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# Sources of uncertainty in long-term global scenarios of solar photovoltaic technology

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RENEWABLE ENERGY SYSTEMS



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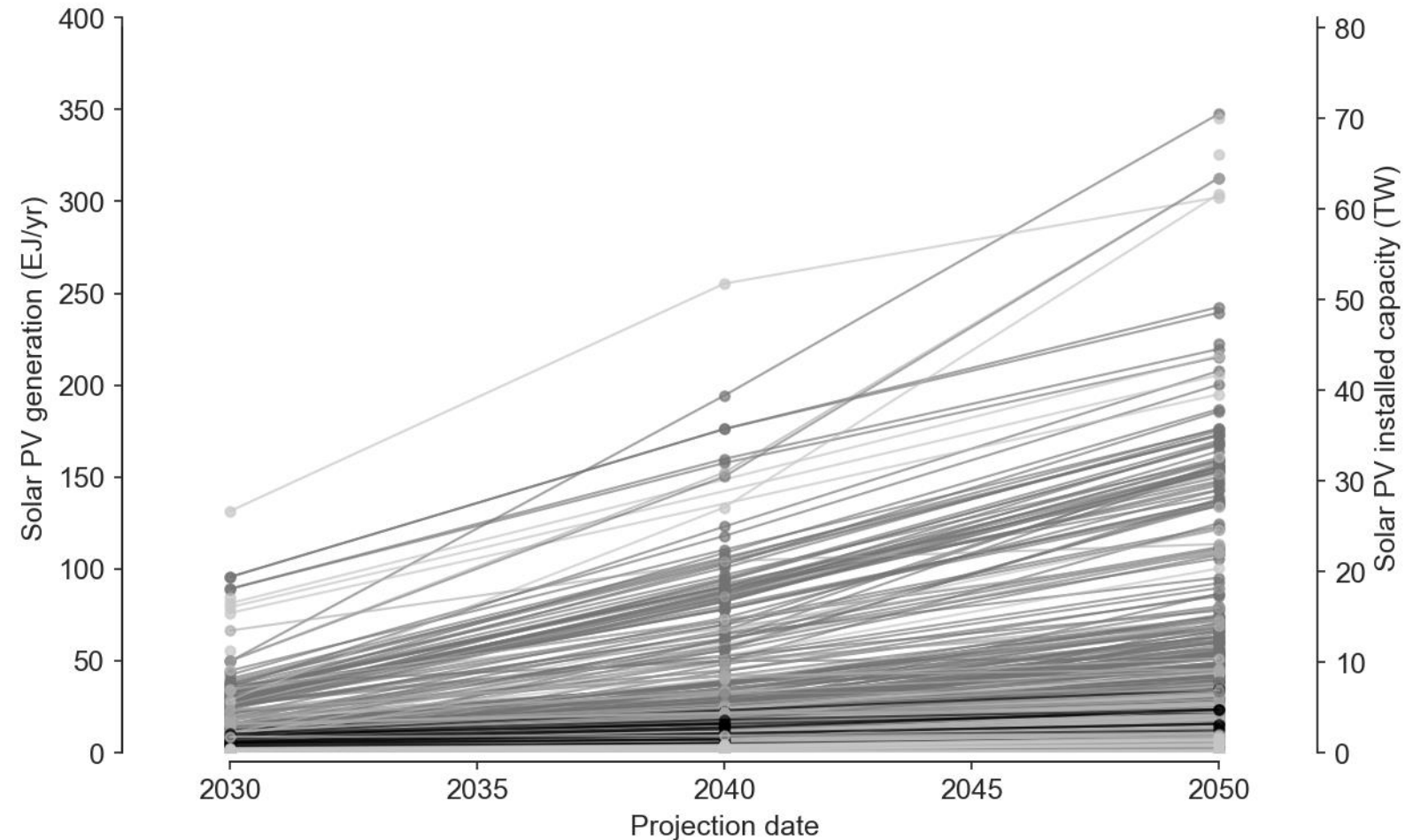
# Background

- What can we expect for the future role of PV in the global energy system in 2050?

# Background

- How do different organizations in science and practice perceive PV futures?
- Are there consistent differences between scenarios presented in IPCC assessments, and other scenarios from academic/gray literatures?
- What are the modeling and institutional factors which may shape these differences?

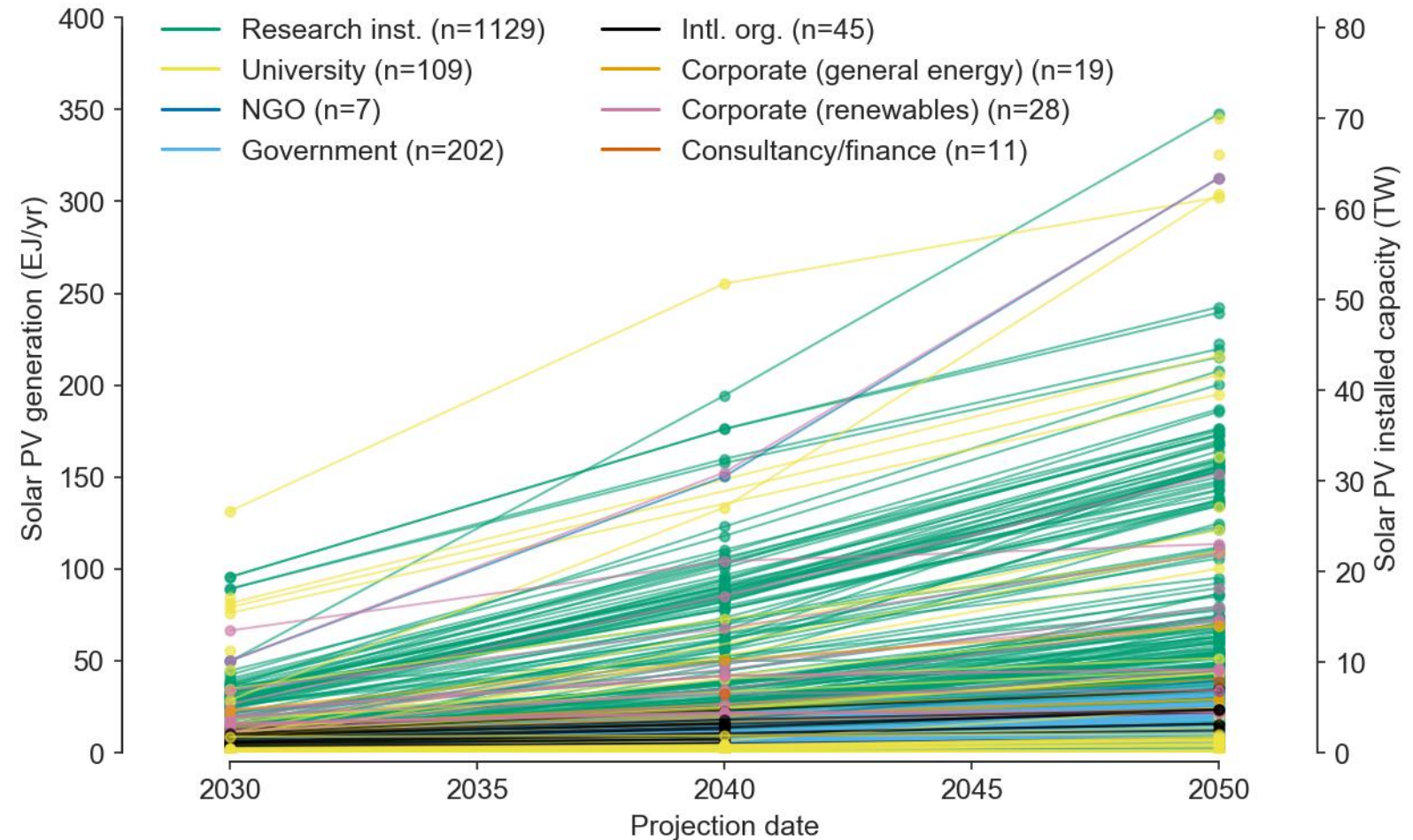
All figures: Jaxa-Rozen & Trutnevyte (2021), <https://doi.org/10.1038/s41558-021-00998-8>



# Background

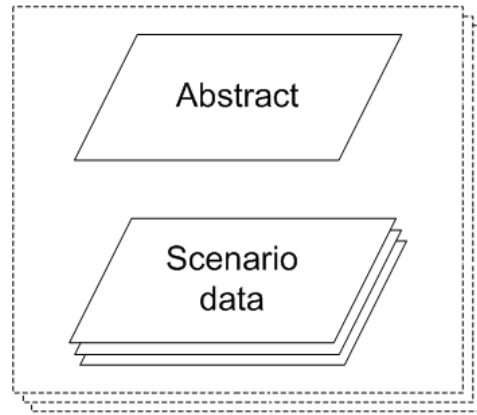
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# Methods

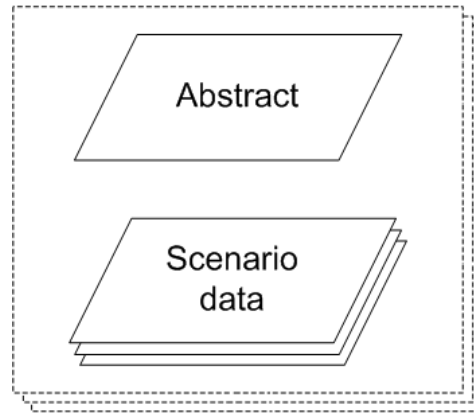
## Publications





# Methods

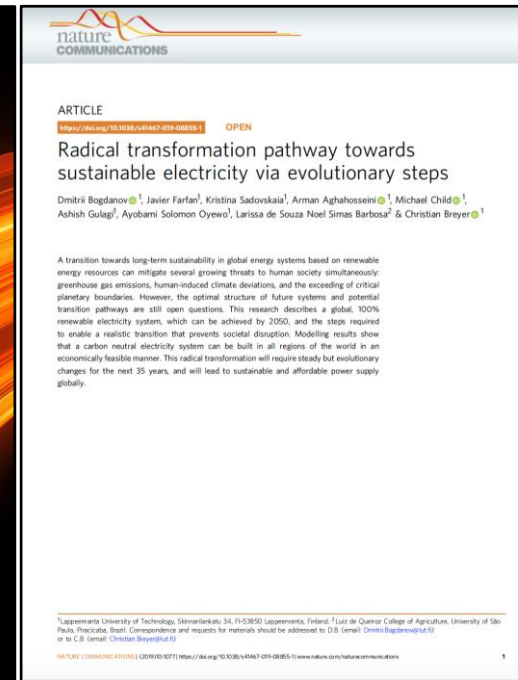
## Publications



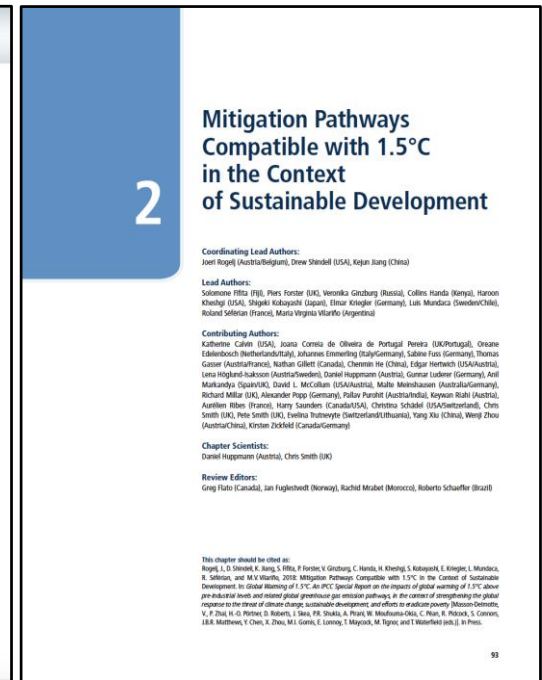
## Gray literature



## Academic literature

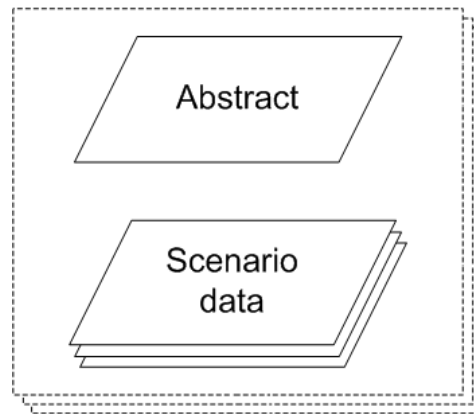


## IPCC databases



# Methods

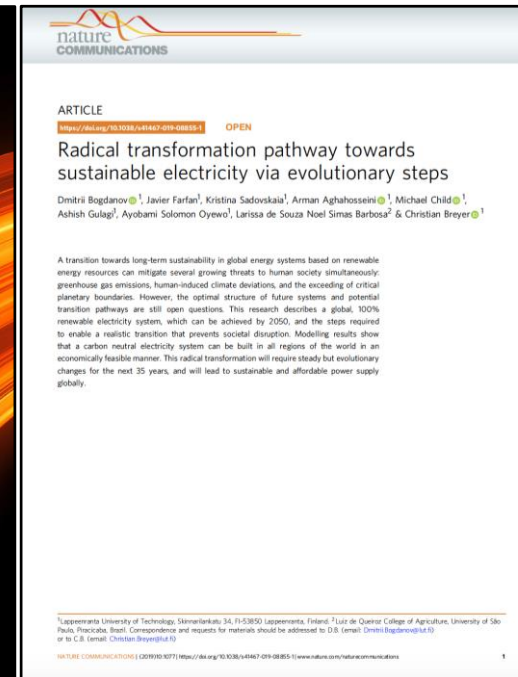
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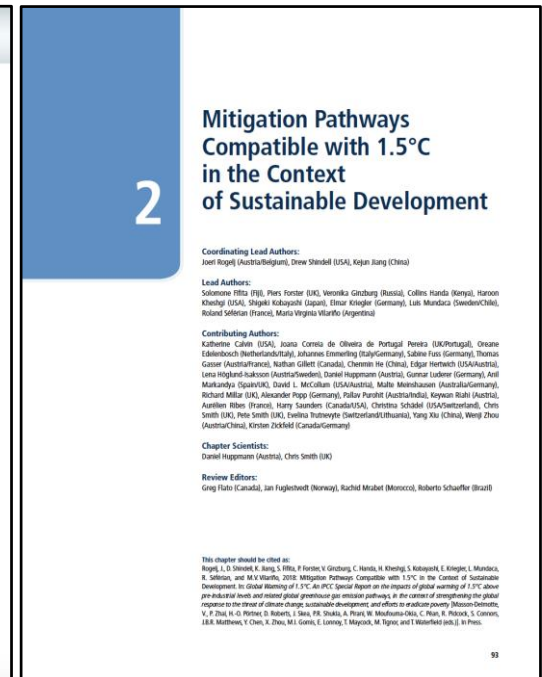
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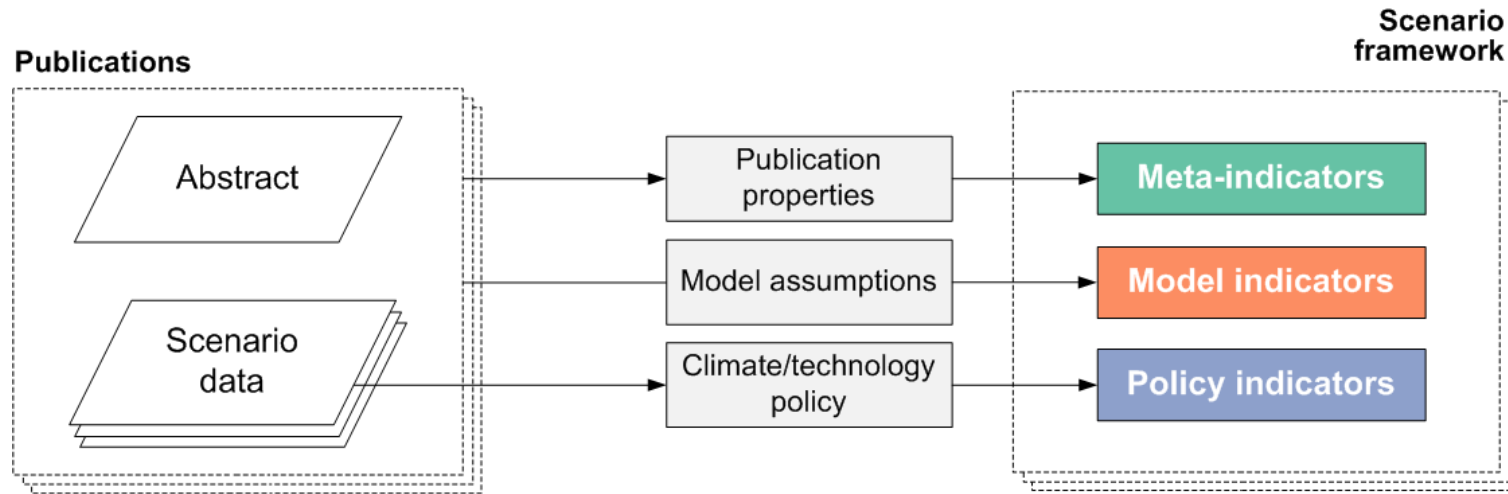


## IPCC databases



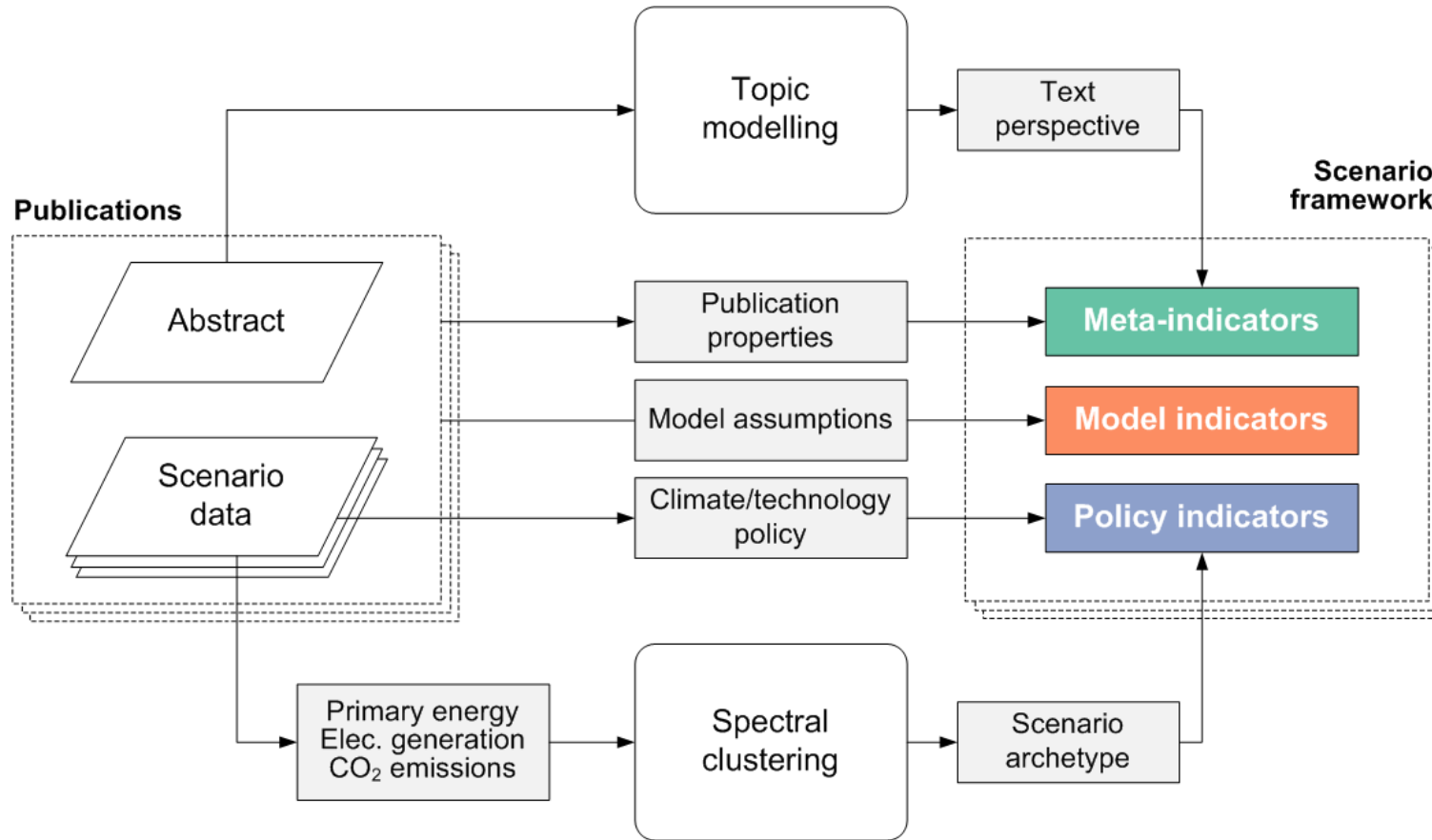
- 190 non-IPCC scenarios
- 1360 scenarios from IPCC Fifth Assessment report and SR1.5 report

# Methods

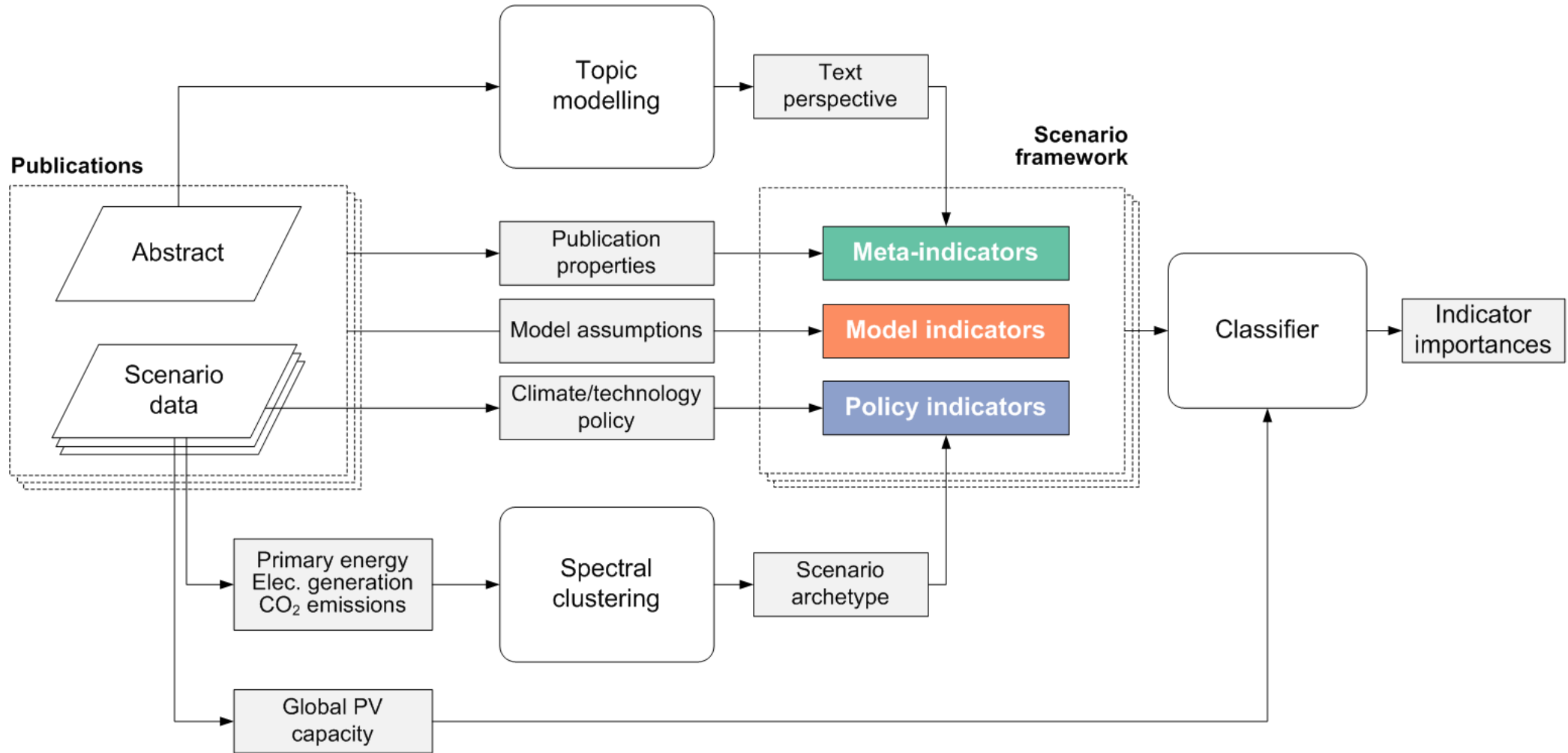




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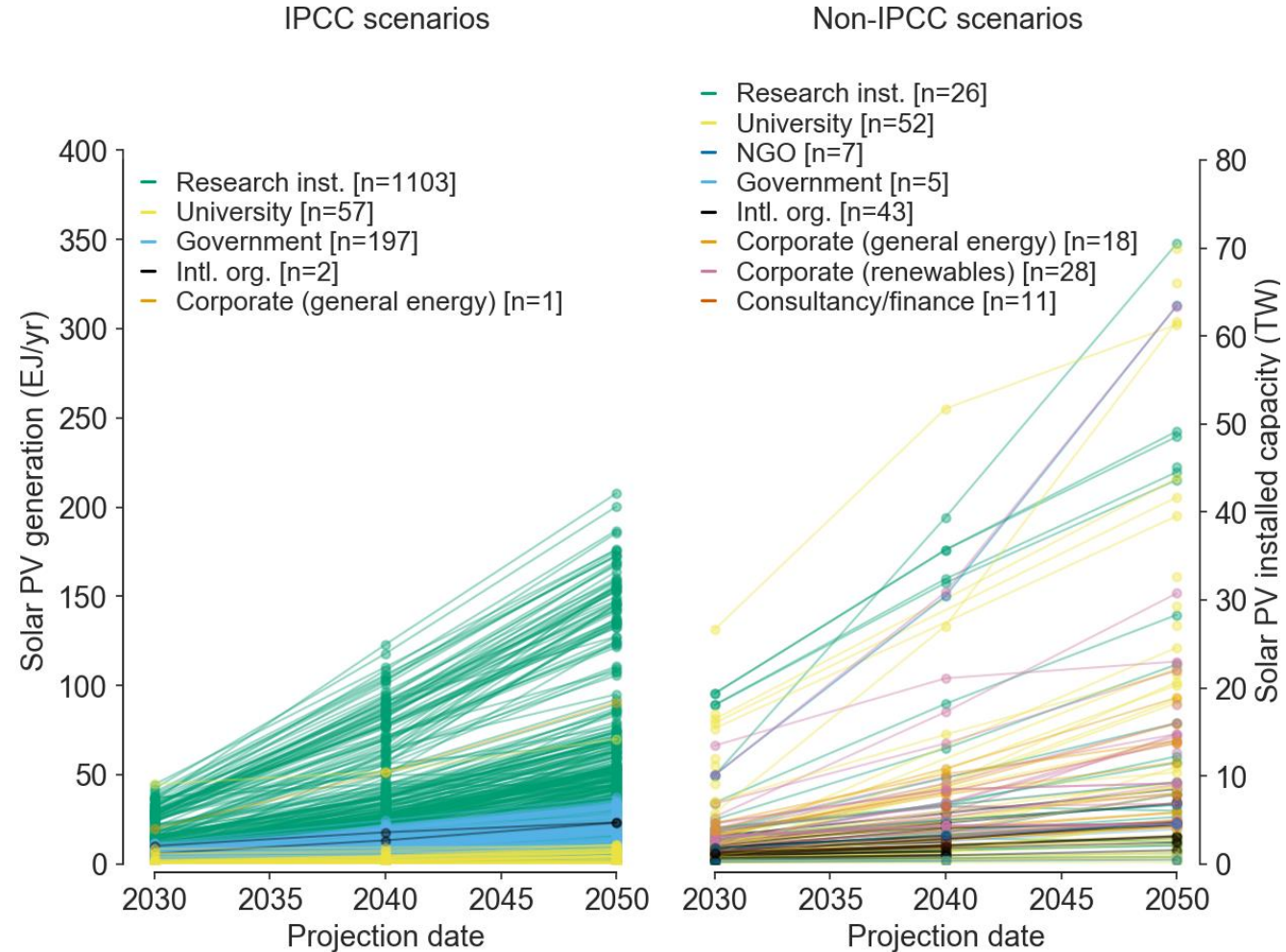


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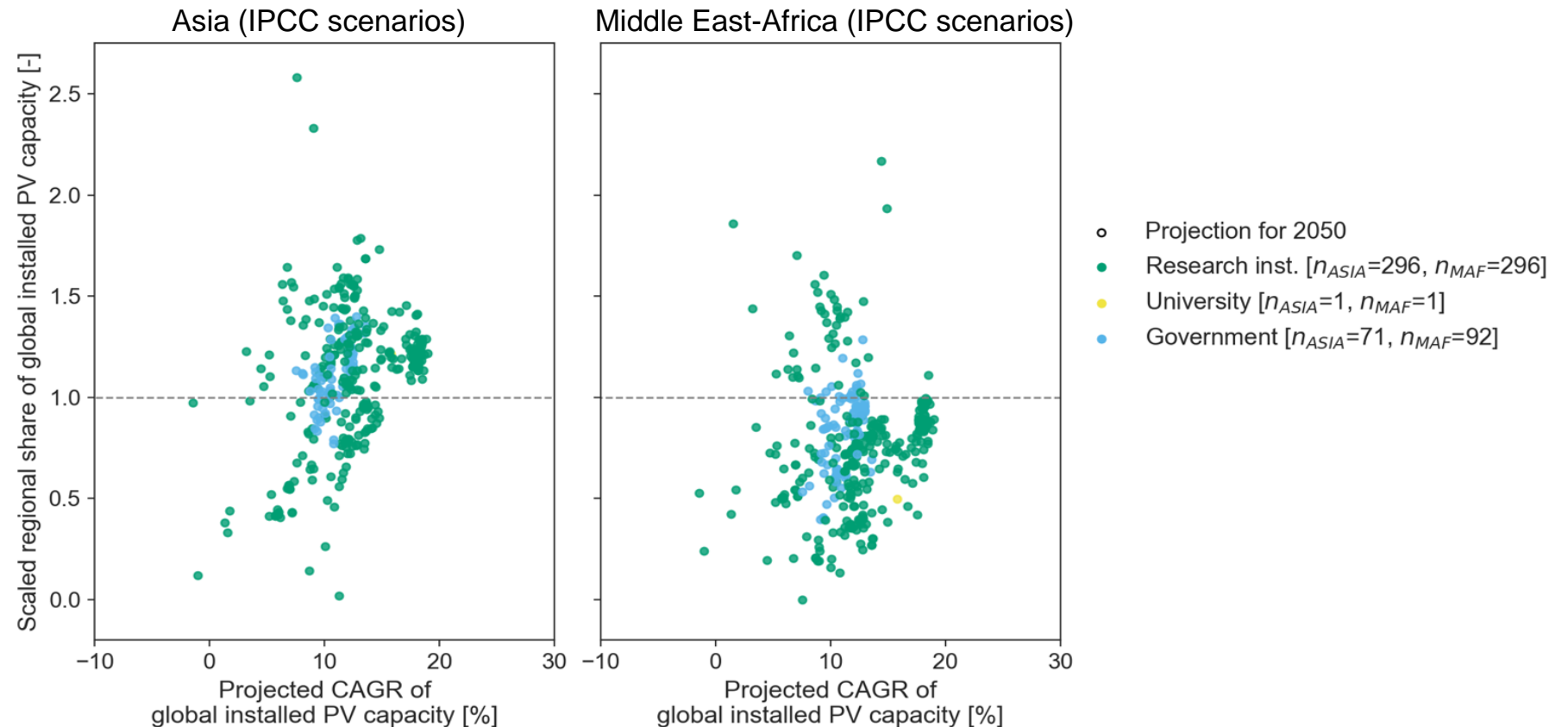
# Global PV scenario outcomes

- Average PV capacity in 2050 is higher in non-IPCC scenarios vs. IPCC scenarios (14.2 TW vs. 5 TW)



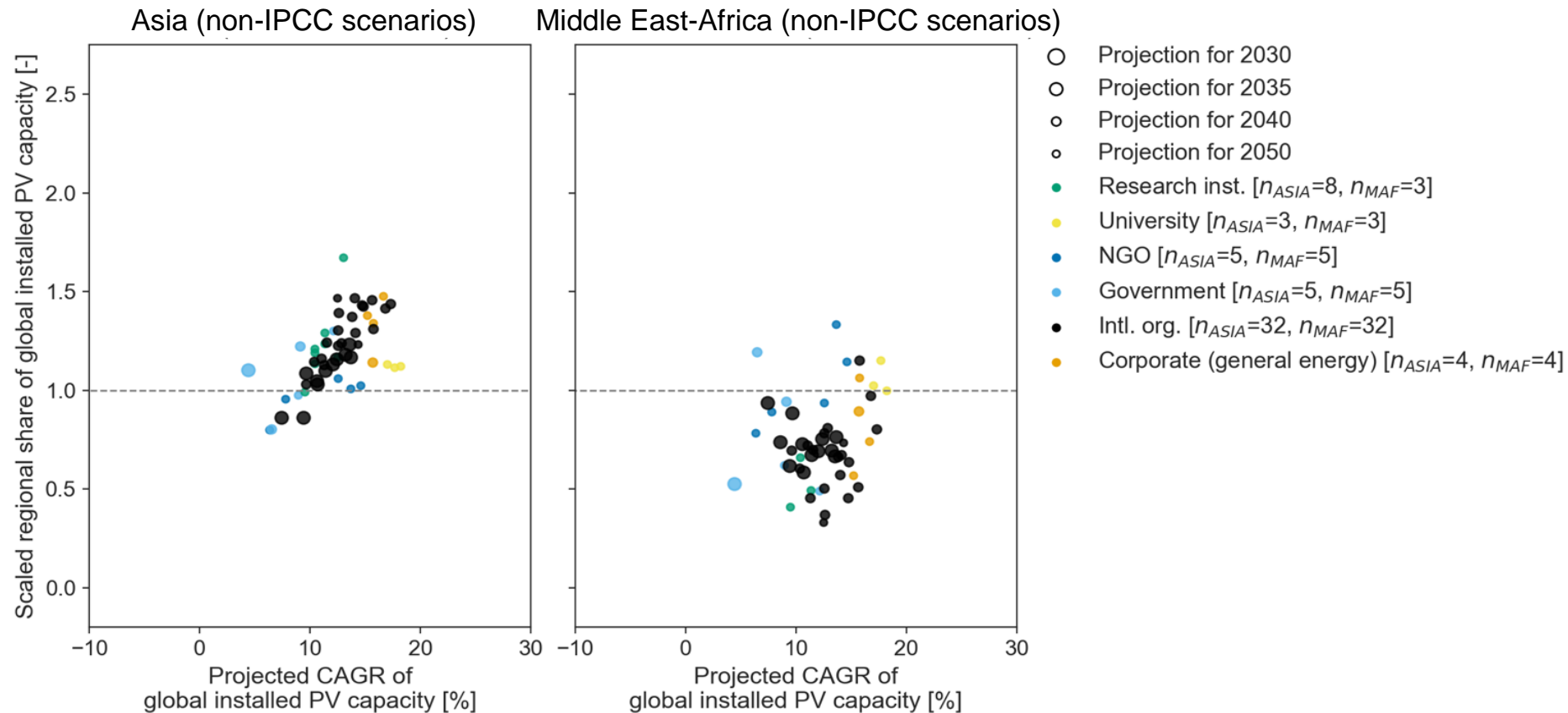
# Regional PV scenario outcomes: IPCC scenarios

- Scaled regional share: 
$$\frac{PV_{Region,year} [GW] / PV_{World,year} [GW]}{TPED_{Region,year} [EJ/yr] / TPED_{World,year} [EJ/yr]}$$



# Regional PV scenario outcomes: non-IPCC scenarios

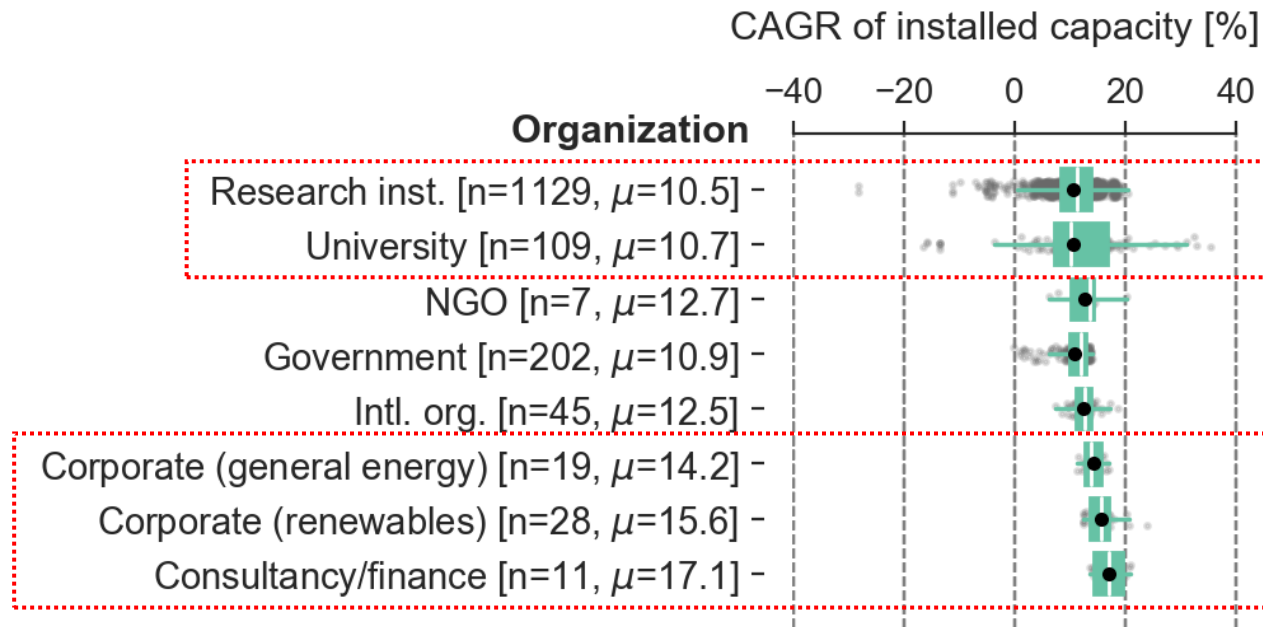
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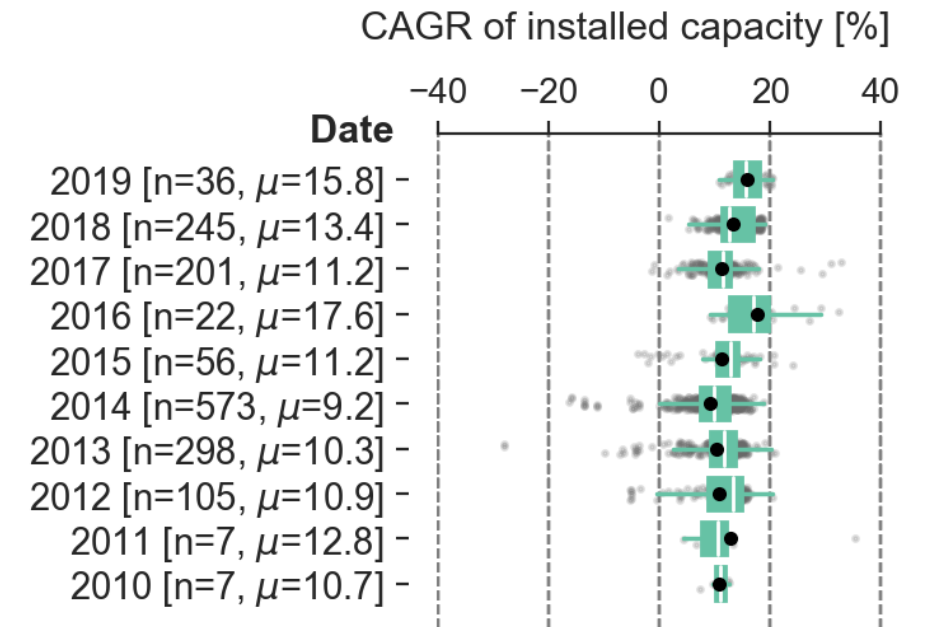
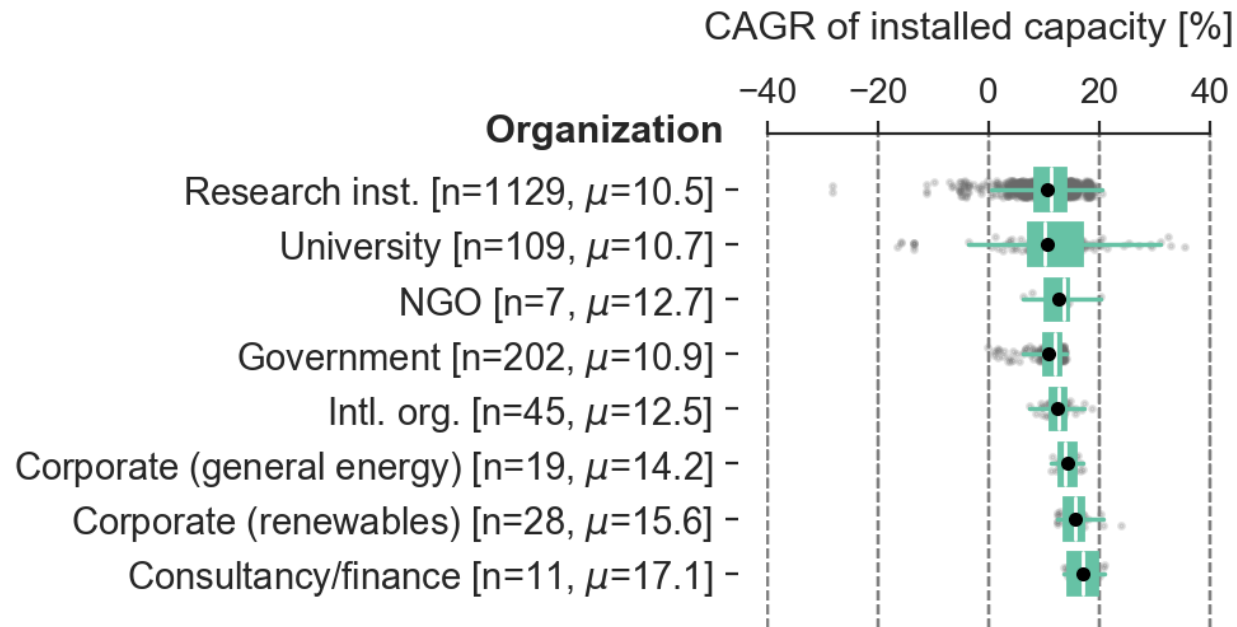
# Visualizing PV scenario outcomes

Meta-indicators



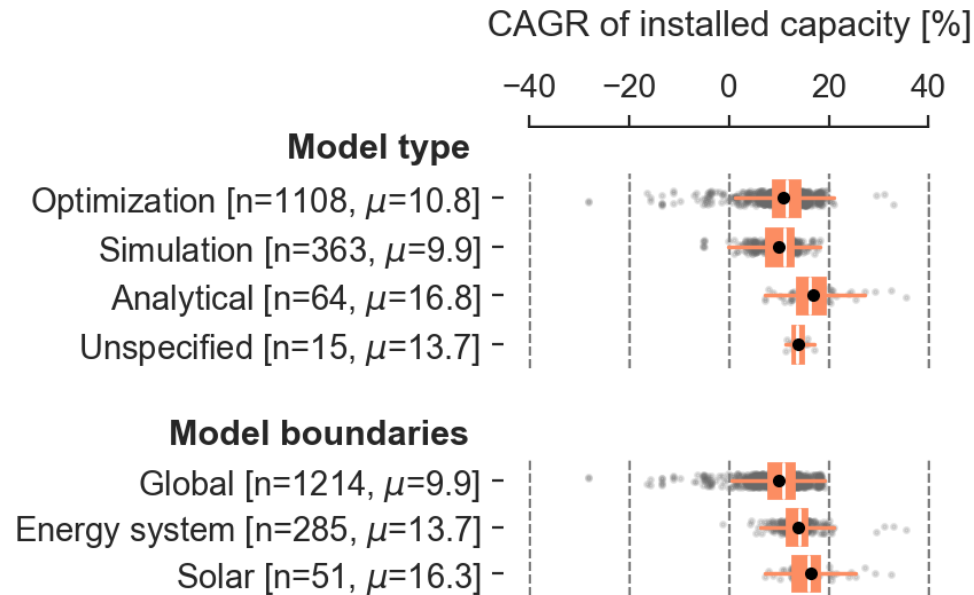
# Visualizing PV scenario outcomes

## Meta-indicators



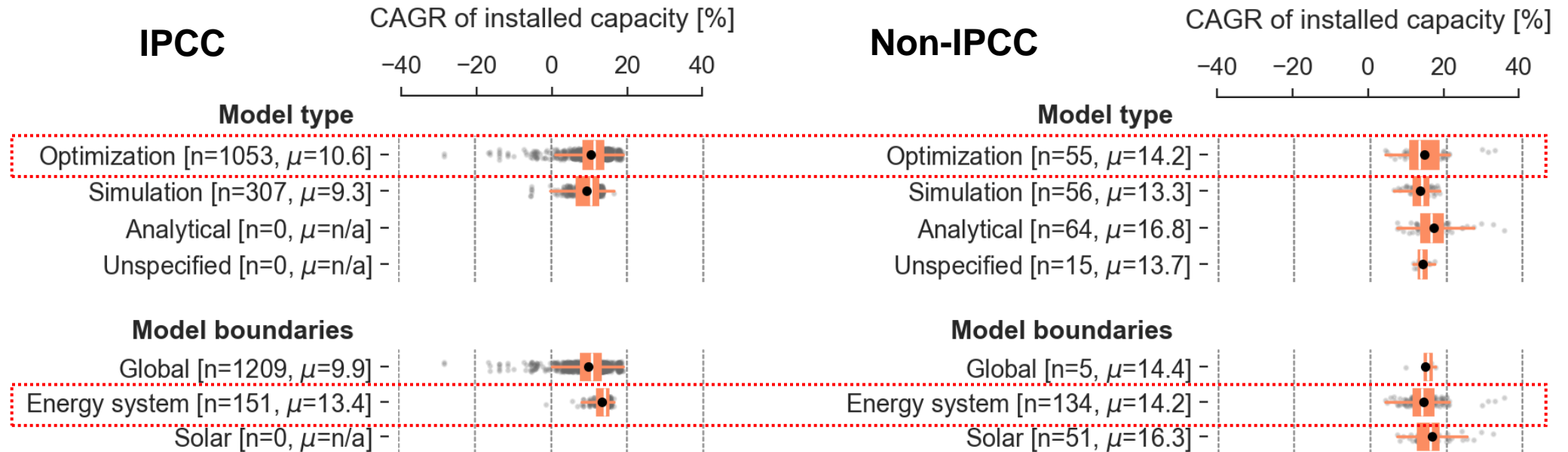
# Visualizing PV scenario outcomes

## Model indicators



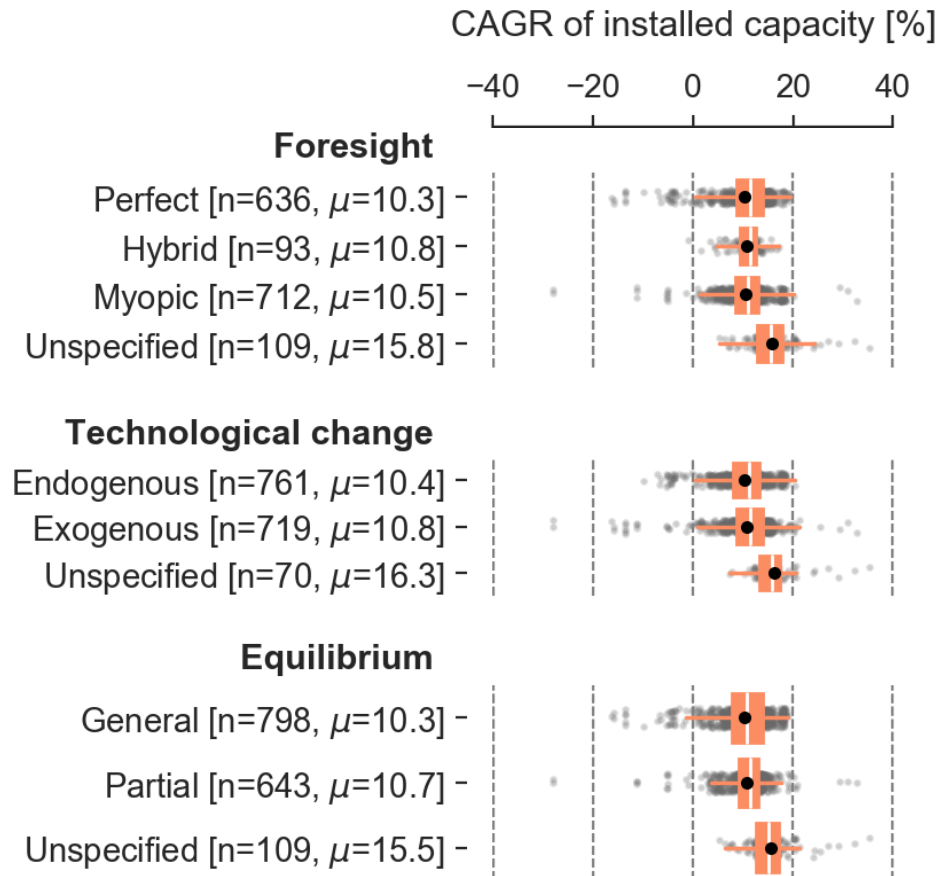
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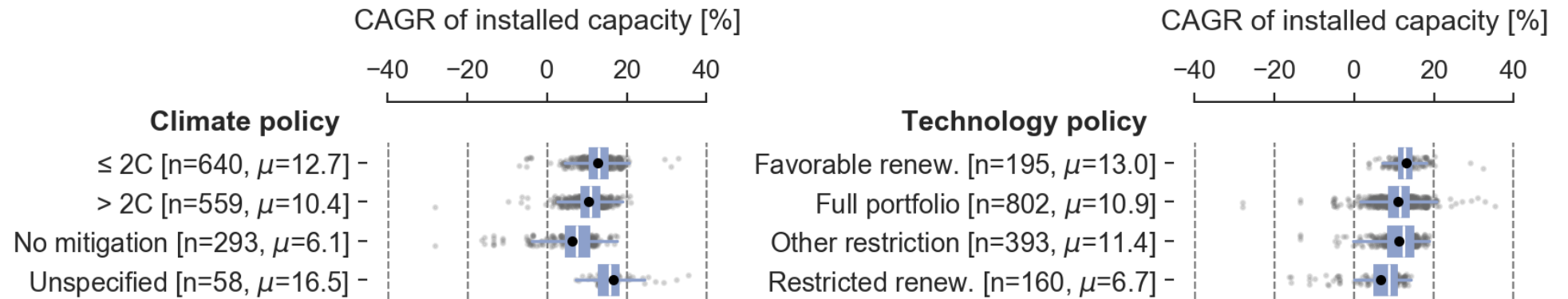
Model indicators





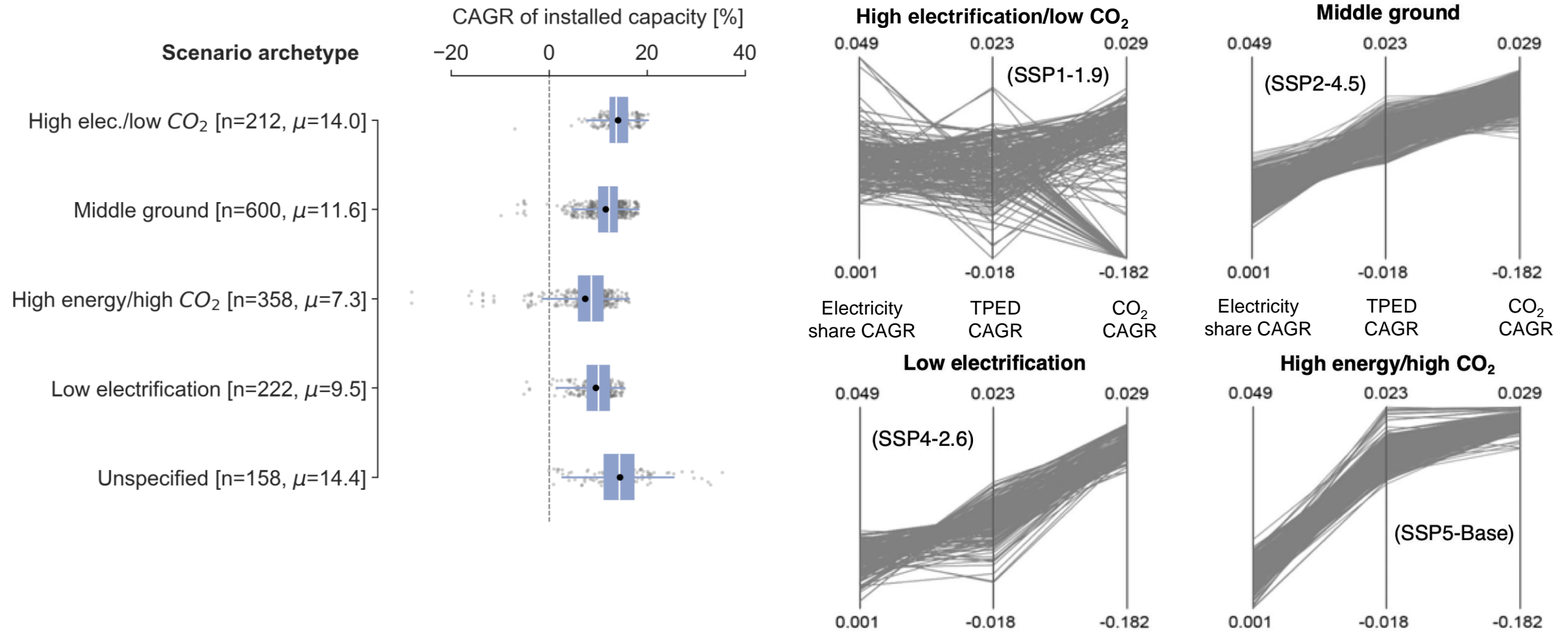
# Visualizing PV scenario outcomes

## Policy indicators



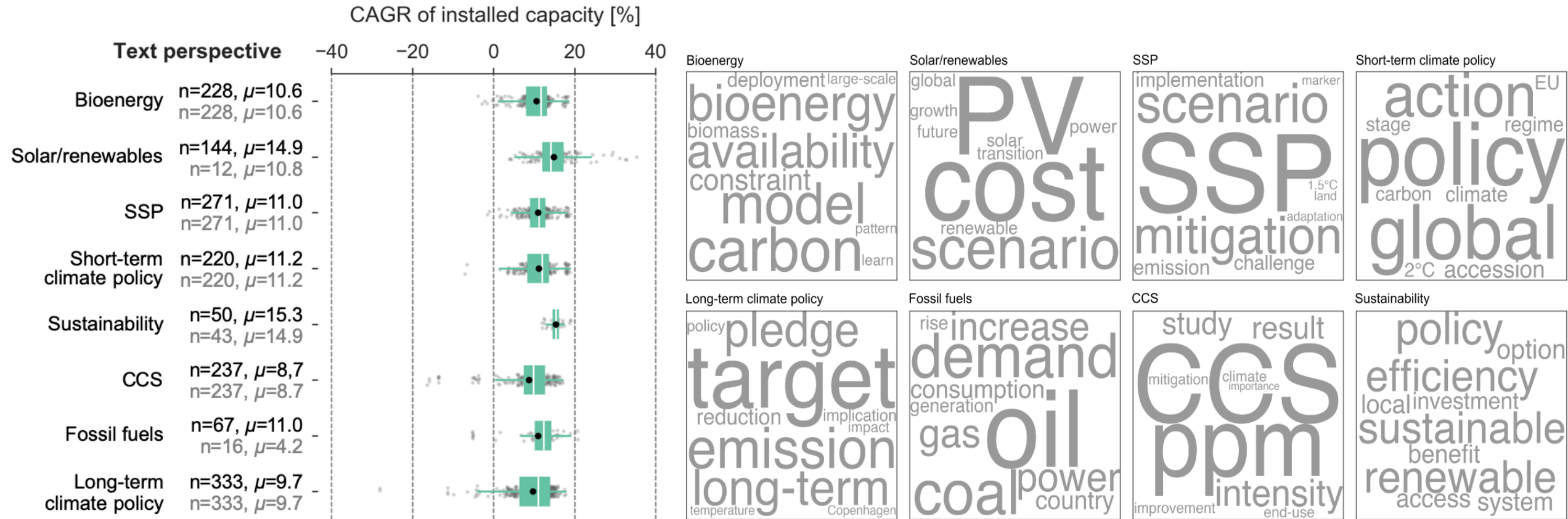
# Extending the indicators

Spectral clustering to identify scenario archetypes based on electrification, TPED, and CO<sub>2</sub> emissions



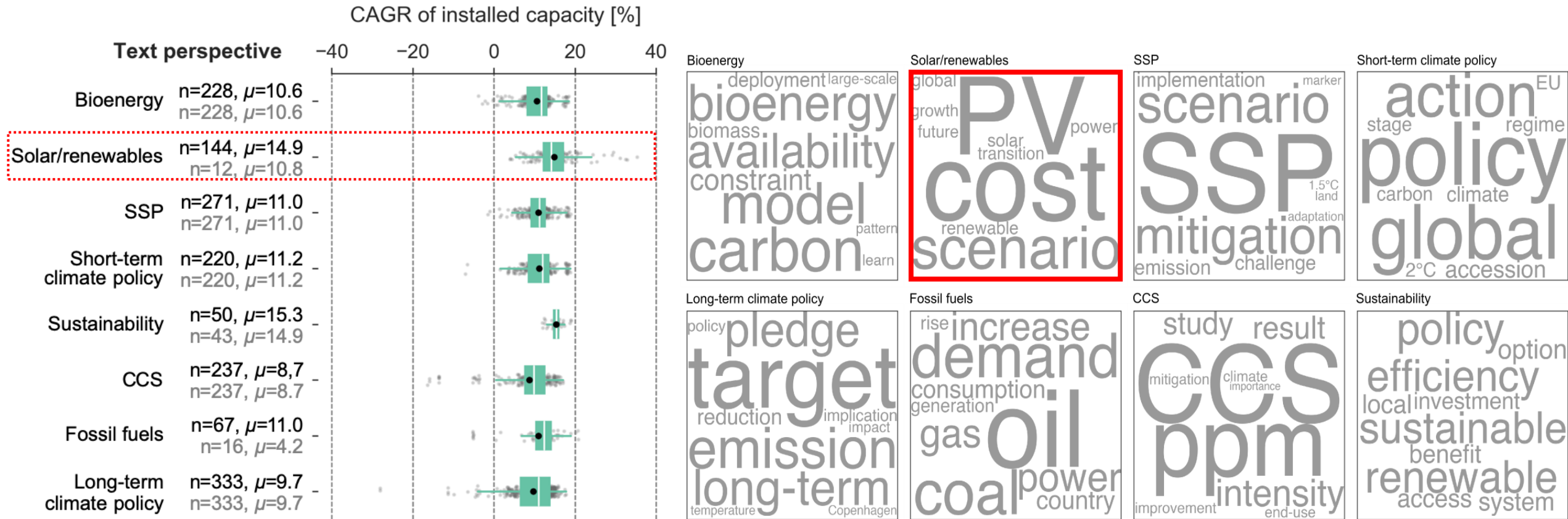
# Extending the indicators

Latent Dirichlet Allocation topic modelling to identify text perspectives in publications



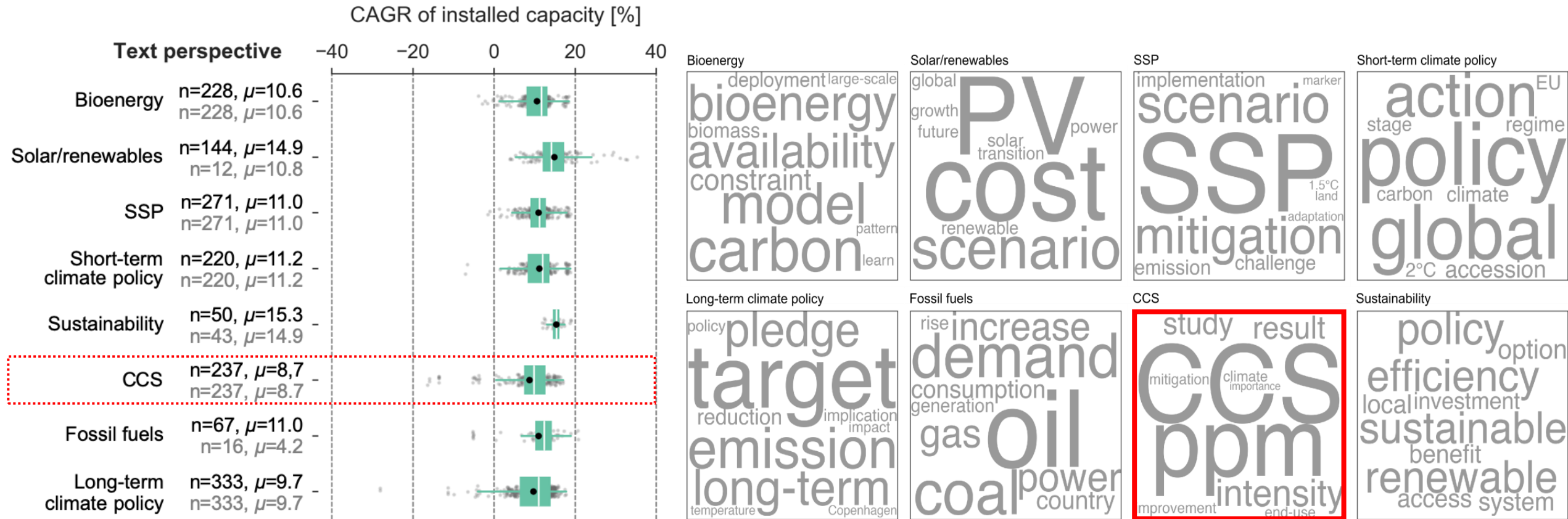
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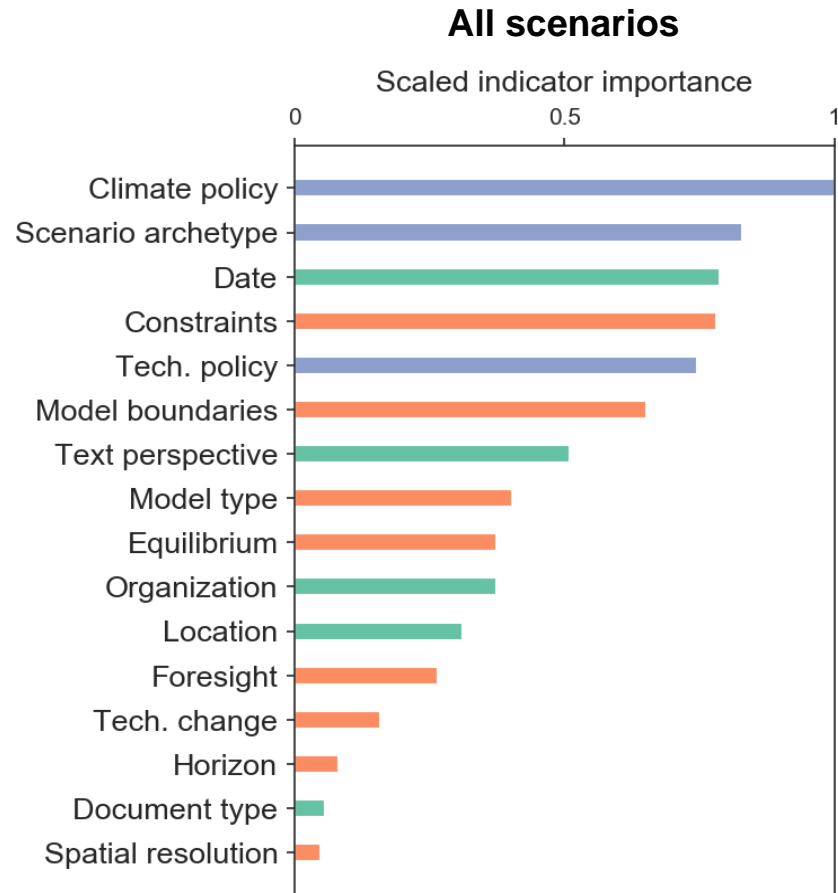
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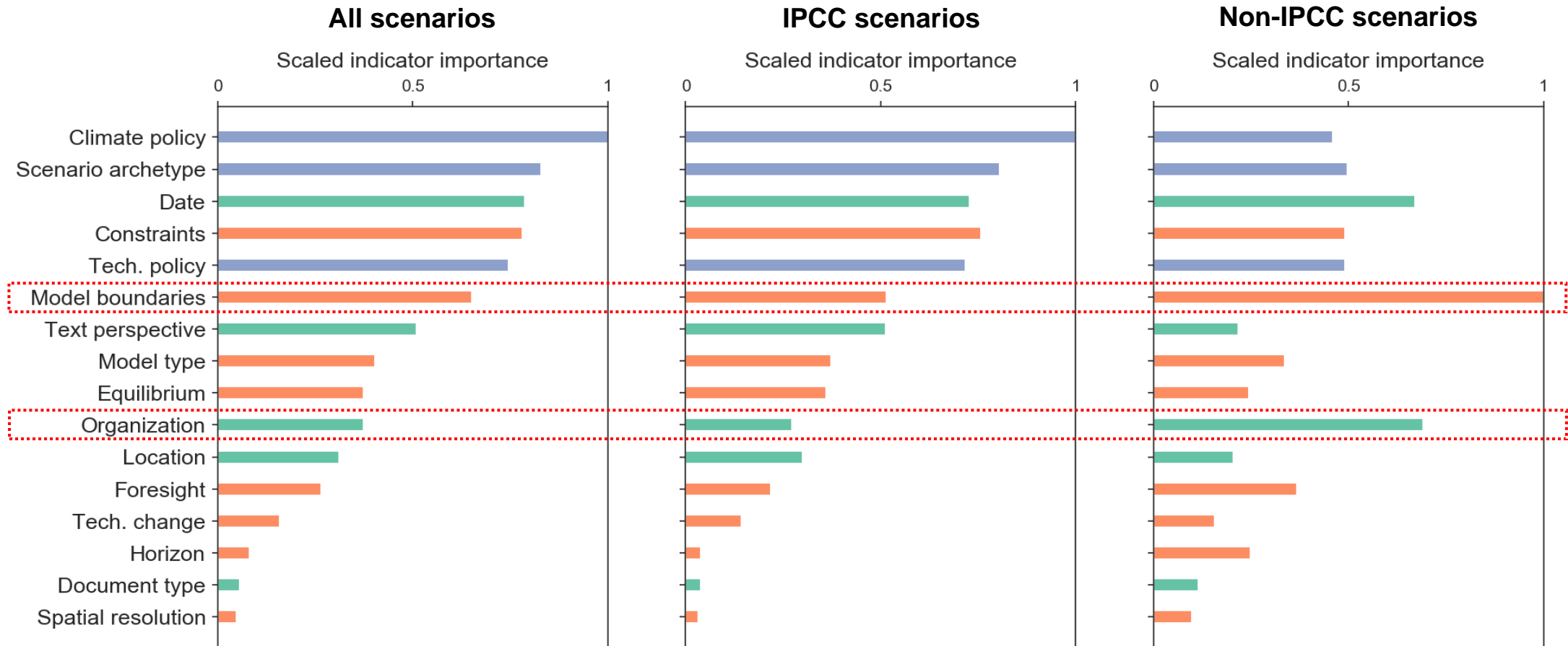
# Matching scenario indicators with PV outcomes

- Can we estimate scenario outcomes only using the generic scenario indicators?
- 73% average accuracy for classifying scenarios into quintiles of projected PV growth, using XGBoost



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# Conclusions

- Diversity of expert views regarding PV prospects is reflected in scenario literature of the last decade: recent global scenarios span two orders of magnitude for global PV capacity by 2050
- Simpler models and corporate scenarios are on average more optimistic about PV growth; IPCC scenarios represent more diverse regional pathways for Asia and Middle East-Africa
- Large portion of uncertainty in published PV projections can be related to generic scenario and model characteristics, without including specific scenario assumptions: keep in mind the “who, how, when” when interpreting scenarios



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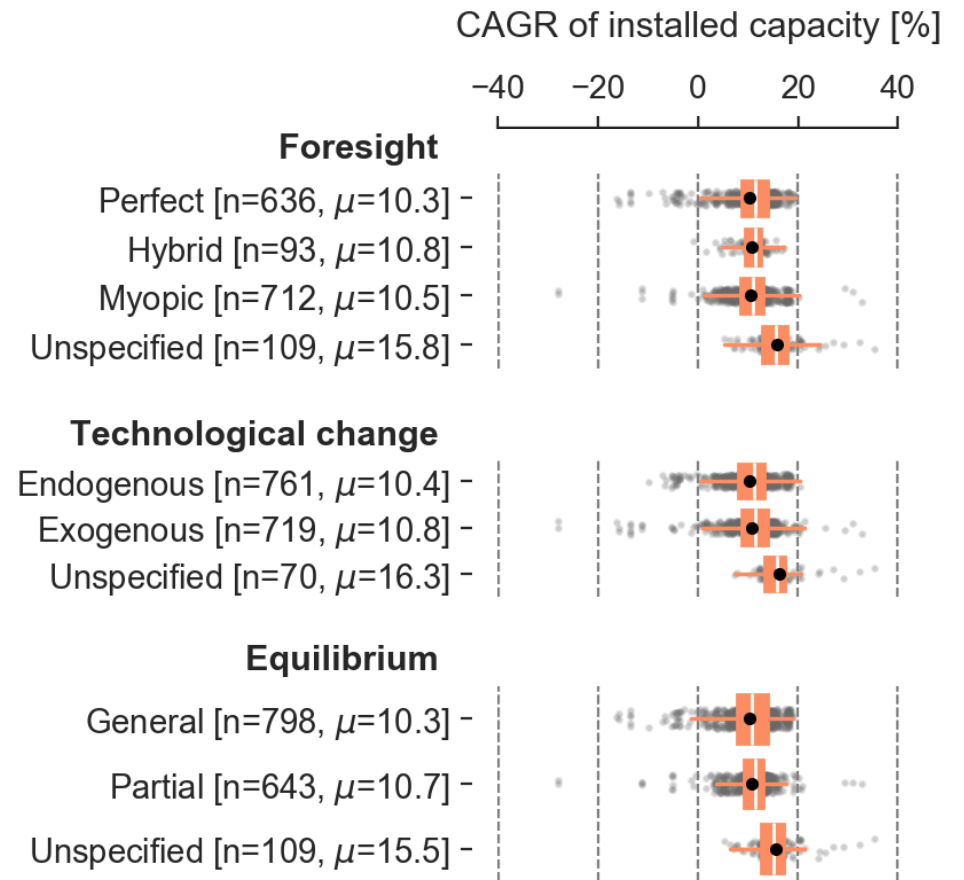
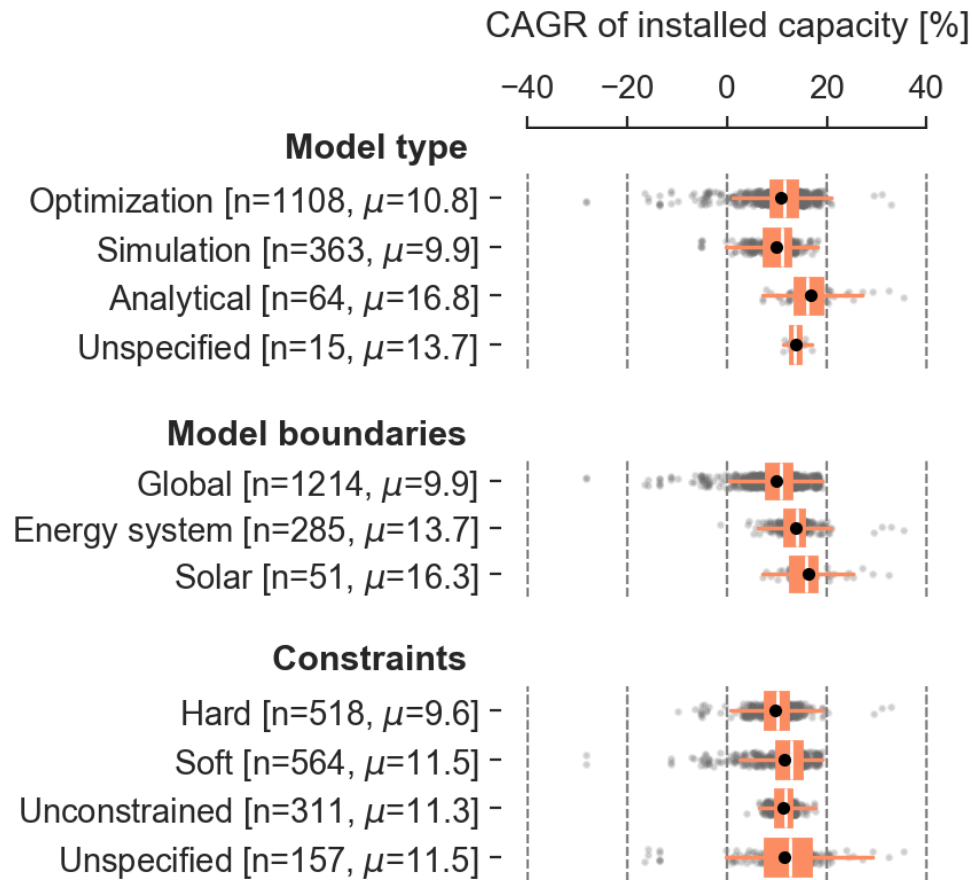
# Thank you for your attention!

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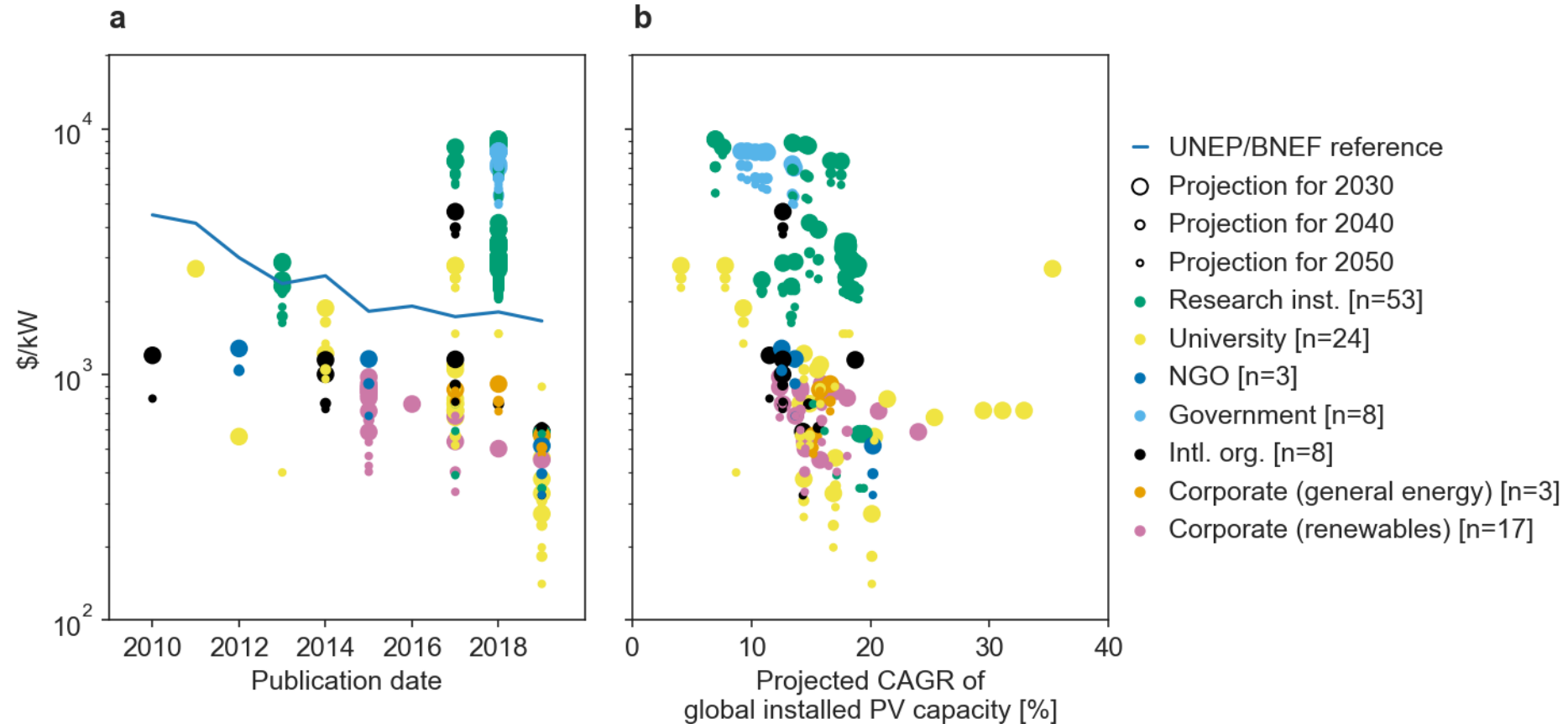
# Visualizing scenario outcomes

## Model indicators





# Scenario cost assumptions



# Matching organizations, scenario archetypes and topics

