

# RENEWABLE ELECTIRICTY ENERGY POLICIES: CASE OF TURKEY

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# Outlook

- Scope
- Energy Outlook Turkey
- Policy
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- Conclusion

# Scope of the study

- The focus of this study is to assess the potential CO<sub>2</sub> abatement through renewable energy policies within the economy
- Benchmark the effects of policies compared to equivalent emission tax policies
- Report the cost of policies analyzed

# Energy Outlook Turkey

- Fast increase in energy consumption due to
  - *Urbanization and*
  - *Relatively high population growth : Average population growth rate between 1990-2017 1.4% per year.*
  - *Dynamic economic activity: Average GDP Growth rate between 1990-2017 4.5% per year*

# Energy Outlook Turkey

- Primary Energy Consumption for year 2015 is roughly 5407 PJ.
- 87% of primary energy consumption is from fossil resources.
- 35% of primary energy consumption is consumed by electricity sector.
- 80% of electricity fuel consumption is fossil based fuels
- Only 5% of the electricity produced is based on intermittent/non-dispatchable resources (e.g. Wind and solar)

# Policy - YEKDEM

- The law became valid in 2005. Price guarantee applicable for ten years after the generation facility becomes operational by the end of 2020.
- Solar electricity is subsidized for 13.3 ¢/kWh
- Wind electricity is subsidized for 7.7 ¢/kWh

# Policy - Alternatives

- Continuum of the current YEKDEM subsidies.
- An equivalent feed in tariff to YEKDEM share of intermittent generation
- An equivalent emission level to YEKDEM tax policy
- A feed in tariff targeting 15% intermittent generation share by 2030
- An equivalent emission level to 15% intermittent generation share by 2030 tax policy

# Methodology

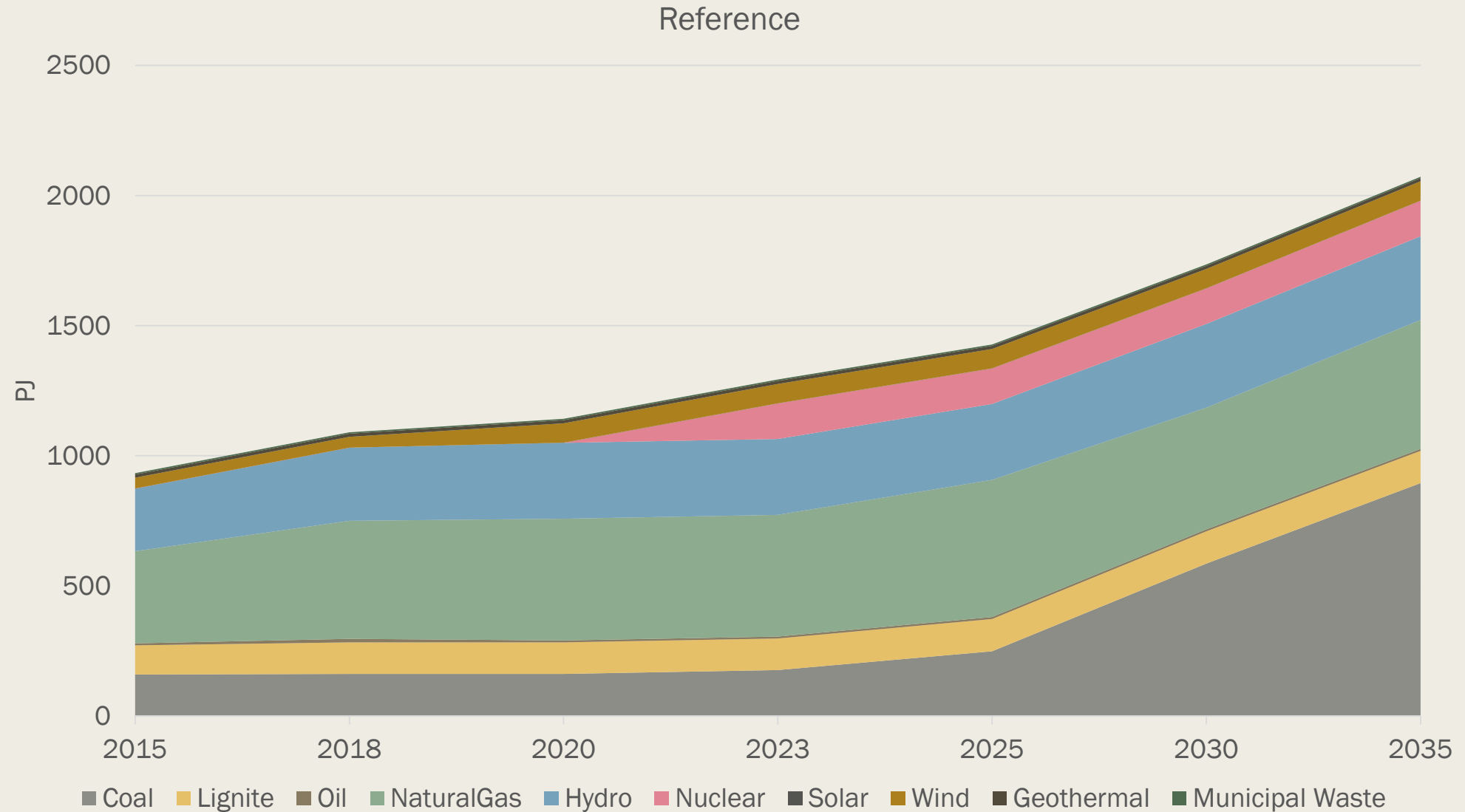
- IEA TIMES modelling framework has been utilized
- Bottom-up, perfect foresight model
- Maximizing total surplus of the consumers and producers
- Linear optimization model
- Partial equilibrium model



# Methodology

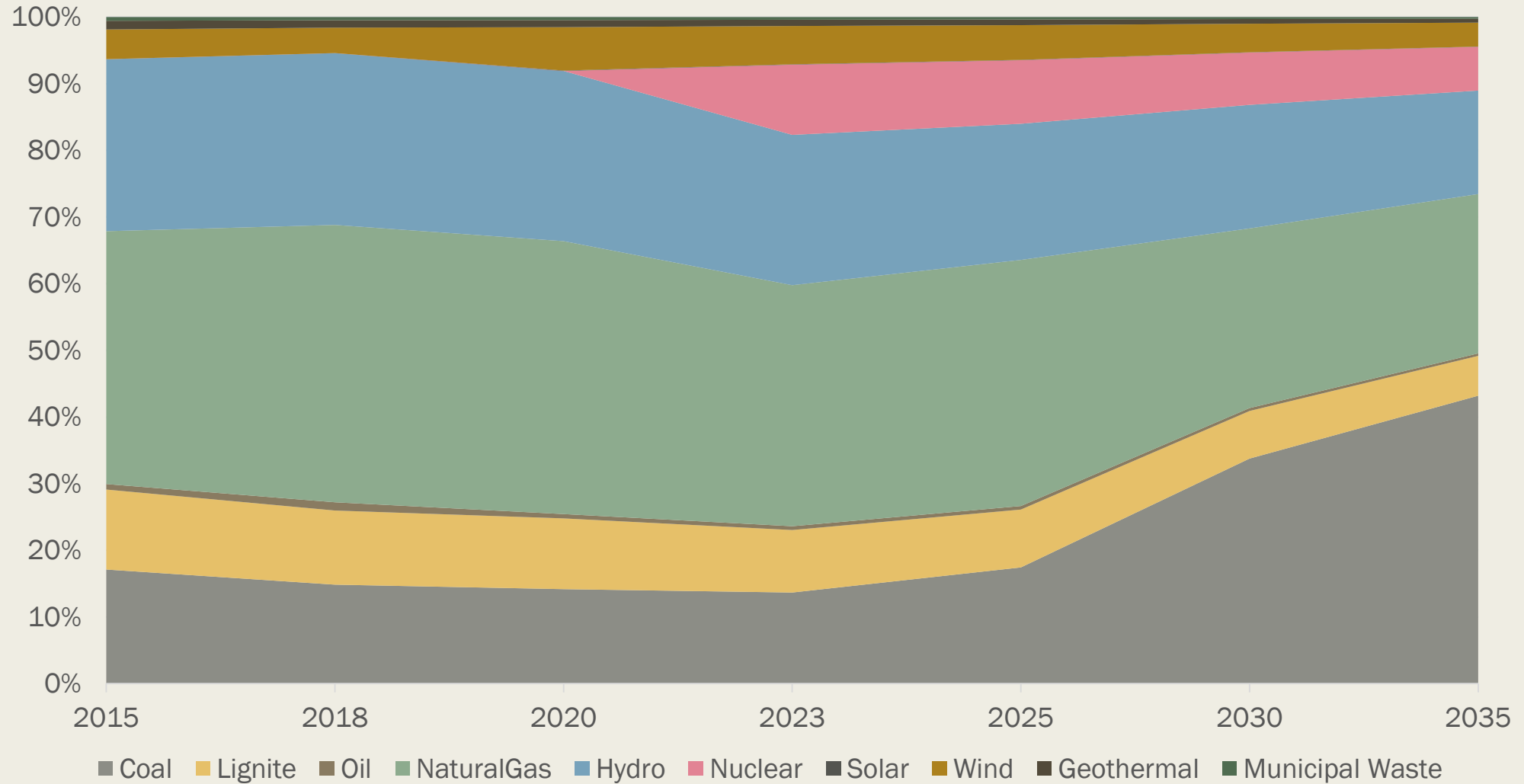
- Model covering electricity, industry, transportation, buildings and refinery has been developed
- Model with 582 commodities, 792 Technologies and 209000 data values
- 288 timeslices (24 hours for each season) has been deployed to assess the impacts on the hourly time slices.
- Base power plants flexibility has been limited (e.g. Nuclear, coal, lignite)
- Modelling time horizon has been selected as 2015 to 2035.
- Model calibrated based on 2015 energy balance

# Results



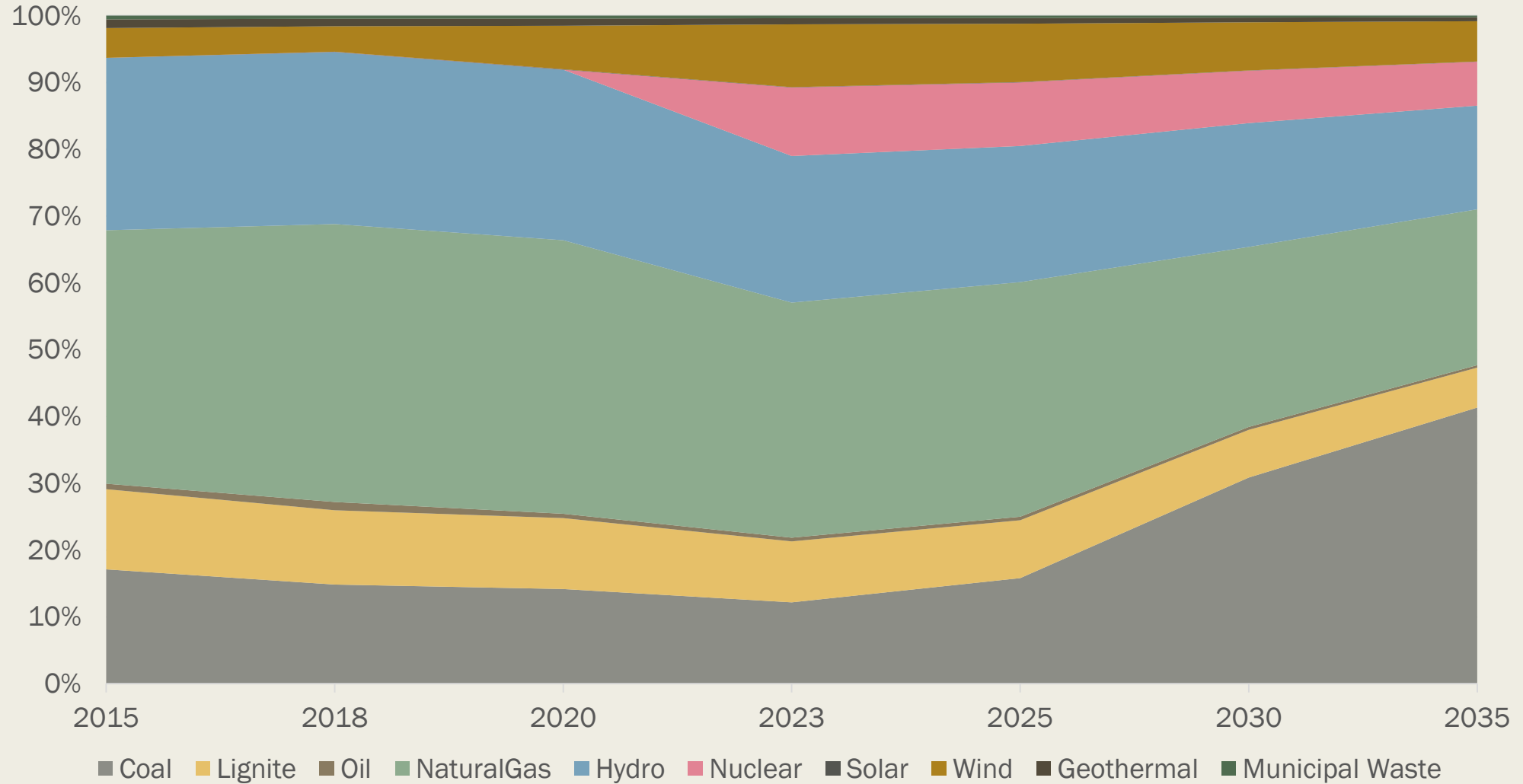
# Results

Reference



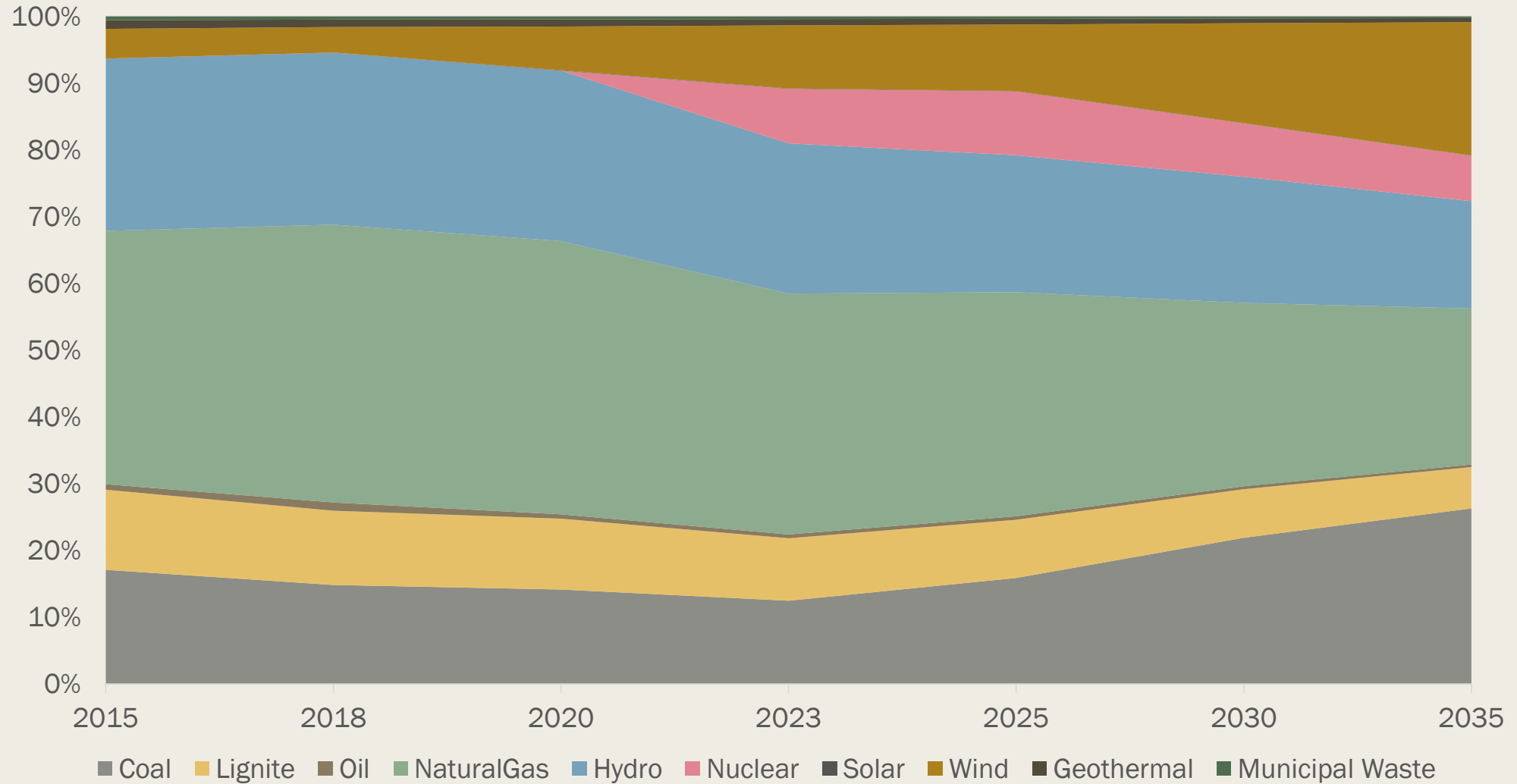
# Results

Continuum of YEKDEM

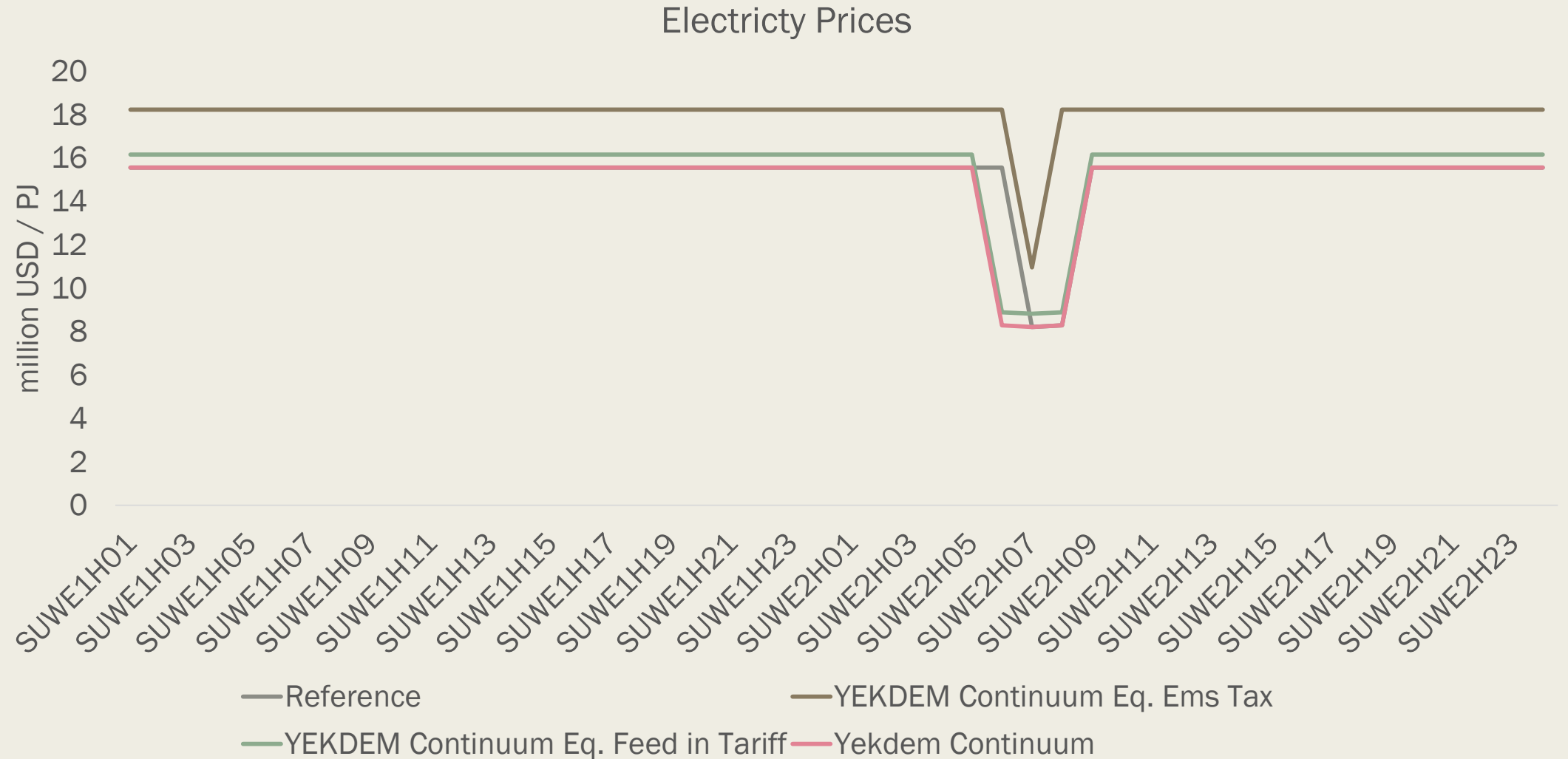


# Results

15% Intermittent Target Feed in Tariff

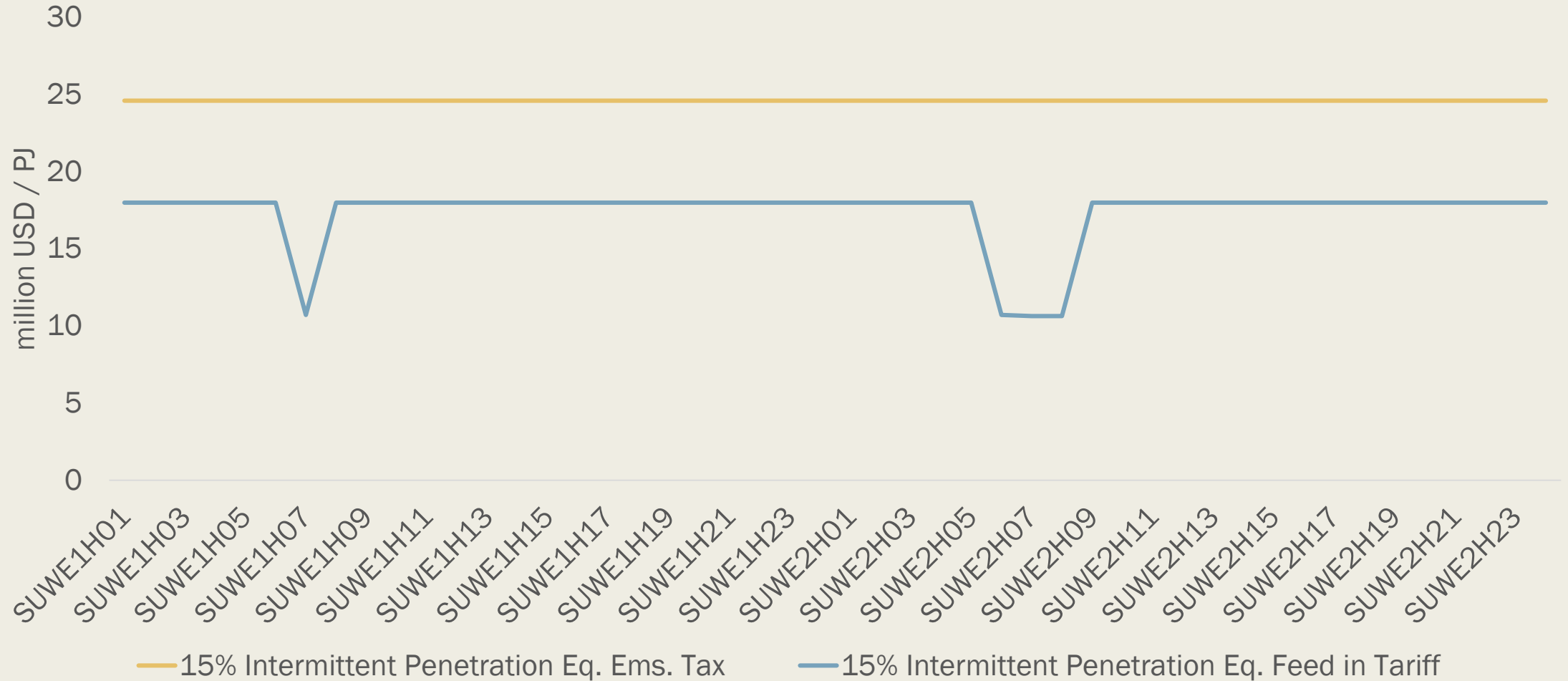


# Results



# Results

## Electricity Prices



# Results

	2030			
	System Annual Cost (billion USD)	Emission Level (million ton)	Intermittent Generation Share	Average Mitigation Cost (\$ / ton CO <sub>2</sub> )
Reference	\$ 386.72	578.44	4.3%	
YEKDEM Continuum	\$ 388.11	566.00	7.2%	112.45
YEKDEM Continuum Feed in Tariff	\$ 387.45	565.23	7.2%	55.67
15% Intermittent Target Tariff	\$ 389.66	528.02	15.0%	58.37
YEKDEM Continuum Eq. Emission Tax	\$ 386.74	566.00	4.4%	1.99
15% Intermittent Target Eq. Emission Tax	\$ 386.94	528.02	11.0%	4.43



# Conclusions

- Direct subsidy of renewables can help to reach higher level of penetration, leading lower emission levels.
- However, efficiency of the subsidy policy is questionable.
- Instead of direct subsidy feed in tariff is shown to be more cost effective for the same level of intermittent generation.
- For the same level abatement level carbon pricing is found to be the most cost effective policy option.
- For Turkey to achieve INDC targets carbon pricing is the most suitable option to have the least impact on the economy.

# Thank you for listening!

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