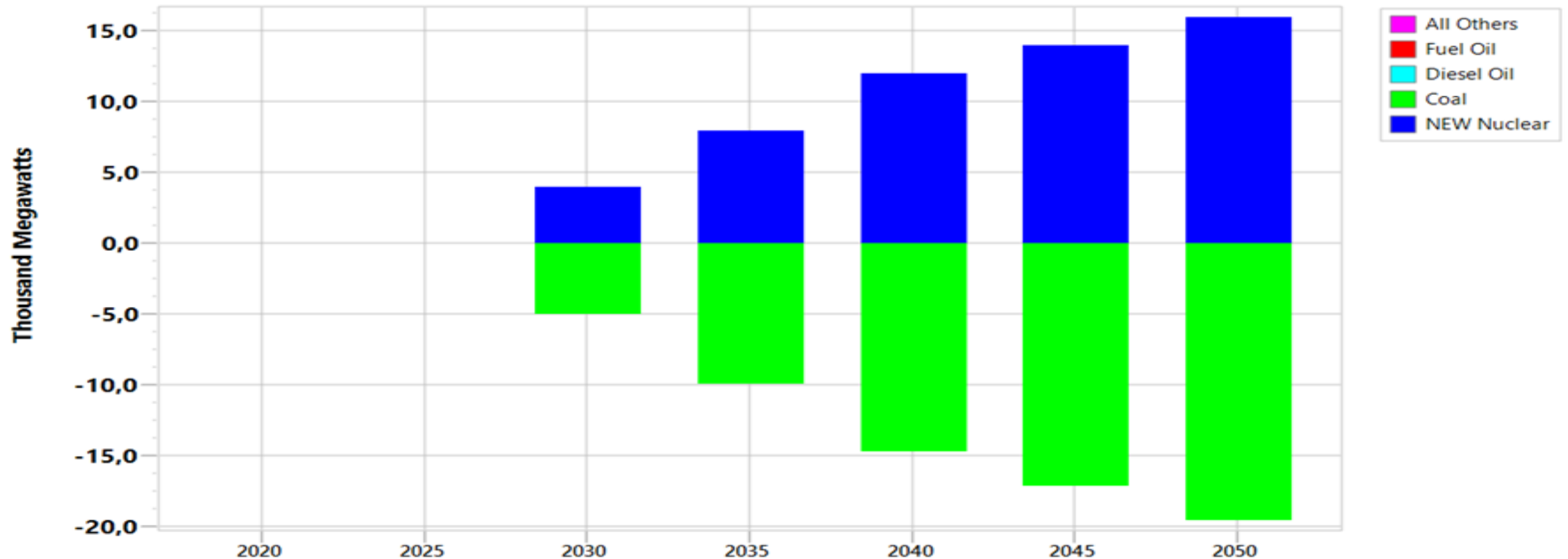
# High Nuclear Power Plant Scenario (Nuc+4)



# Nuclear Scenario Differences With BAU

## Capacity

High Nuc. PP. Scenario Differences vs. BAU (Business As Usual), All Capacities



# HAM Scenario

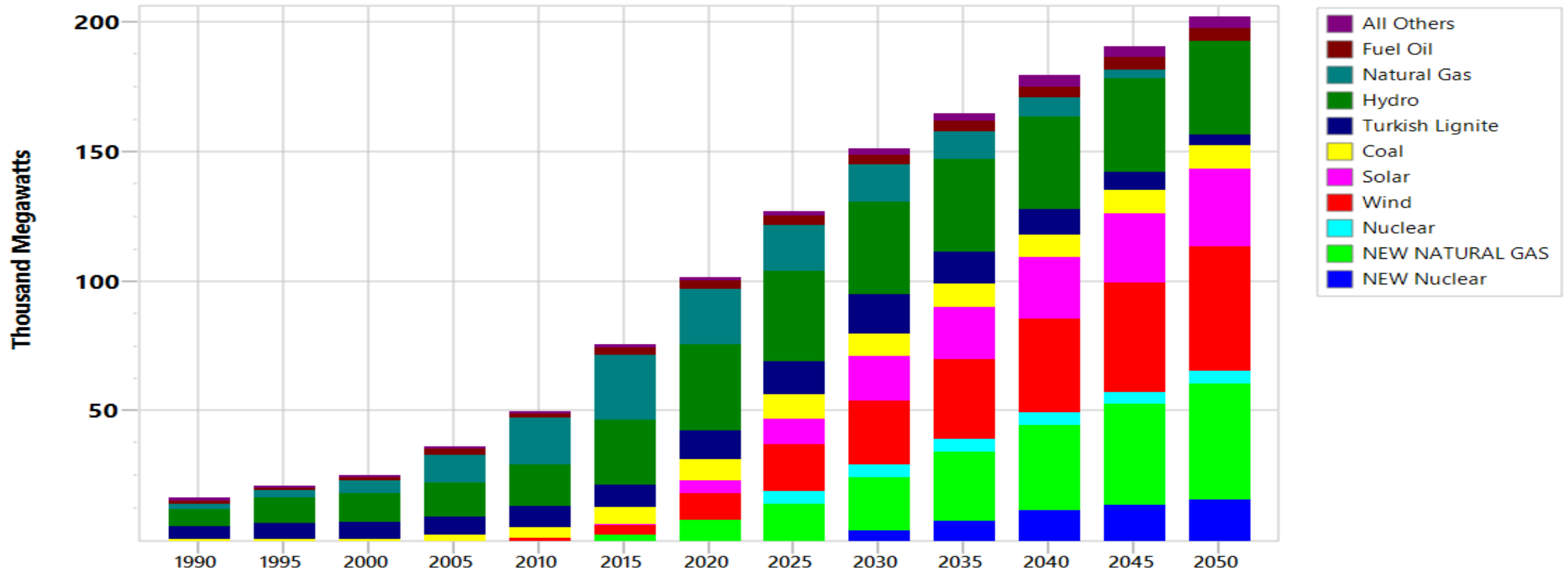
- 5 scenarios, which have best results in cost benefit analyses, were integrated into one scenario, called HAM (Highest Ambitious Mitigation) Scenario (manually and automatically combined by using LEAP software). These scenarios are;
- Max. Solar, Max Wind, High Nuclear and the sub-scenario New Natural Gas scenario.



# HAM Scenario Capacities

## Capacity

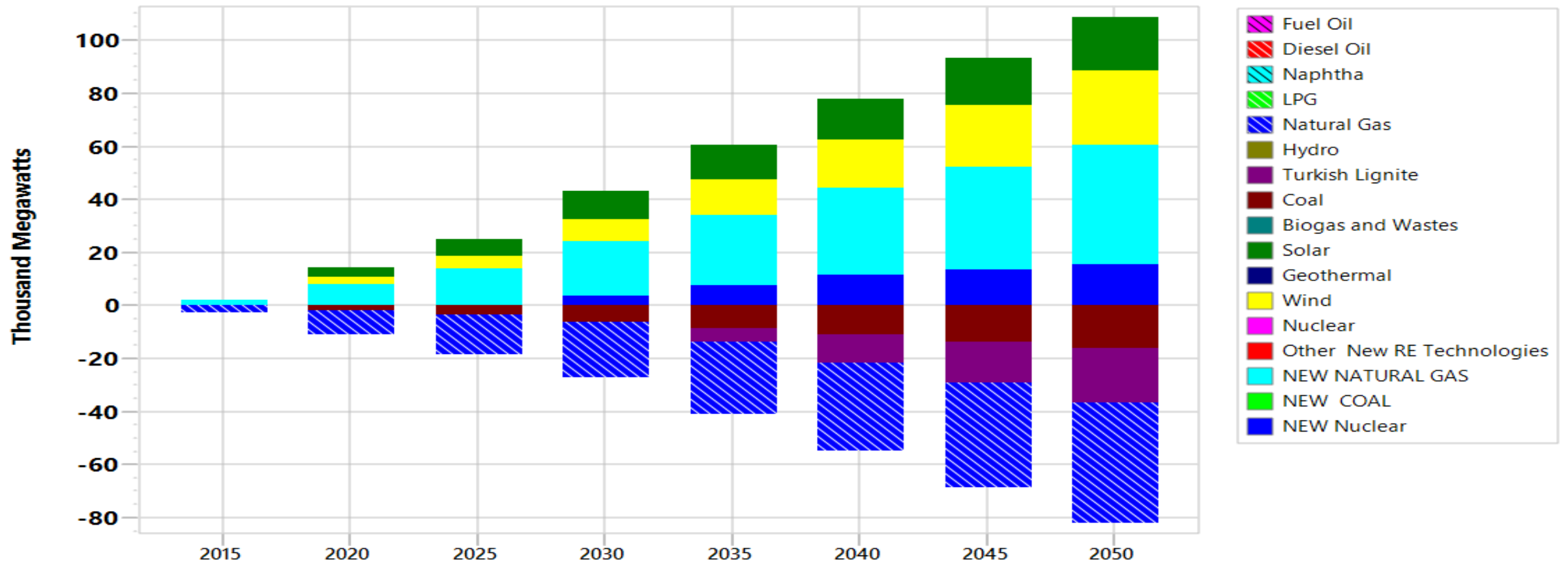
## HAM Scenario Scenario, All Capacities



# HAM Scenario Differences with BAU

## Capacity

HAM Scenario Scenario Differences vs. BAU (Business As Usual), All Capacities

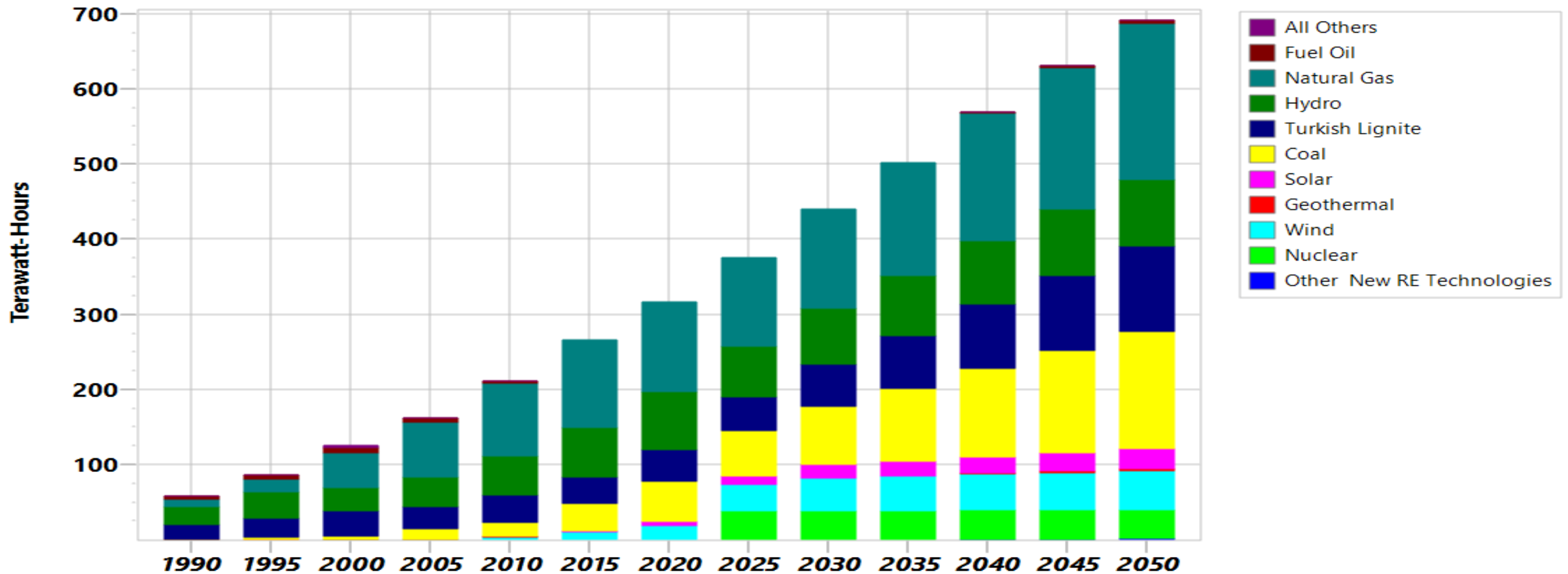


RESULTS?

# BAU Electricity Production by Fuels

## Outputs by Output Fuel

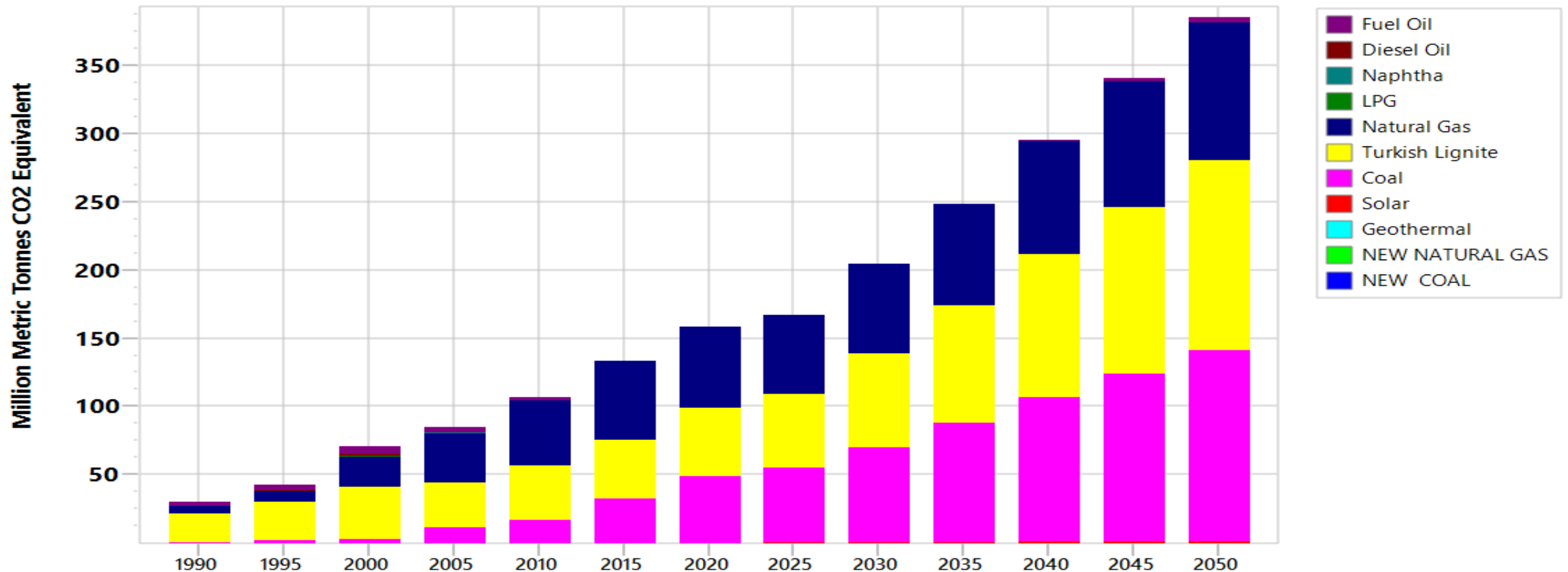
BAU (Business As Usual) Scenario, All Fuels, All Output types



# GHG Emission from Electricity

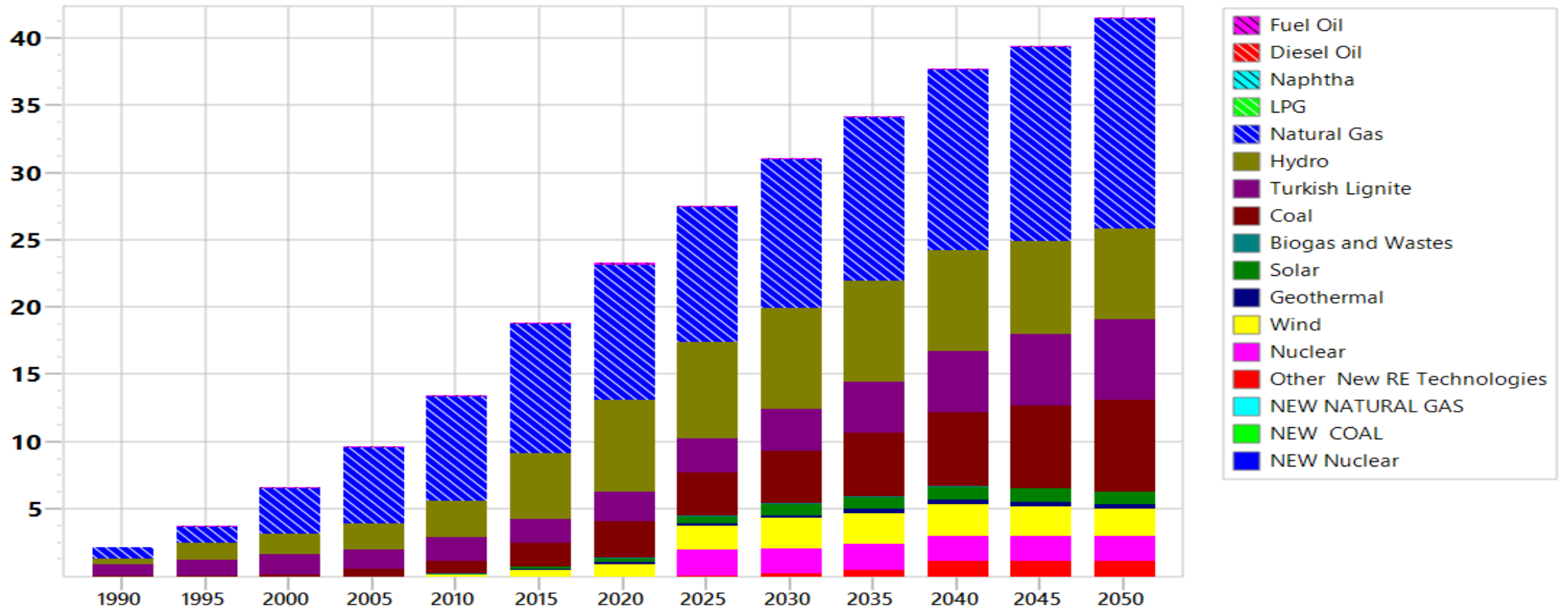
## One Hundred Year GWP: Direct (At Point of Emissions)

BAU (Business As Usual) Scenario, All Fuels, Effects



## Cost of Production

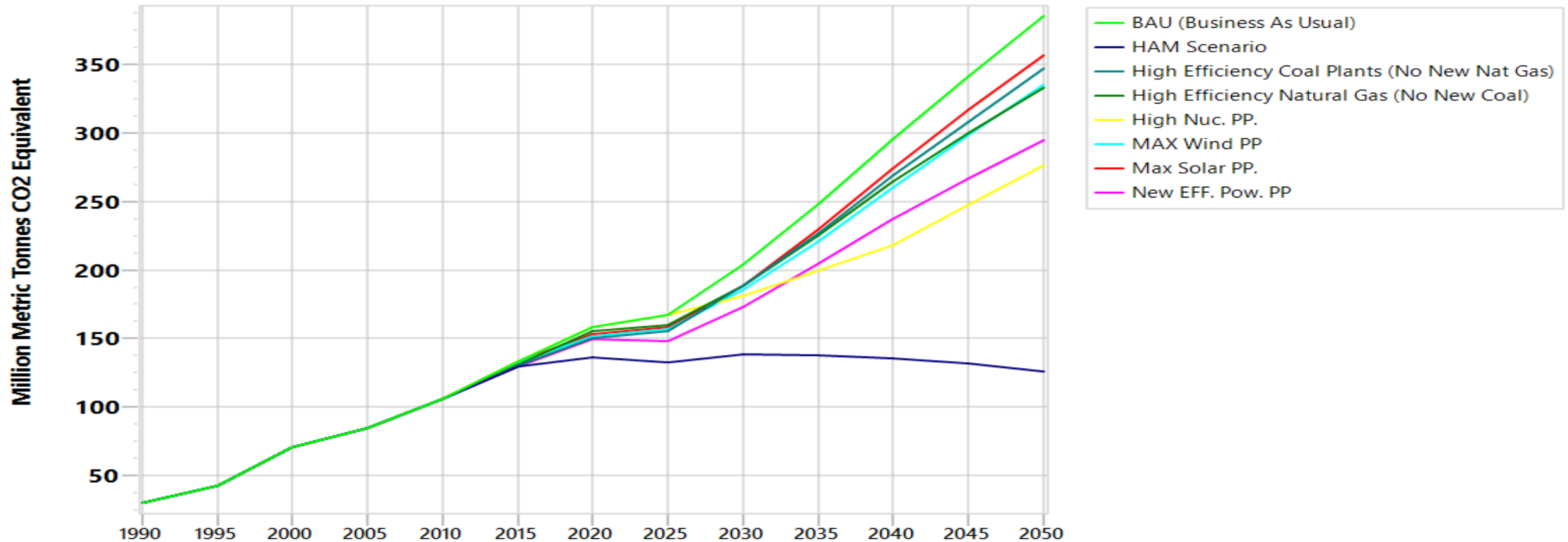
Billion U.S. Dollars



# BAU and HAM Scenarios

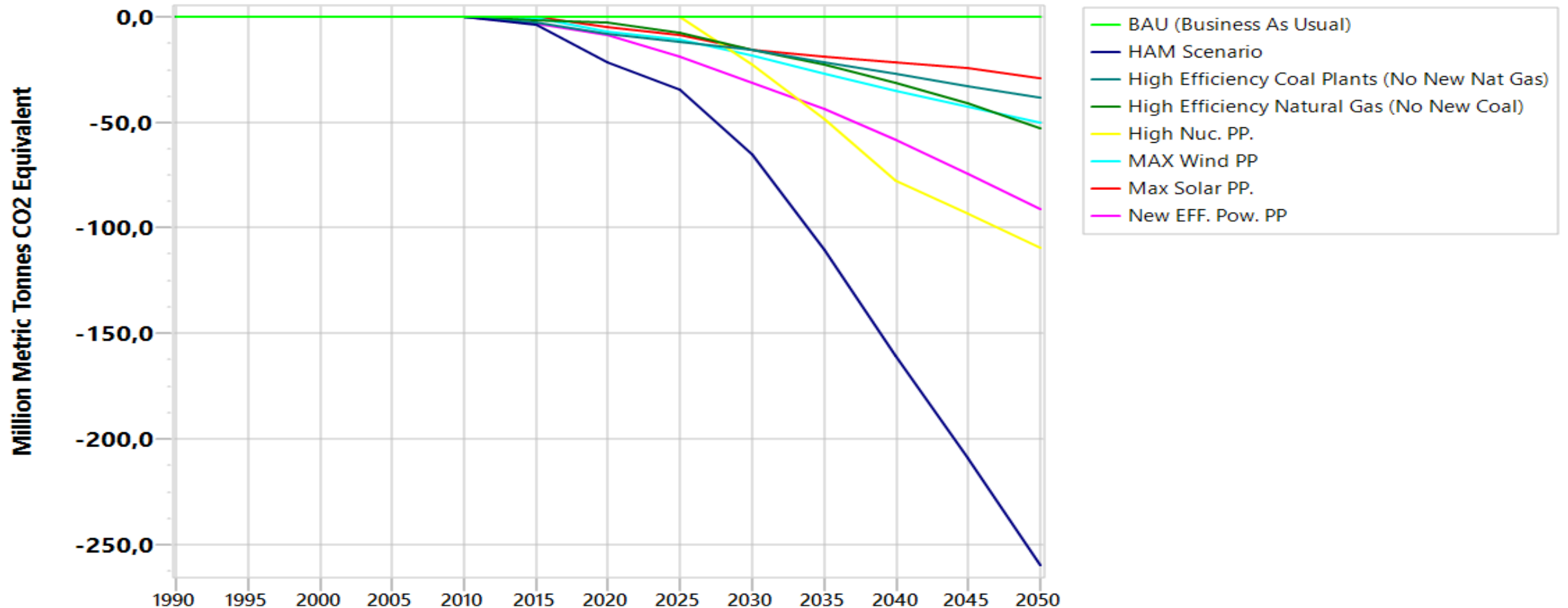
## One Hundred Year GWP: Direct (At Point of Emissions)

All Fuels, All GHGs



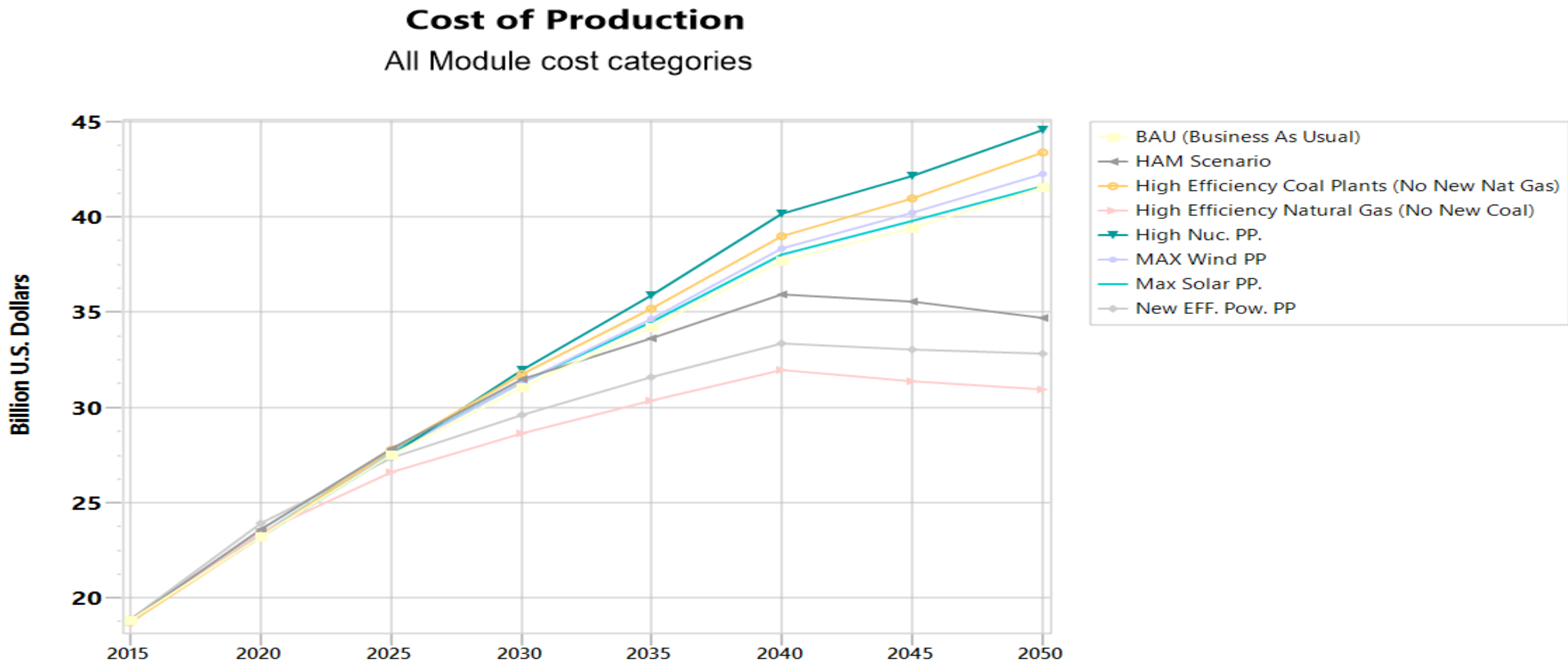
# GHG Results Compared to BAU

## One Hundred Year GWP: Direct (At Point of Emissions) All Fuels, All GHGs



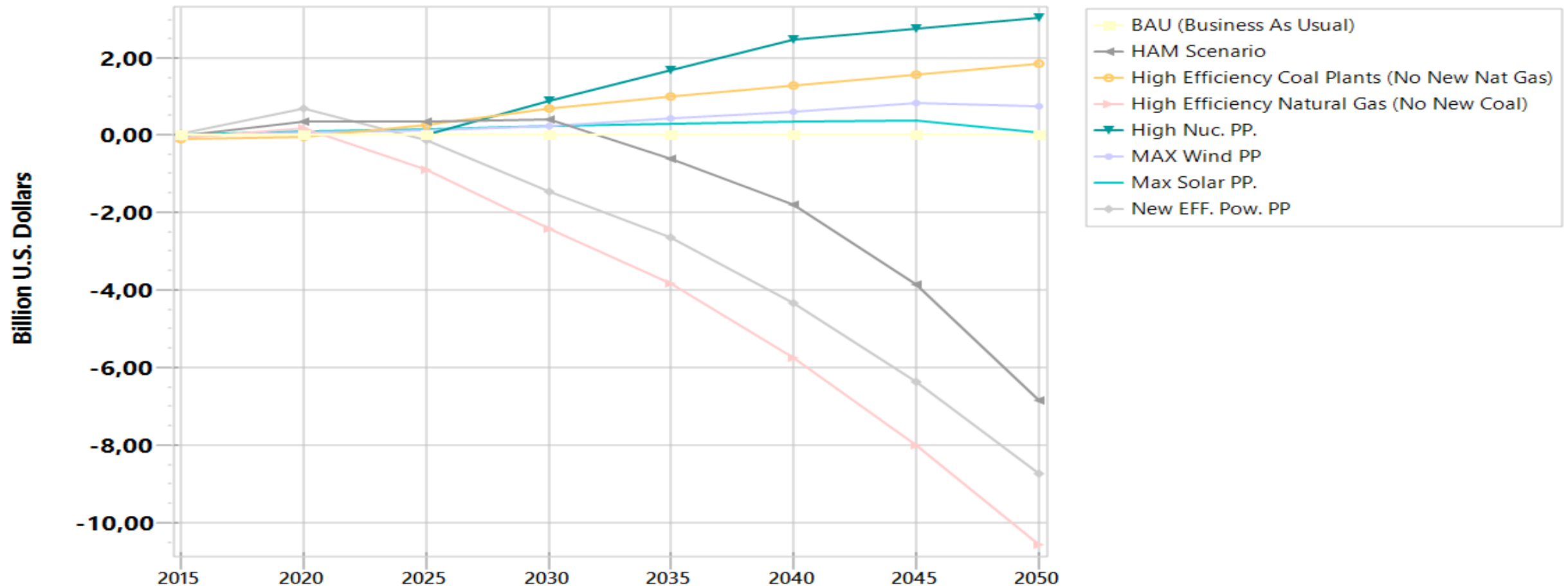


# Cost Data and Comparison of Mitigation Scenarios In Terms Of Costs



# Differences with BAU in terms of Cost of Production

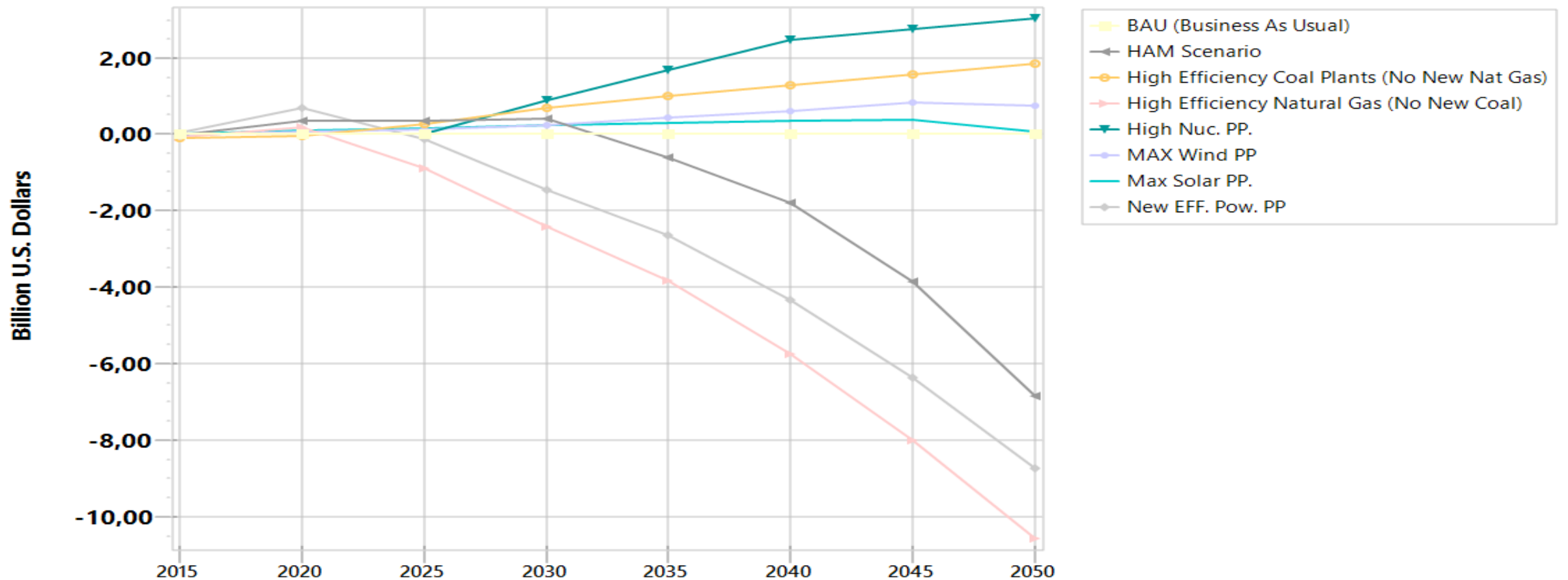
**Cost of Production**  
All Module cost categories



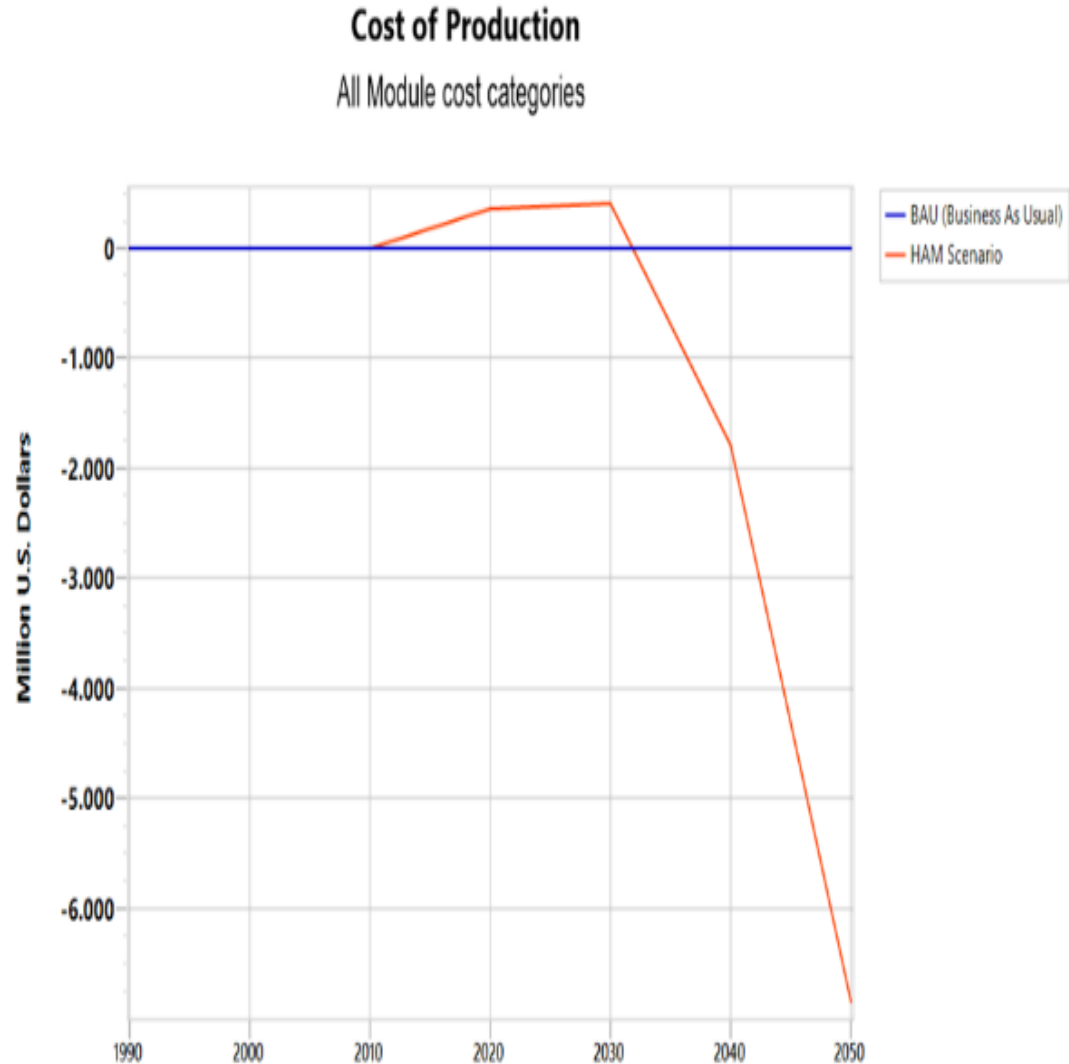
# Cost Benefit Analyses

## Cost of Production

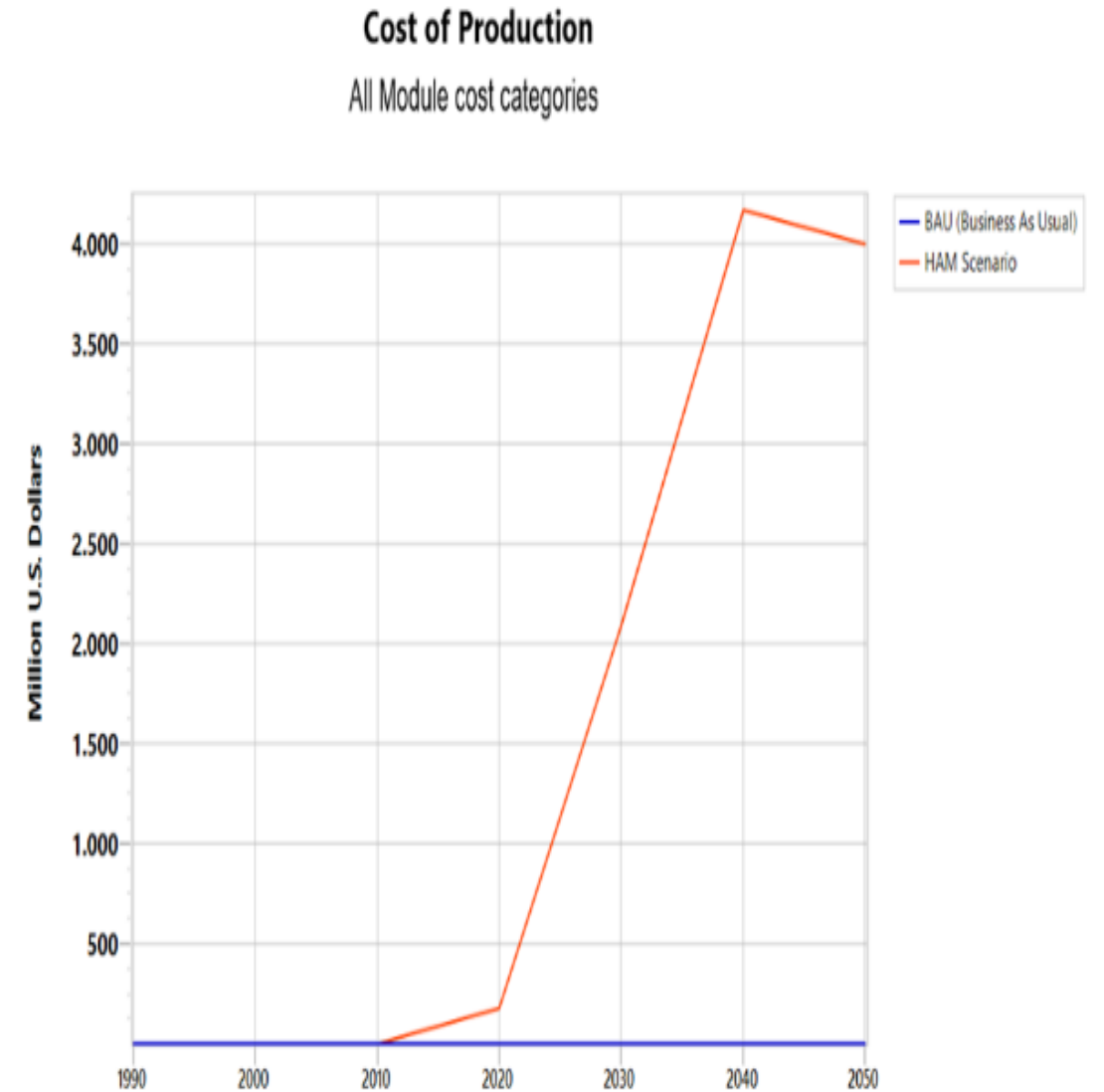
All Module cost categories



## The HAM with Efficient Natural Gas PPs Sc.



## The HAM without Efficient Natural Gas PPs Sc.



Cumulative Costs & Benefits: 1990-2050. Relative to Scenario: BAU (Business As Usual).  
Discounted at 5,0% to year 2005. Units: Billion 2005 U.S. Dollar

						High Efficiency Natural Gas	High Efficiency Coal Plants
	MAX Wind PP	Max Solar PP	New EFF Pow PP	High Nuc PP	HAM Scenario	(No New Coal)	(No New Nat Gas)
Transformation	6,0	4,2	23,6	9,0	35,0	12,2	7,9
distribution and lossess	-	-	-	-	-	-	-
Coke Production	-	-	-	-	-	-	-
Electric Generation	6,0	4,2	23,6	9,0	35,0	12,2	7,9
Refining	-	-	-	-	-	-	-
Resources	-	-	-4,3	-	-1,7	-4,3	-
Production	-	-	-4,3	-	-1,7	-4,3	-
Imports	-	-	-	-	-	-	-
Exports	-	-	-	-	-	-	-
Unmet Requirements	-	-	-	-	-	-	-
Environmental Externalities	-	-	-	-	-	-	-
Non Energy Sector Costs	-	-	-	-	-	-	-
Net Present Value	6,0	4,2	19,4	9,0	33,4	7,9	7,9
GHG Savings (Mill Tonnes CO2e)	854,0	551,7	1.464,9	1.538,7	3.794,2	768,6	719,6
Cost of Avoiding GHGs (US Dollar/Tonne CO2e)	7,1	7,6	13,2	5,9	8,8	10,3	11,0

# •Any Questions?

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