Benchmarking VRE cost assumptions with awarded renewable energy auctions – A comparative assessment of global energy scenarios

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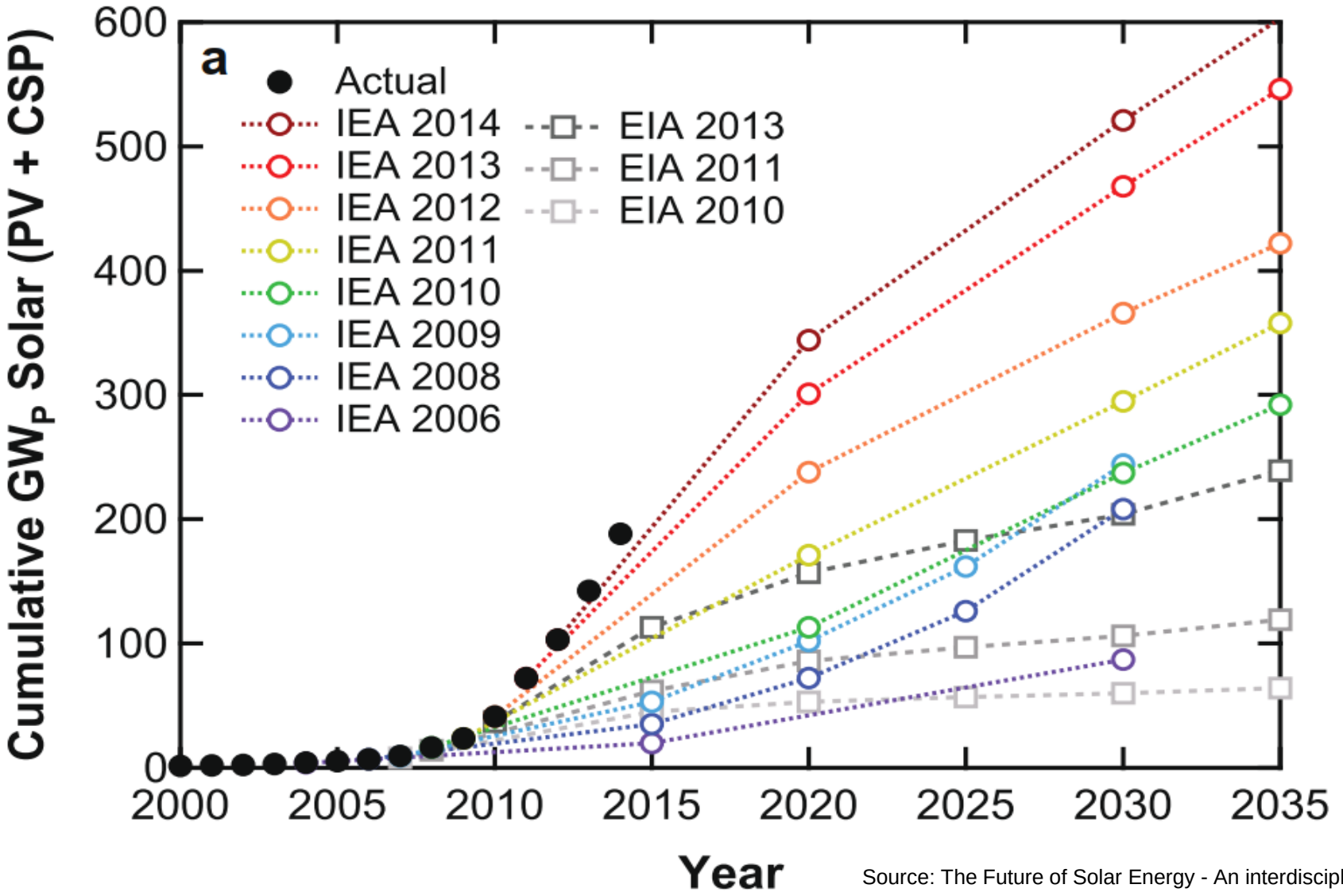
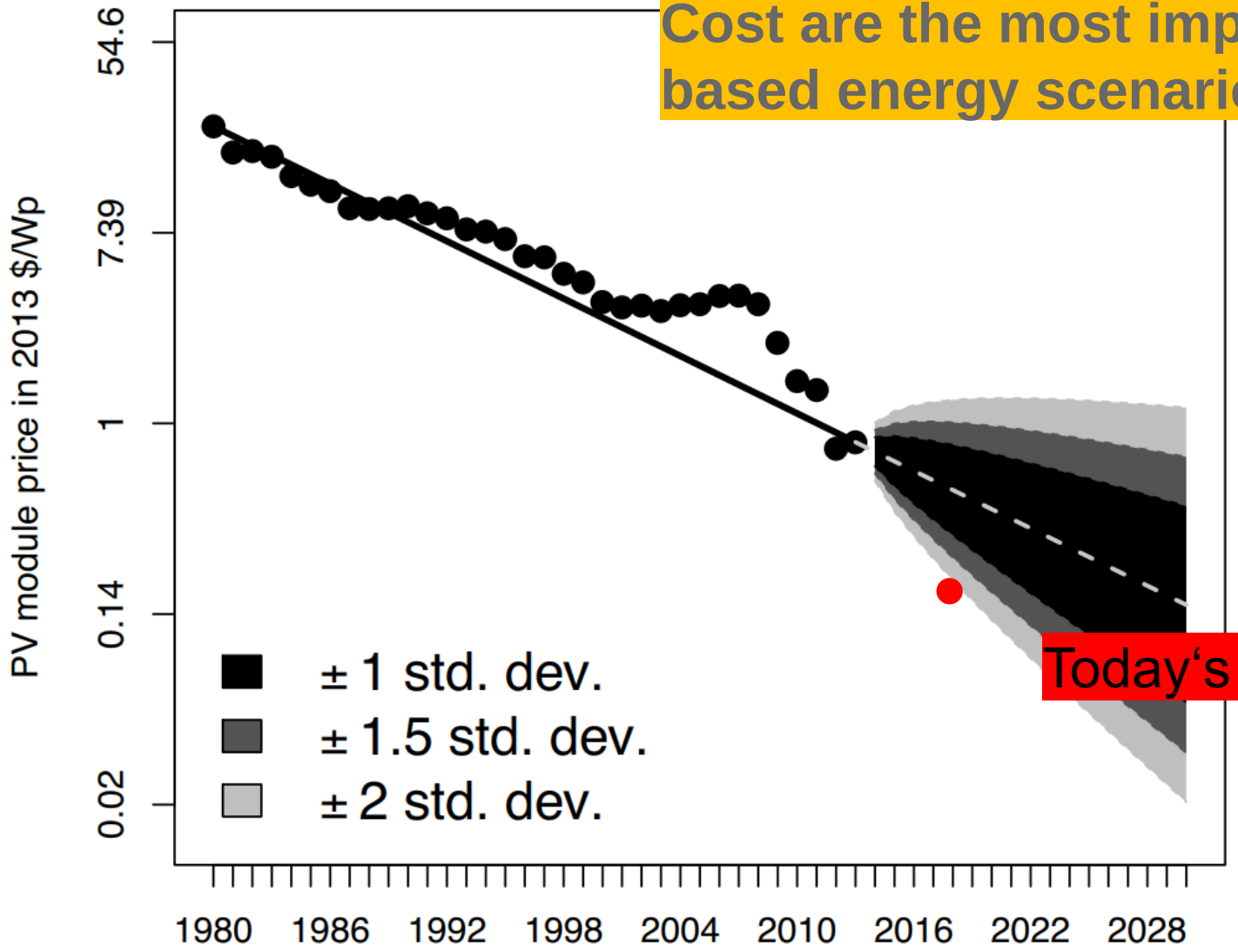
Session C2 – Impact

Energy scenarios have often failed to anticipate RES development



Source: The Future of Solar Energy - An interdisciplinary MIT study (2015)

Renewables have shown rapid cost decline



Cost are the most important driver of model-based energy scenarios

PV cost on an exponential decline (!?)

PV cost on a *faster* than exponential decline (?!)

Today‘s low-cost value

Source: Farmer and Lafond - How predictable is technological progress? (2016) *Research Policy*

Methods – Review selection criteria

Energy scenarios that are part of the review:

- Long-term energy scenarios including capacity development
- Report cost values (either in CAPEX or LCOE)
- 2015 or later, i.e. after the Paris Agreement,
- Global or regional scope (regional only if the level of remuneration for renewables has been set by tenders)

Current cost benchmark:

- IRENA - Renewable Power Generation Costs in 2017
- IRENA - Renewable Energy Auctions: Analysing 2016

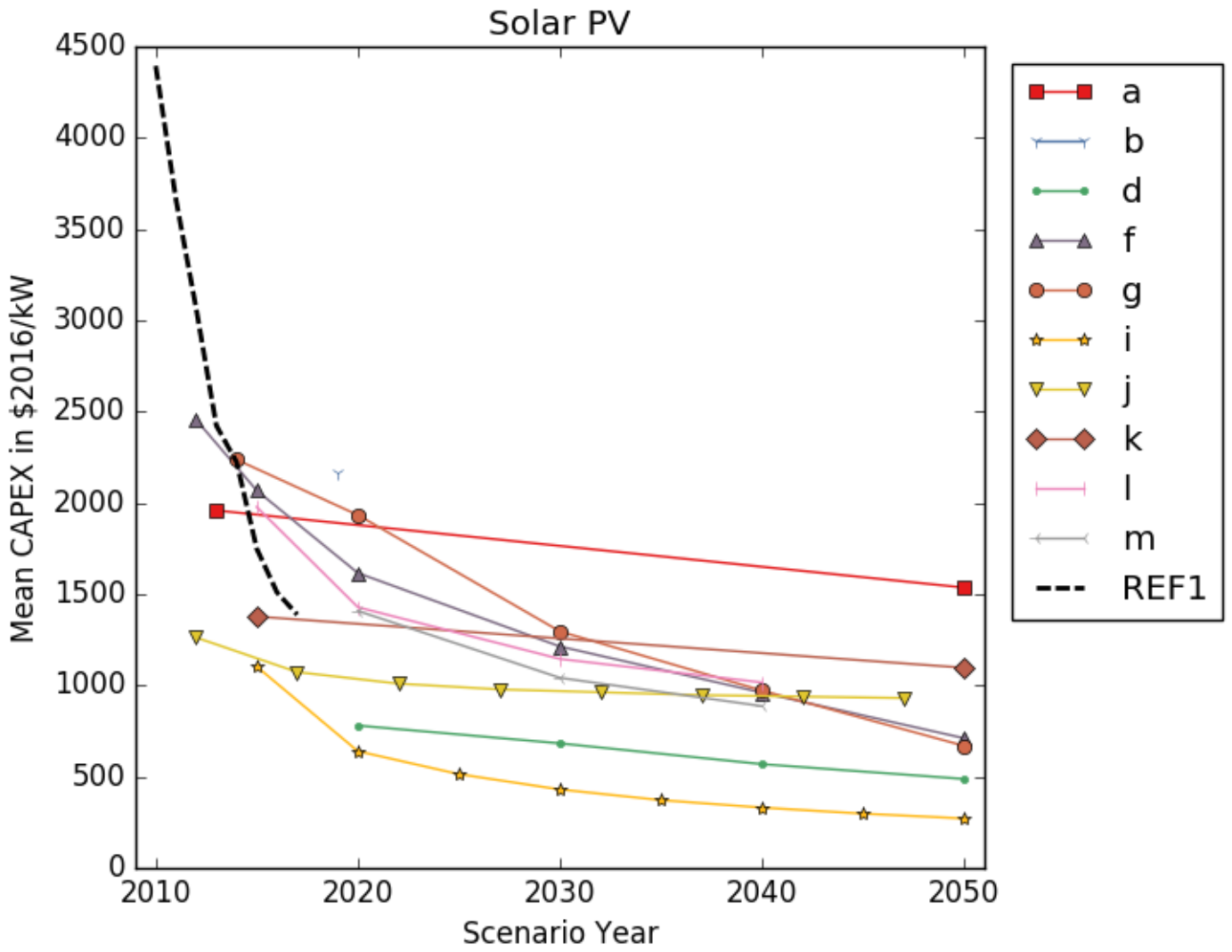
Technologies:

- Solar PV, CSP, Wind Onshore, Wind Offshore

Studies under consideration

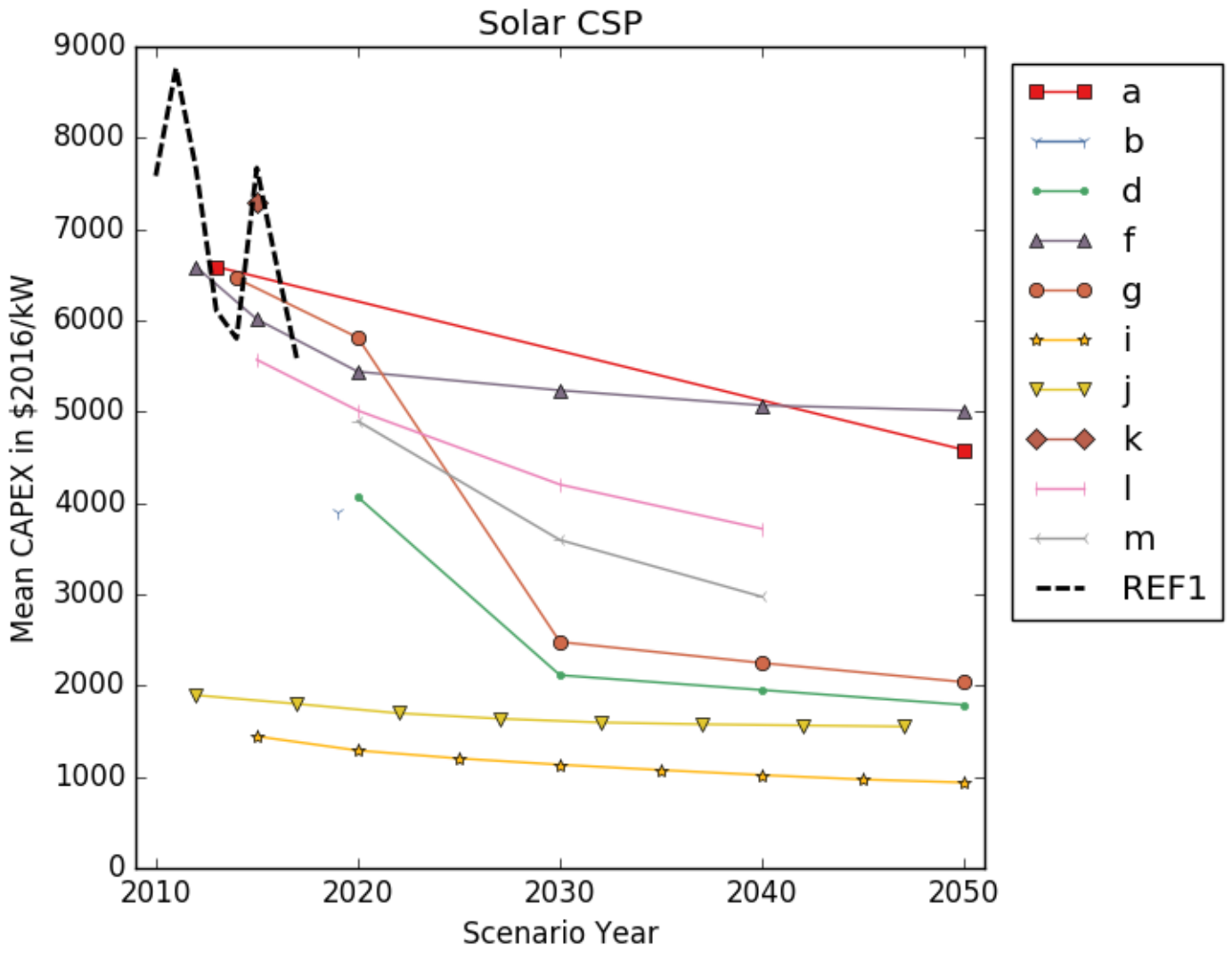
No.	Scenario	Scope	Year	Author/Institute
a	100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World	World	2017	Jacobson et al.
b	Annual Energy Outlook	USA	2017	U.S. Energy Information Administration (EIA)
c, p-t	Assessment of wind and solar power in global low-carbon energy scenarios	World	2017	Luderer et al.
d	China Renewable Energy Outlook 2017	China	2017	Energy Research Institute of Academy of Macroeconomic Research & China National Renewable Energy Centre
f	Energy [R]evolution	World	2015	Greenpeace
g	Energy [R]evolution Brazil	Brazil	2016	Greenpeace
h	EU Reference Scenario 2016	EU	2016	European Commission
i	Global Energy System Based on 100% Renewable Energy - Power Sector	World	2017	LUT & Energy Watchgroup
j	India Energy Security Scenarios 2047	India	2015	Government of India, Energy Division
k	Integrated Resource Plan	South Africa	2017	Department of Energy, South Africa
l	World Energy Outlook - New Policies Scenario	World	2017	International Energy Agency (IEA)
m	World Energy Outlook - 450 Scenario	World	2017	International Energy Agency (IEA)
REF1	Renewable Power Generation Costs in 2017 (Cost database)	World	2018	IRENA
REF2	Renewable Power Generation Costs in 2017 (Auction database)	World	2018	IRENA

CAPEX – Solar PV



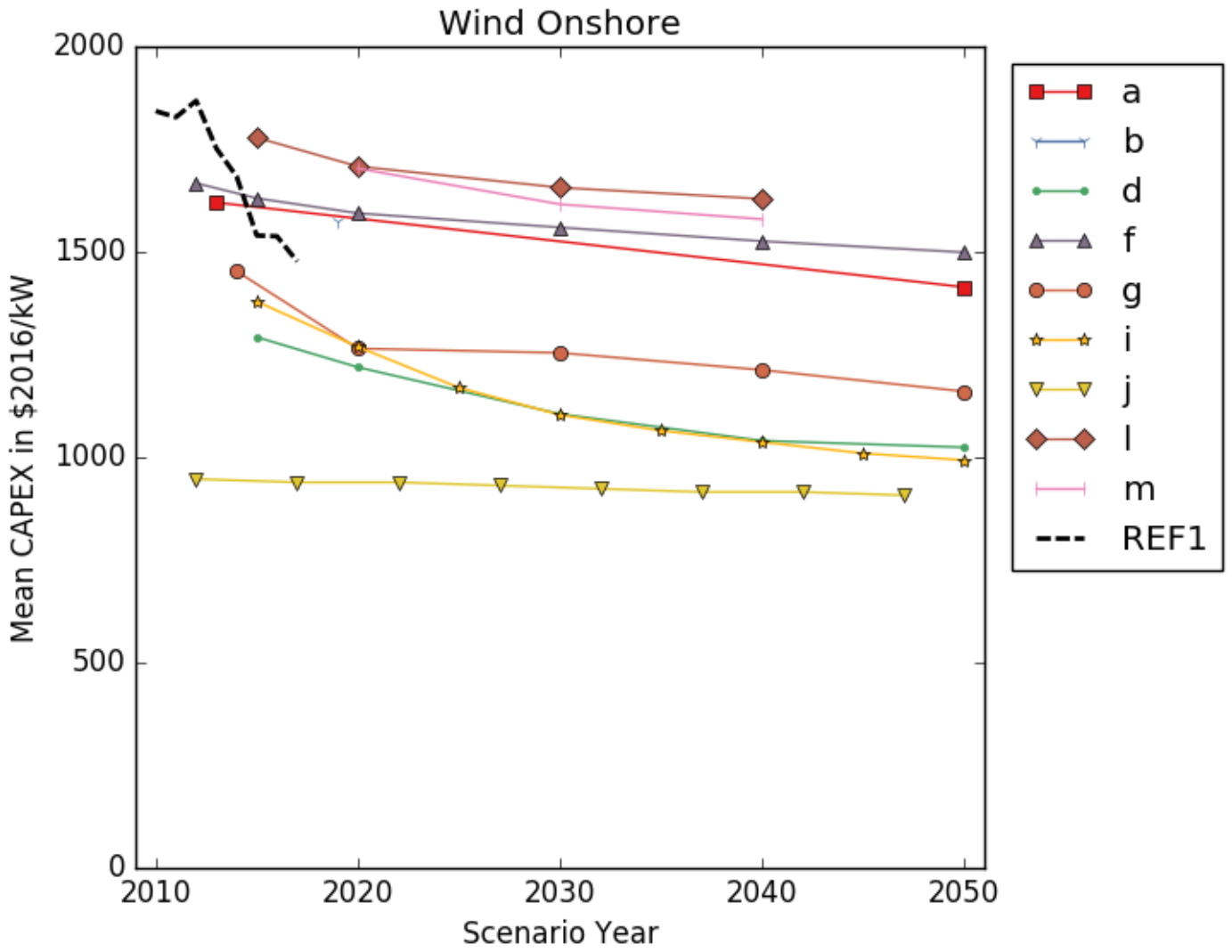
- Slope of the scenarios does not reflect cost trend
- About half of the scenarios above the actual costs around 2015
- Almost all scenarios project rather low absolute cost reduction potential after 2020
- High divergence in 2050

CAPEX – CSP



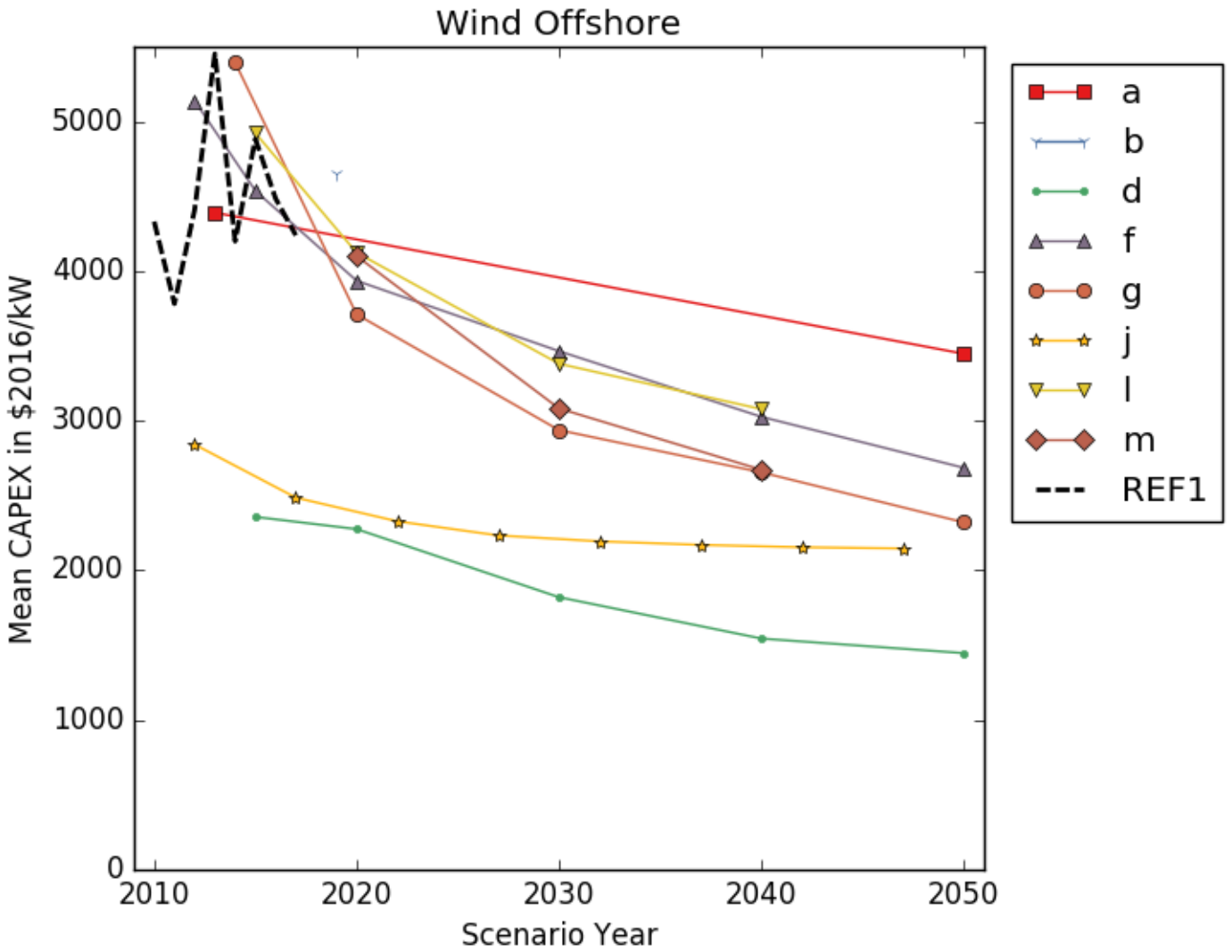
- Large divergence even around 2015, probably due to different assumptions about system configurations (e.g. solar multiple)
- Current cost assumptions subject to greater uncertainty
- Similar to PV, divergence for 2050 around 5

CAPEX – Wind Onshore



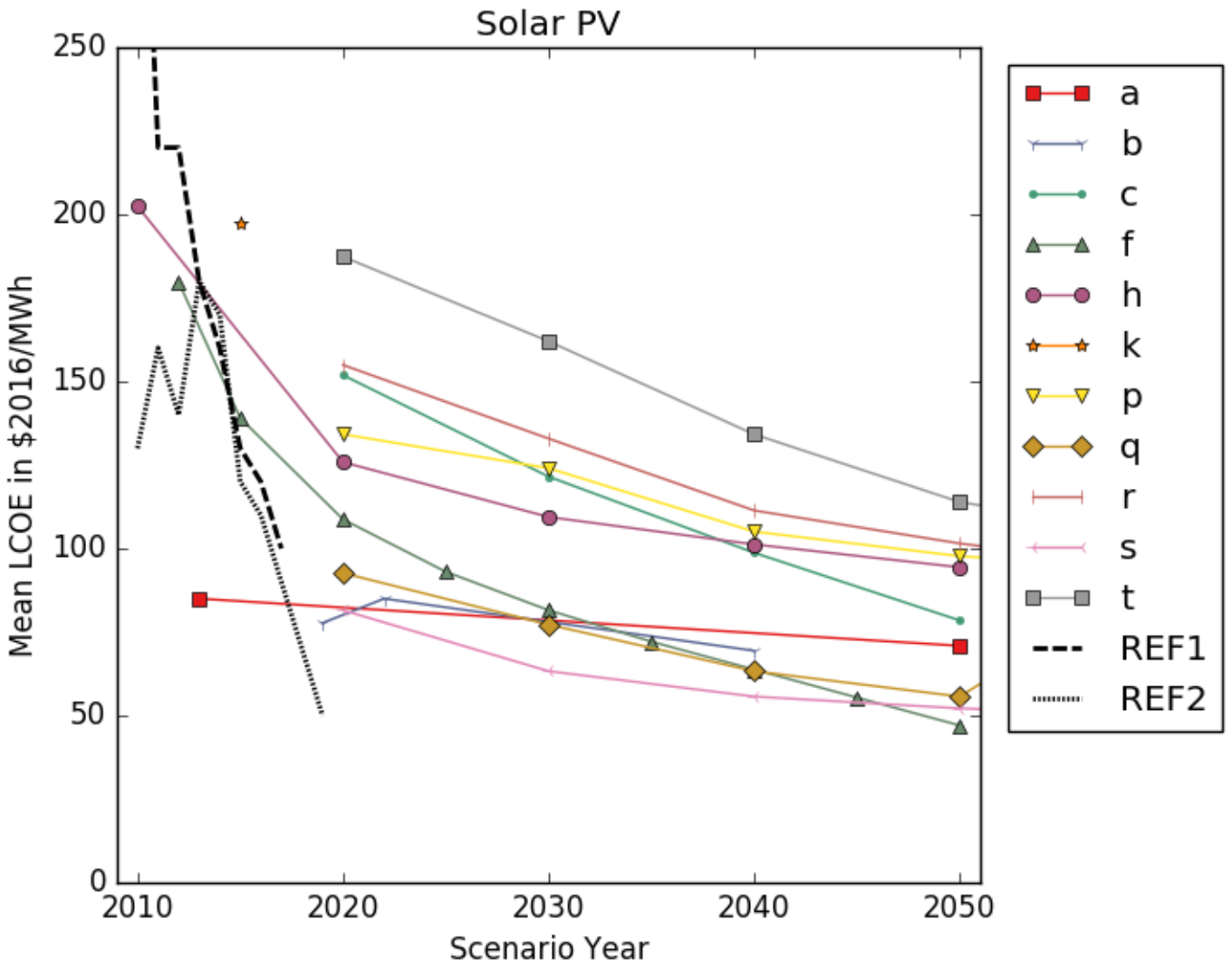
- Current cost assumptions in most studies in a similar range
- Most studies see little potential for cost reduction
- Divergence decreases over time

CAPEX – Wind Offshore



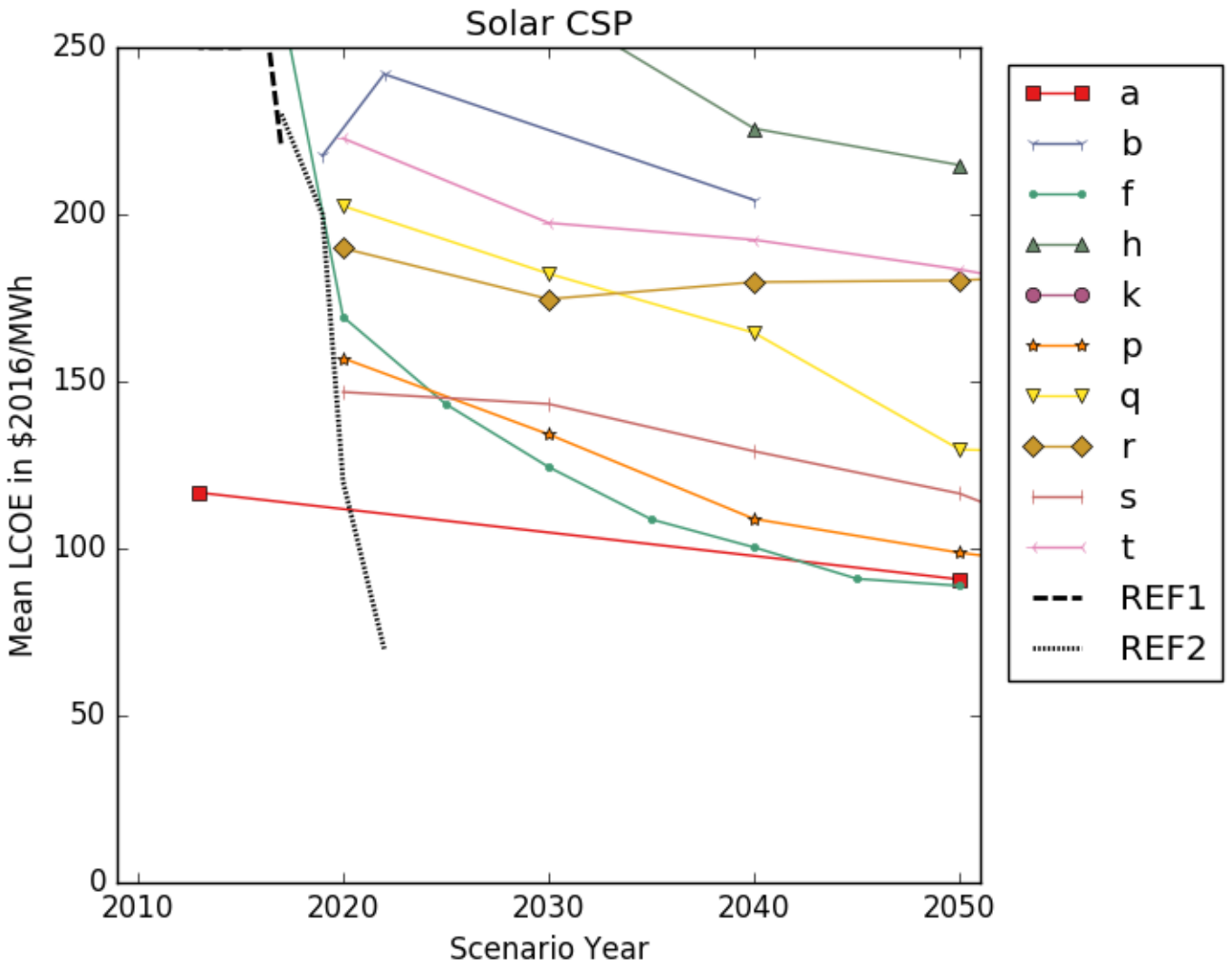
- Uncertainty of current reference cost data seems high
- Current reference CAPEX consistent with most scenario assumptions
- Most studies see large cost reduction potential with a relatively steep drop in costs

LCOE – Solar PV



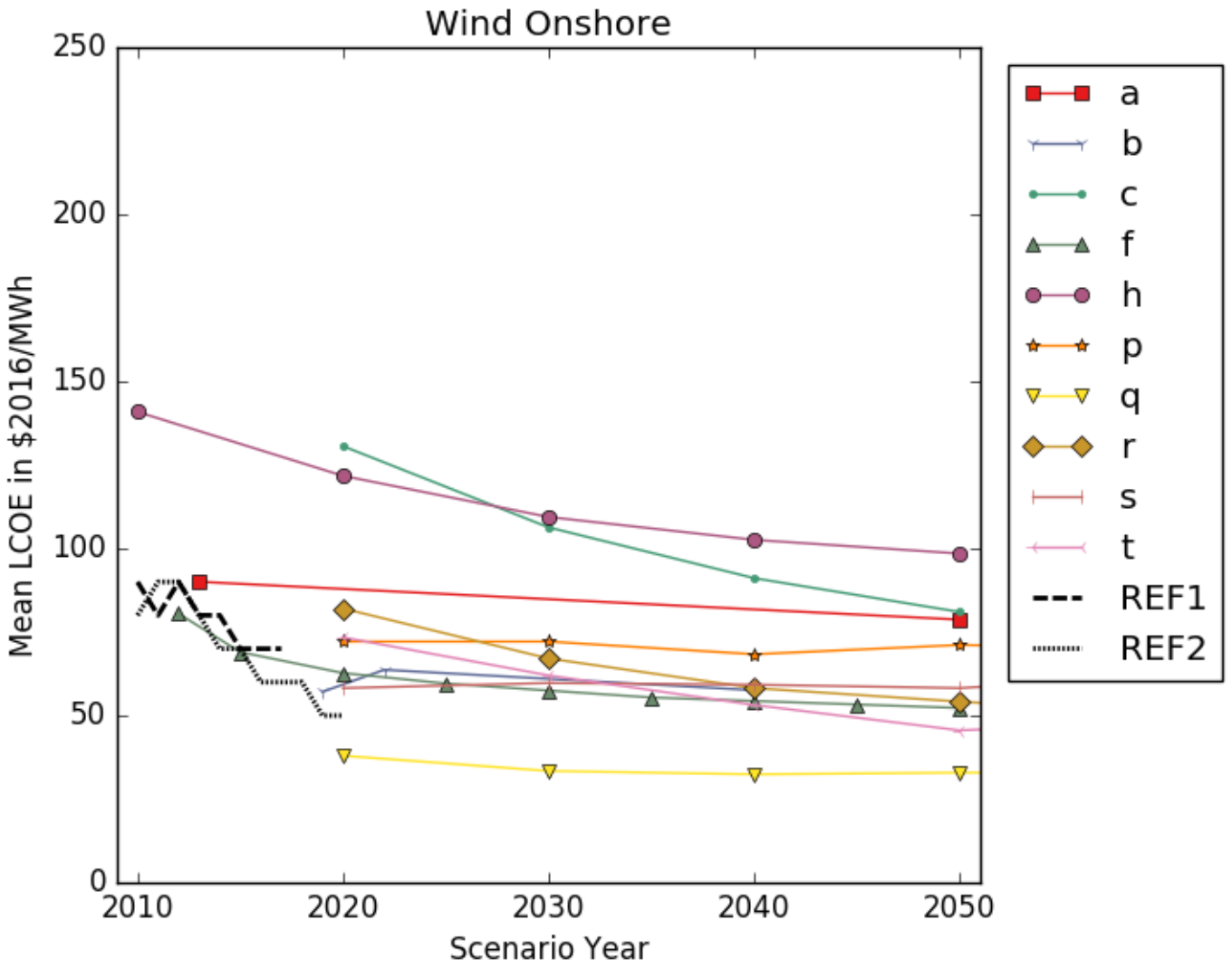
- LCOE decline in reference even greater than the CAPEX
- All studies show decrease in LCOEs, but at slower rate than the reference
- All studies in 2040 still above today's values, and only one study in 2050 above today's reference value

LCOE – CSP



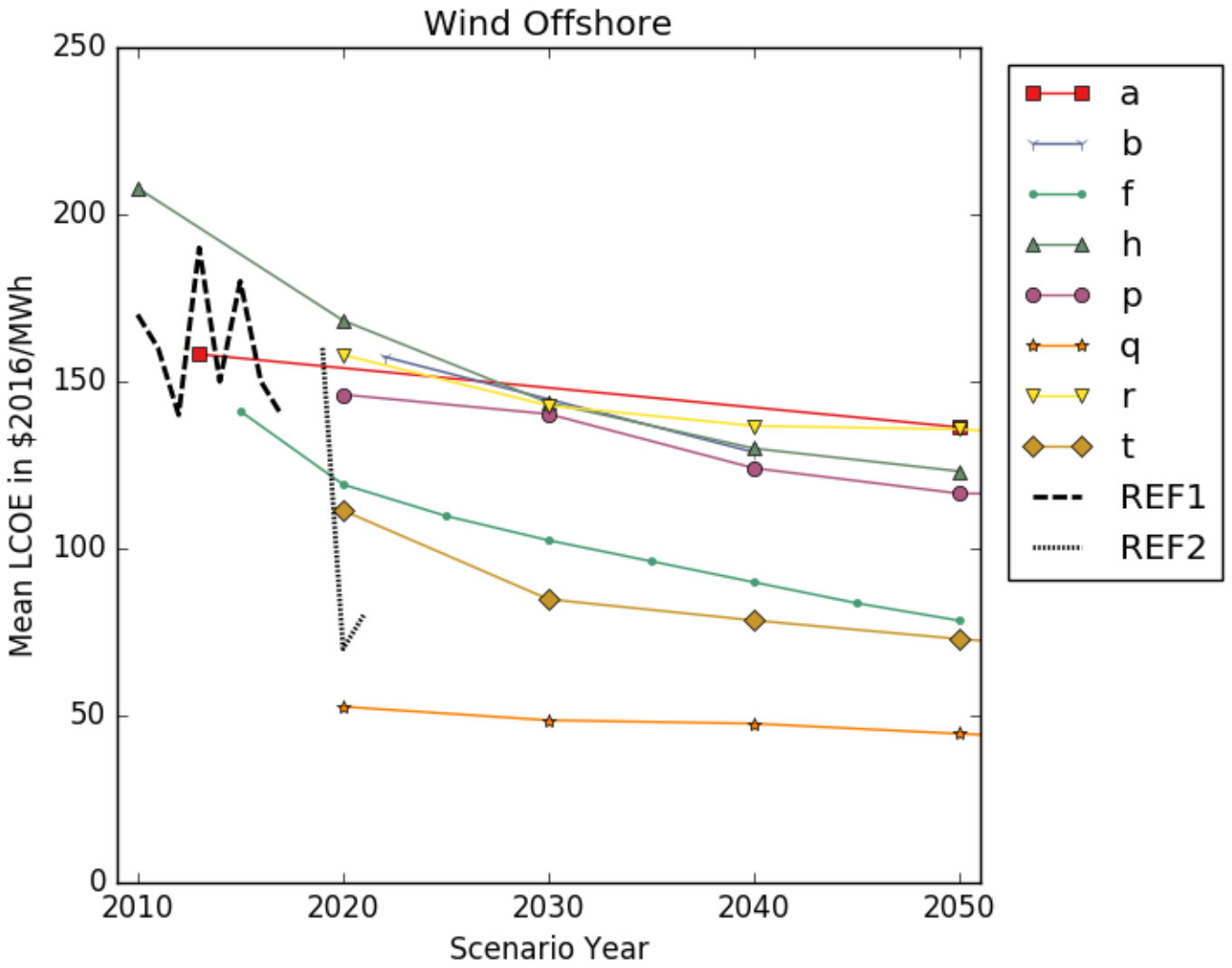
- Relatively limited cost reduction potential seen by scenarios, albeit from completely different starting points
- Actual and anticipated cost reduction is not covered by any study
- Divergence in studies is high and remains high

LCOE – Wind Onshore



- Comparable to CAPEX evaluation
- Most studies see a limited potential for costs reduction
- Reduction currently taking place is considered by virtually no study

LCOE – Wind Offshore



- Analogous to CAPEX evaluation, current reference values appear to have greater uncertainty
- Auction data: sharp fall in prices is emerging, which is anticipated by virtually no study

Discussion and Conclusion

Possible reasons for mismatch:

- Industry is subject to a speculative bubble
- Reference source is distorted
- Community suffers from a status quo bias
  does not update assumptions quickly enough

Consequences:

- Cost decline underestimated
- Economic potential of renewables underestimated
- Transformation and mitigation costs overestimated
- Worst case: delay of transformation efforts towards clean energy, waste of emission reduction potential

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