

# APPROACHES FOR USING SCENARIOS IN STRATEGIC DECISION- MAKING

TCFD U.S. Scenario Analysis Conference

Nathaniel Bullard

May 1, 2018

# Analysis to help you understand the future of energy

## Clean Energy



Solar   Wind   Decentralized Energy   Impact on Power & Utilities   Storage   Frontier Power

## Advanced Transport



Electrified Transport   Impact on Transport   Impact on oil demand   Autonomous Driving   Shared Mobility

## Commodities



Carbon   EU Power, US Power   LNG & Gas   Oil & Products

## Emerging Technologies



Internet of Things   Machine Learning & Analytics   Advanced Materials   Impact on Industrials and Energy

# New Energy Outlook



# Principles for using climate scenarios

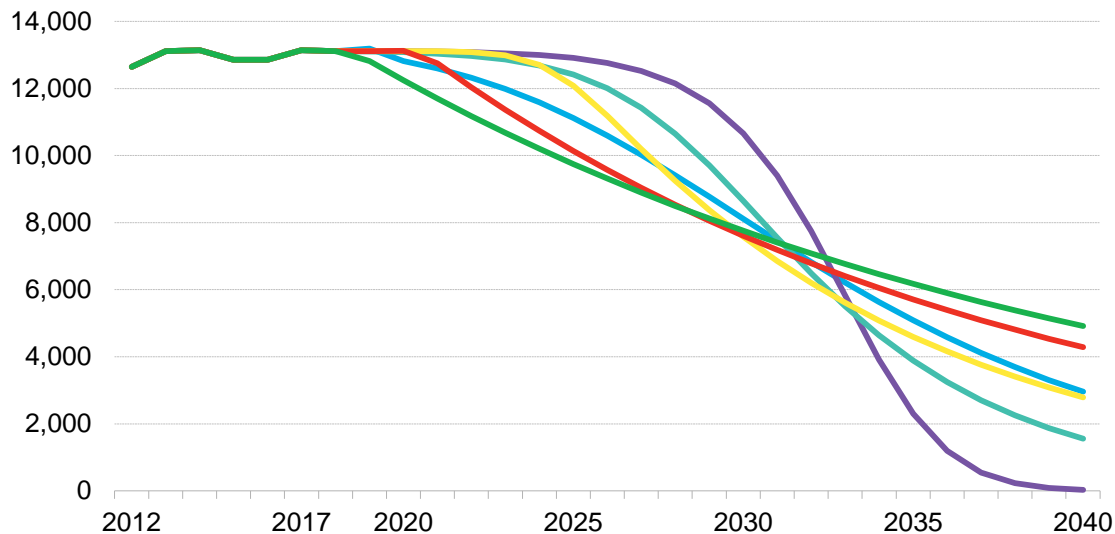
- Use a range of scenarios from multiple sources
- Ask “what do I need to believe?” for this to come true
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- Get the most up to date data and review often
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# Many routes to meet two degree carbon budget...

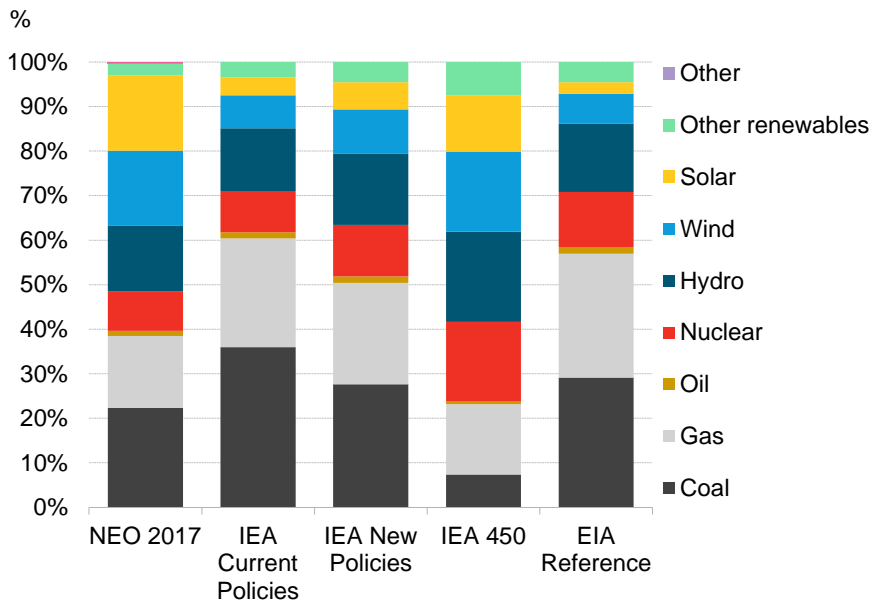
Carbon emissions (MtCO<sub>2</sub>)



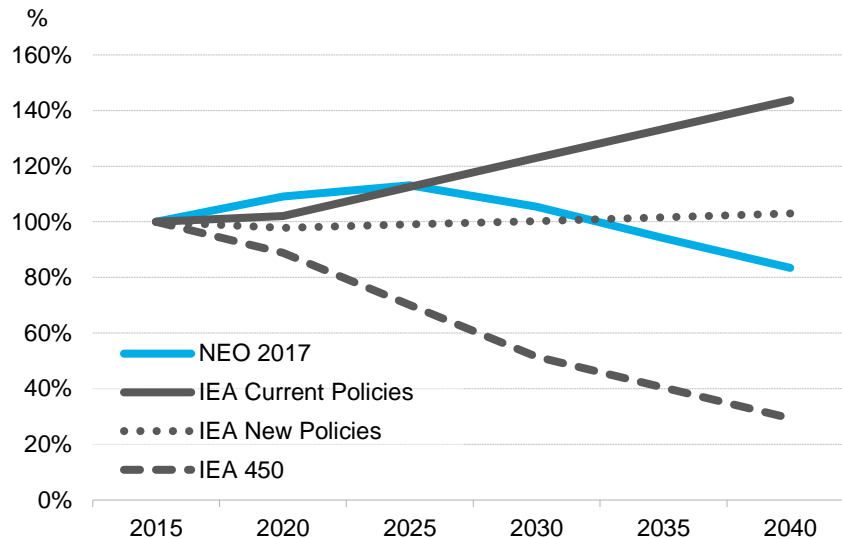
Source: Bloomberg New Energy Finance Note: data is for power sector only.

# ...and many tech pathways

## Installed capacity by technology, 2040



## Change in gas demand, 2015-2040



Source: Bloomberg New Energy Finance, IEA, EIA; Note: solar includes PV & solar thermal; wind includes onshore and offshore wind.

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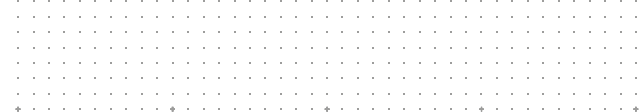
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# CCS is still found everywhere



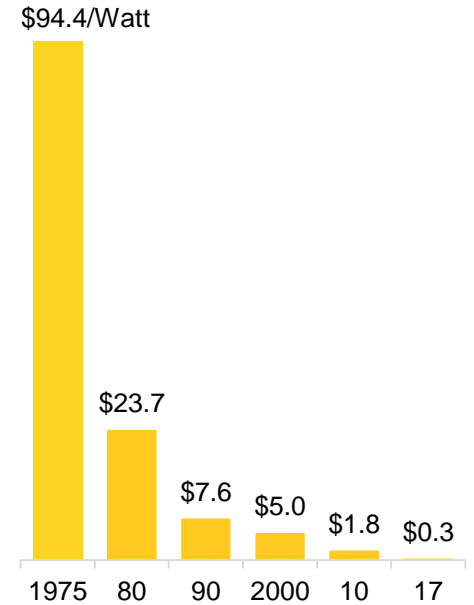
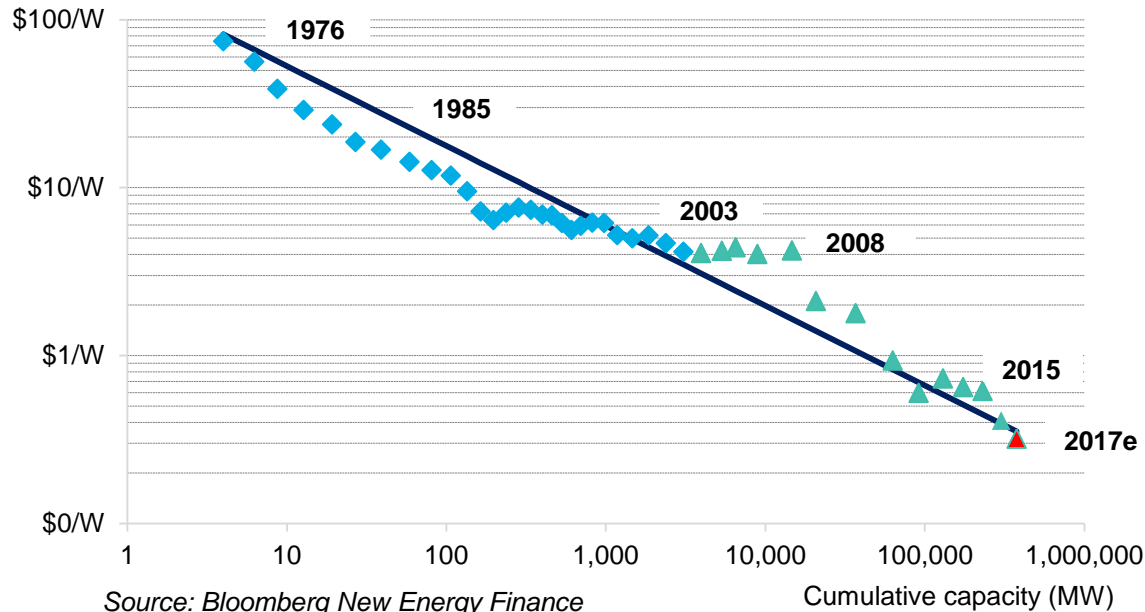
Company	Role of CCS in forecast
Bloomberg New Energy Finance	<b>CCS not part of analysis</b>
IEA	<ul style="list-style-type: none"><li>• <b>450 scenario</b>: “(...) Carbon capture and storage (CCS) picking up in the 2030s (...); 70% of coal plants equipped with CCS</li><li>• <b>New Policies scenario</b>: &lt;1,000 Mtce of coal demand for CCS/IGCC</li></ul>
BP	<ul style="list-style-type: none"><li>• <b>Base case</b>: not clear</li><li>• <b>Even Faster transition</b>: “more than a third of the carbon emissions from the remaining coal and gas power generation are capture and stored”</li></ul>
ExxonMobil	<ul style="list-style-type: none"><li>• “[Technological] Advances will promote (...) emerging opportunities for technologies like carbon capture and storage (CCS).”</li></ul>
Shell	<ul style="list-style-type: none"><li>• <b>Mountains scenario</b>: “(...) success of carbon capture and storage technologies.”</li><li>• <b>Oceans scenario</b>: “(...) carbon capture and storage is delayed”</li></ul>
Statoil	<ul style="list-style-type: none"><li>• <b>Reform scenario</b>: “Many successful [CCS] projects (...)”</li><li>• <b>Renewal scenario</b>: “Significant growth [of CCS] (...)”</li></ul>

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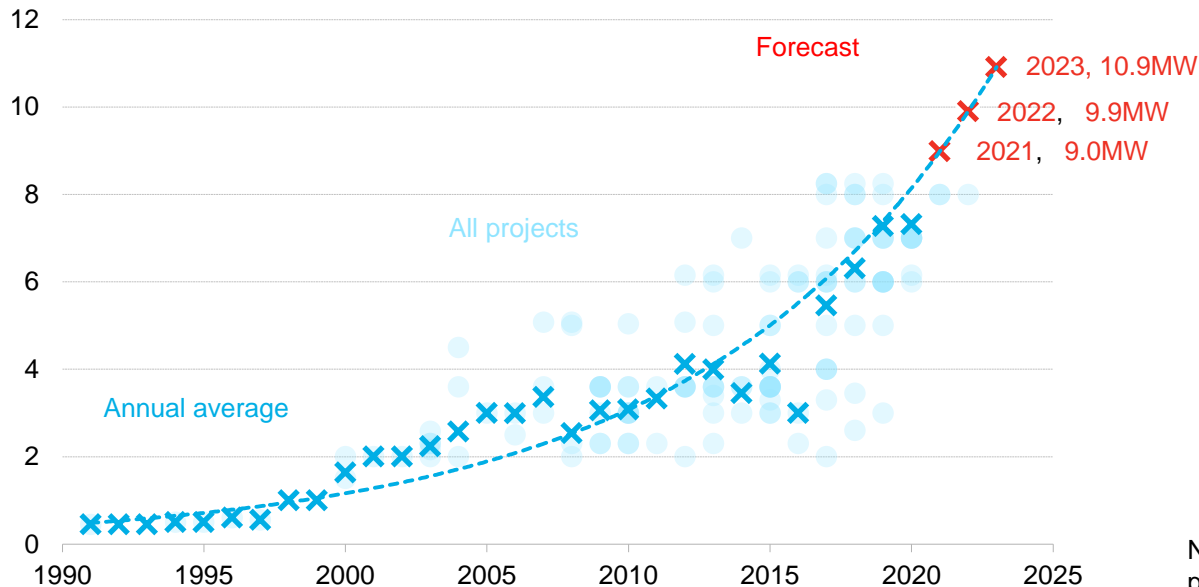
# Solar PV got cheap, and it will get cheaper

## Crystalline silicon solar PV experience curve



# Offshore wind turbine capacity by commissioning date

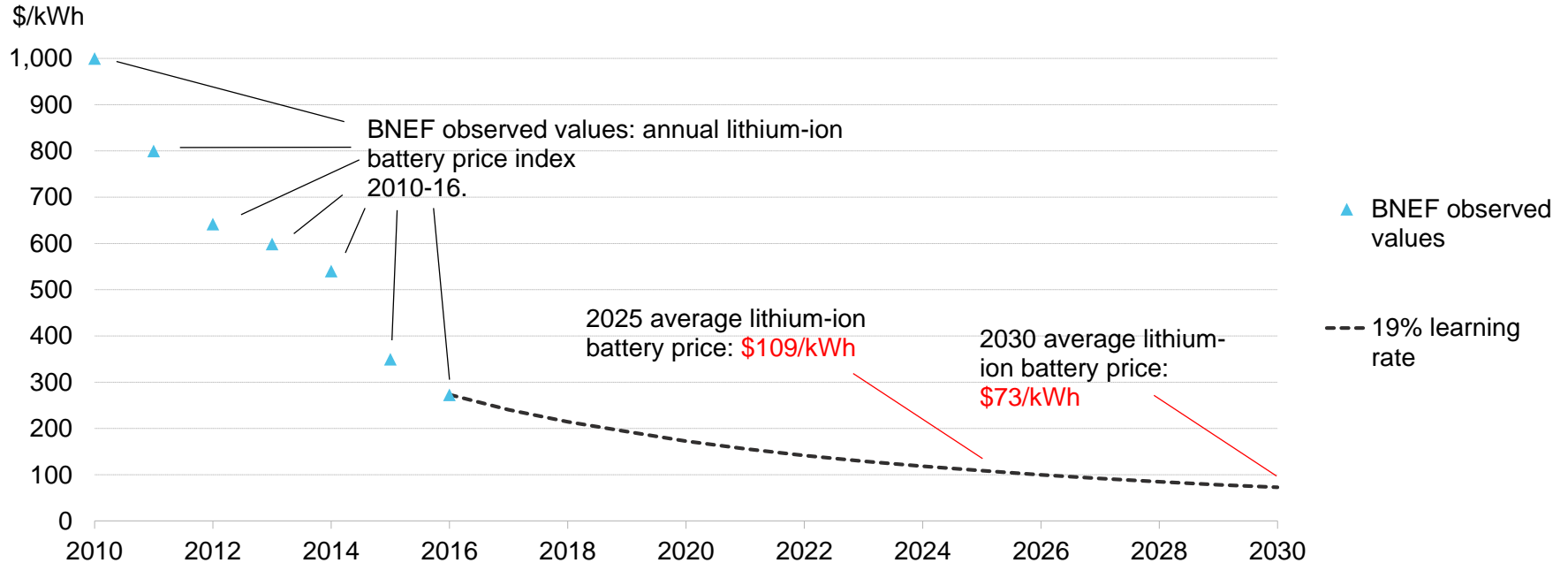
Turbine capacity (MW)



Source: Bloomberg New Energy Finance

Note: X-axis denotes commissioning date. A project-weighted average was used for projects with multiple turbine models.

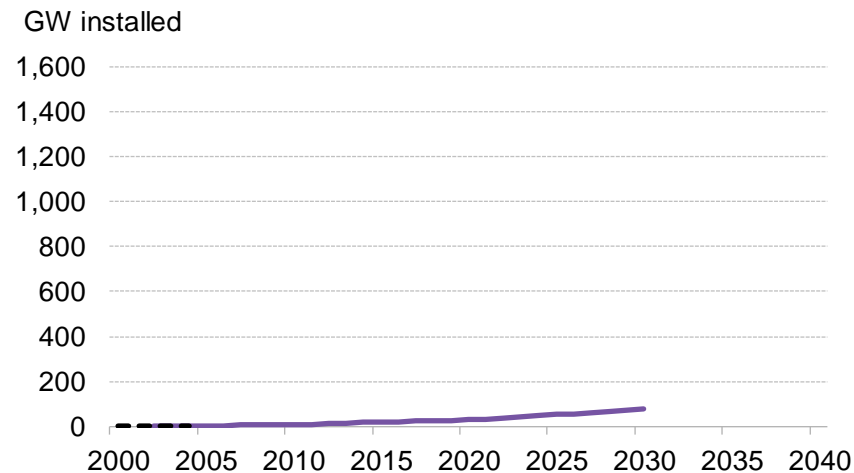
# Lithium-ion battery prices, historical and forecast



Source: Bloomberg New Energy Finance *EVO 2017*; Note: Prices are an average of BEV and PHEV batteries and include both cell and pack costs. Cell costs alone will be lower. Historical prices are nominal, future ones are in real 2016 U.S. dollars.

# IEA solar capacity forecast evolution

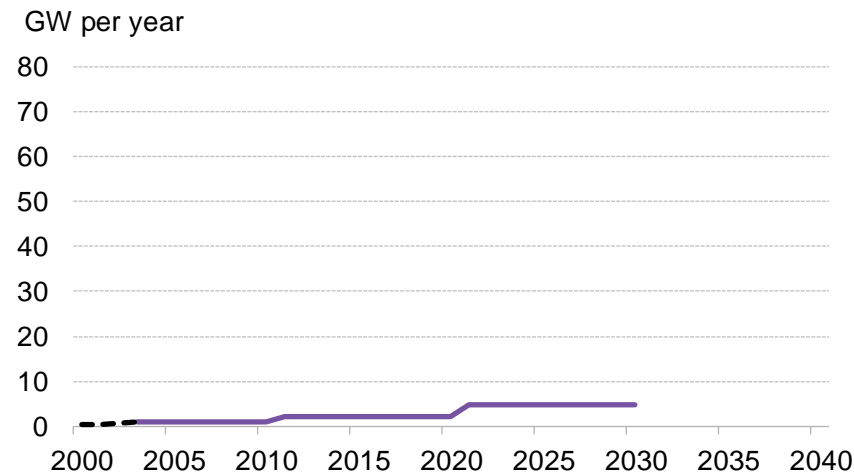
## Global cumulative solar installations



--- Historical — 2004

Note: 2004-2009 Reference, 2010-2016 New Policies Scenario

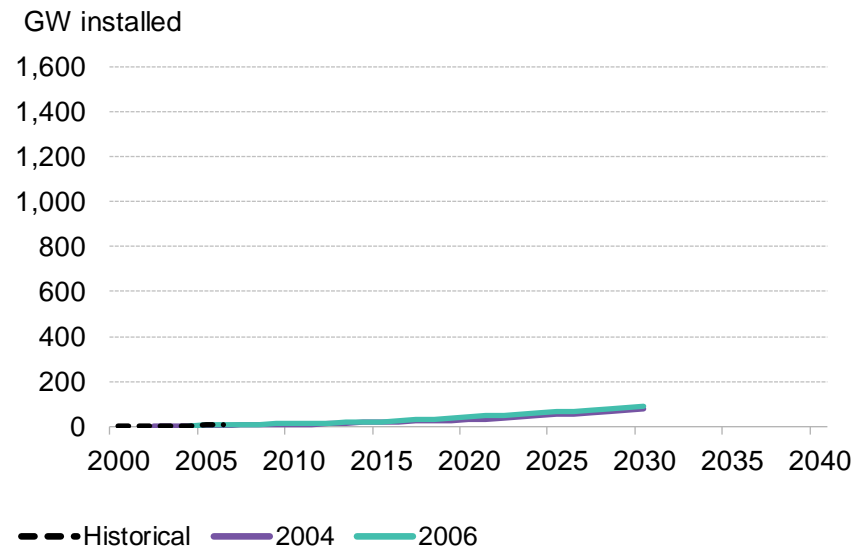
## Annual solar additions



Source: IEA World Energy Outlook

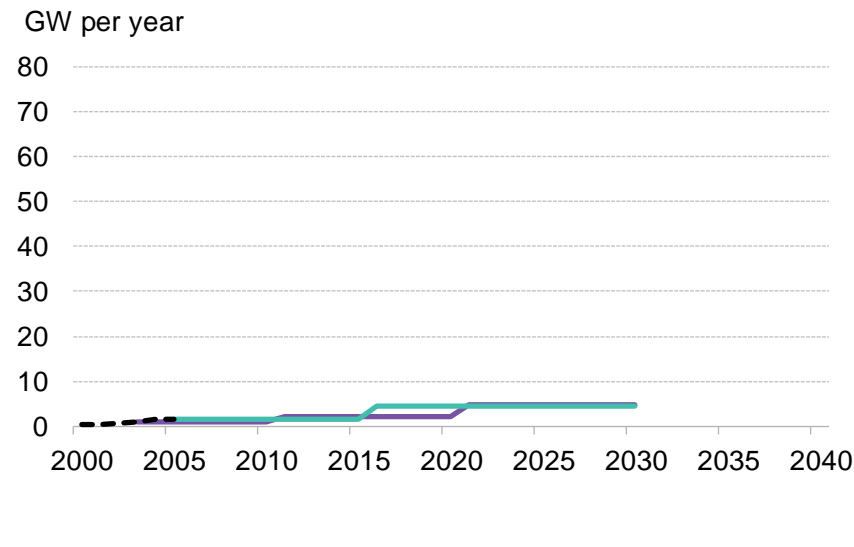
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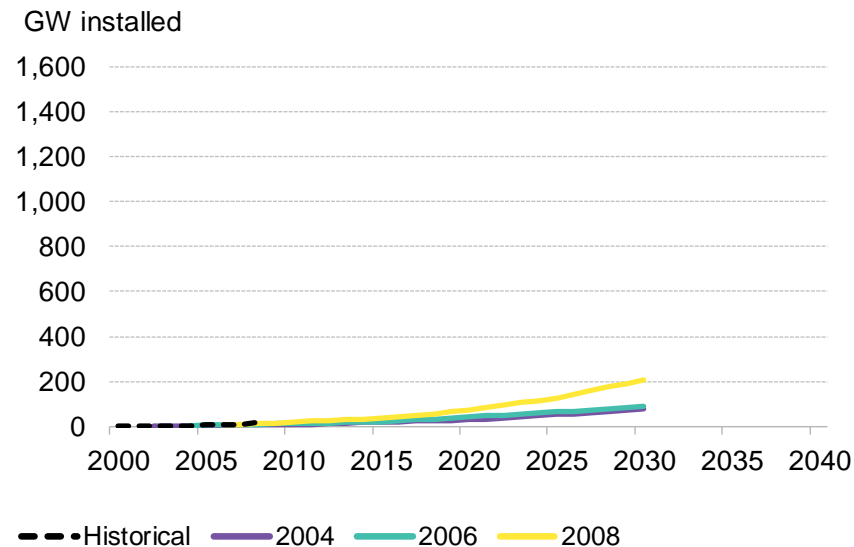


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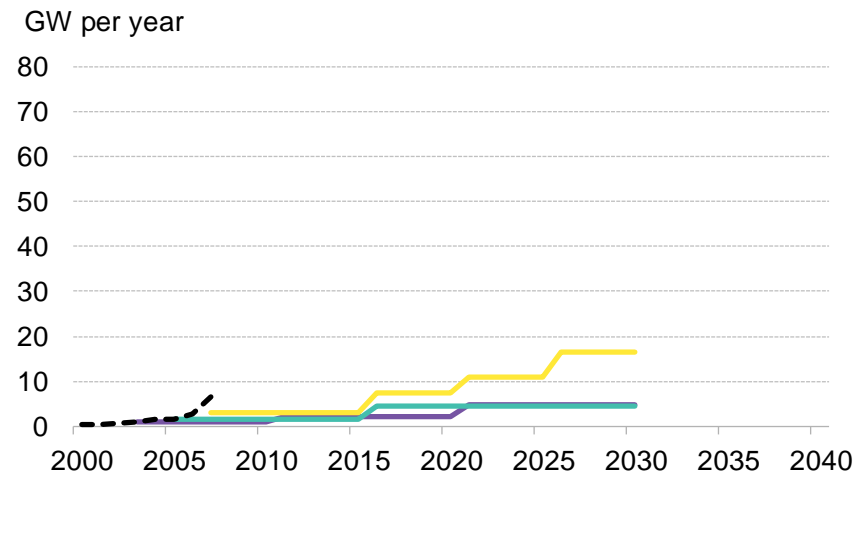
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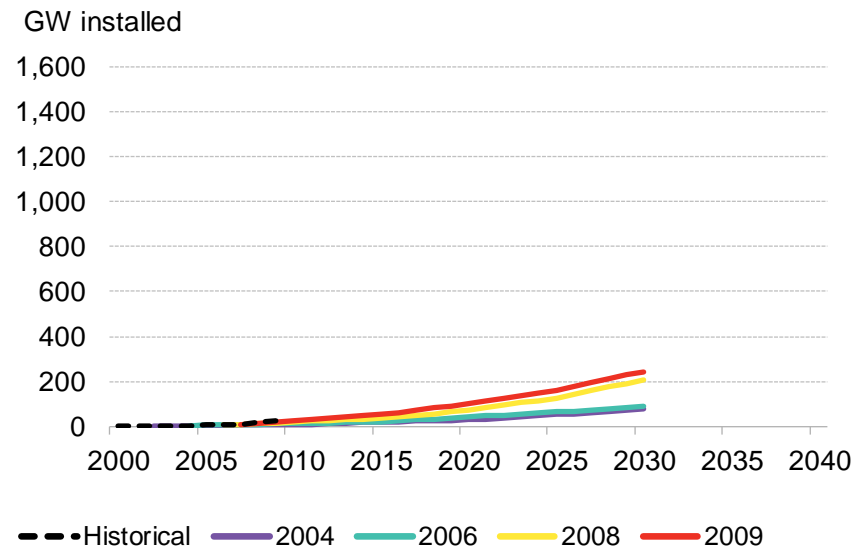
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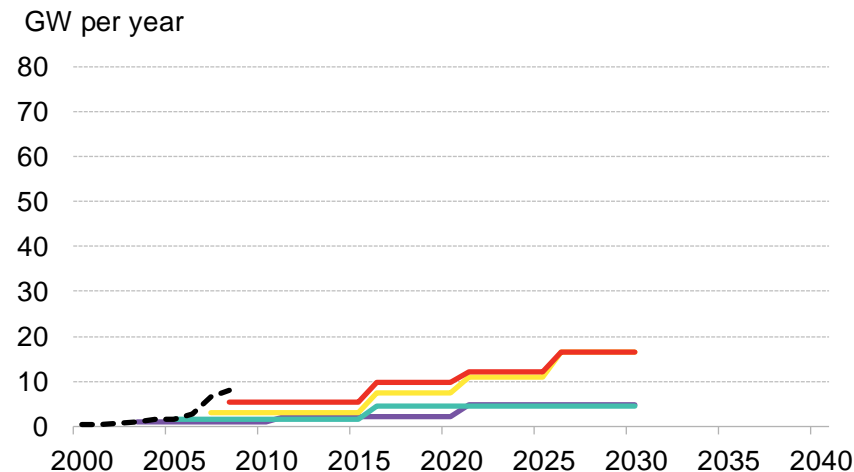
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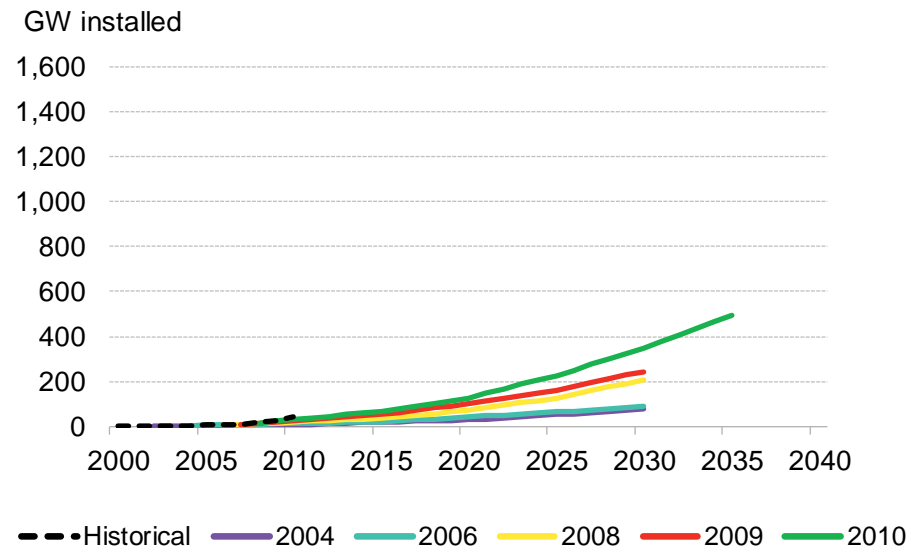
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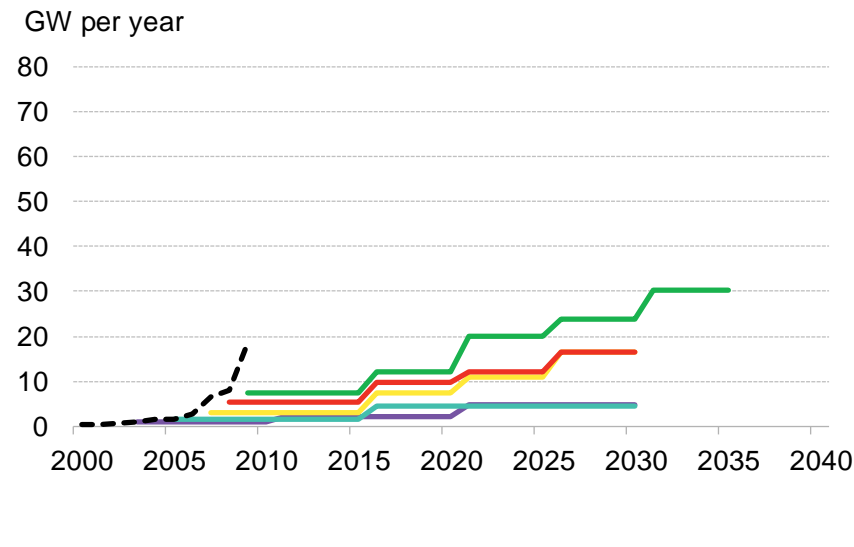
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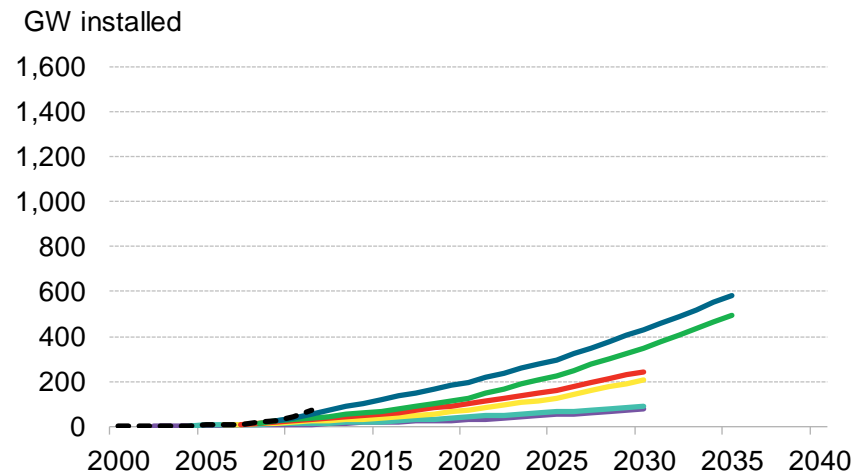
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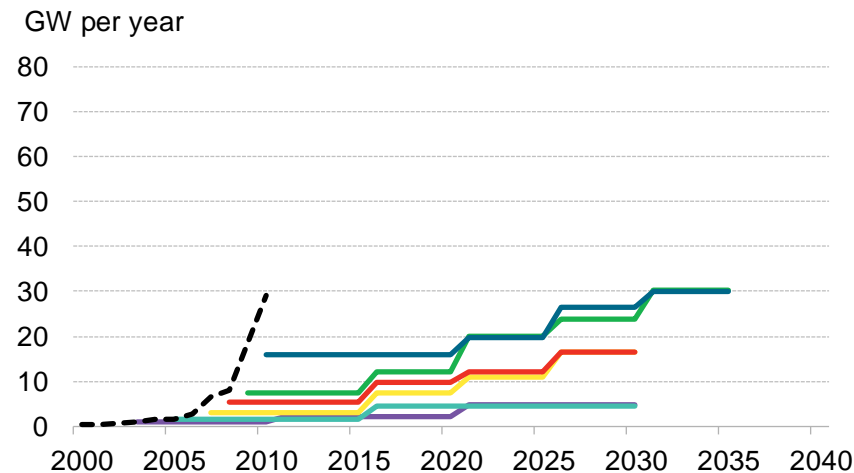
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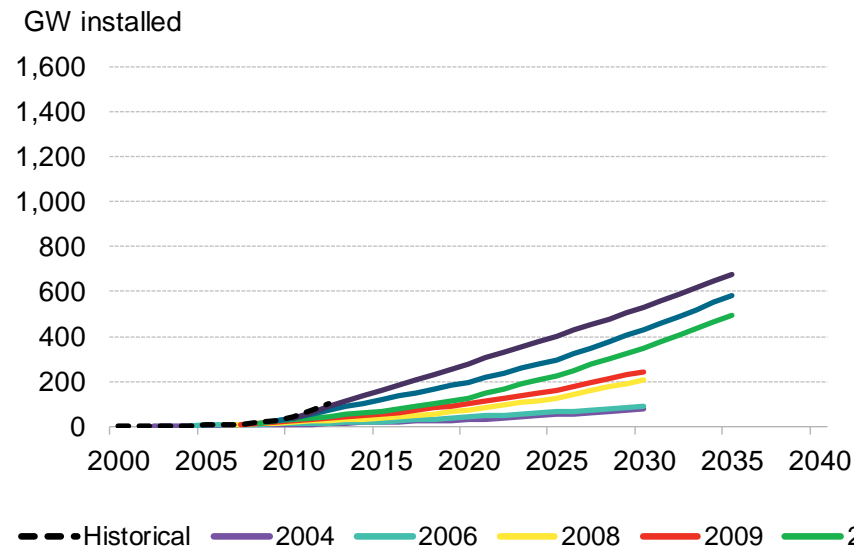
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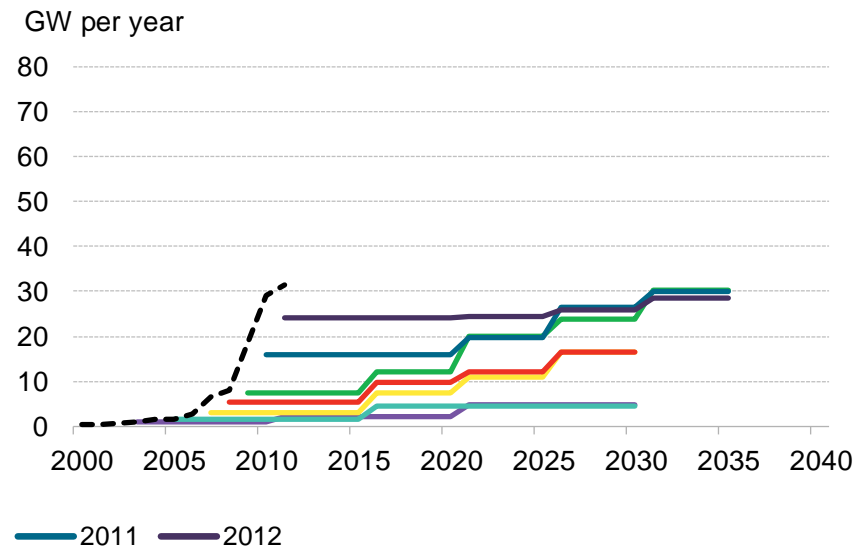
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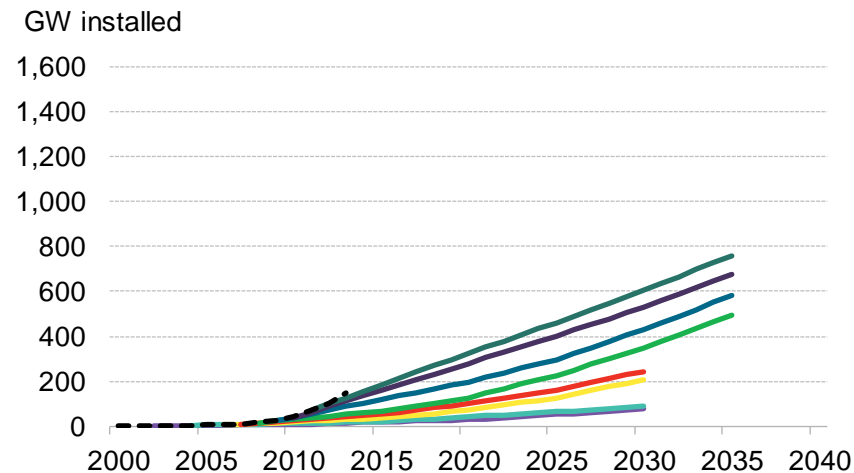
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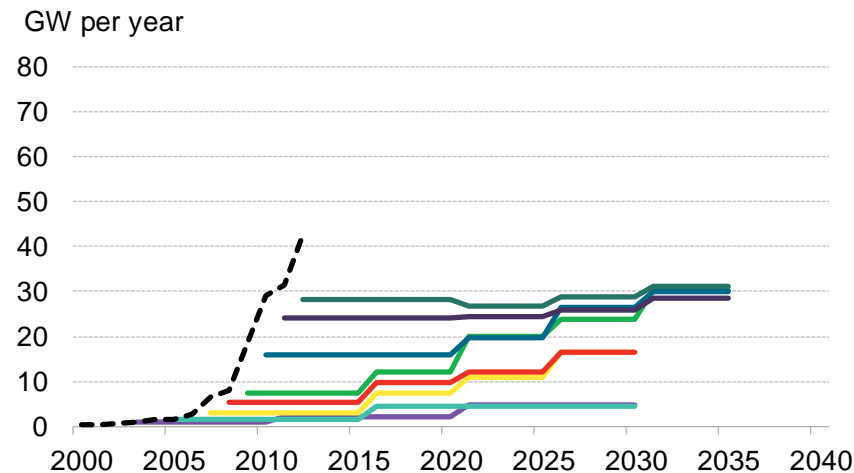
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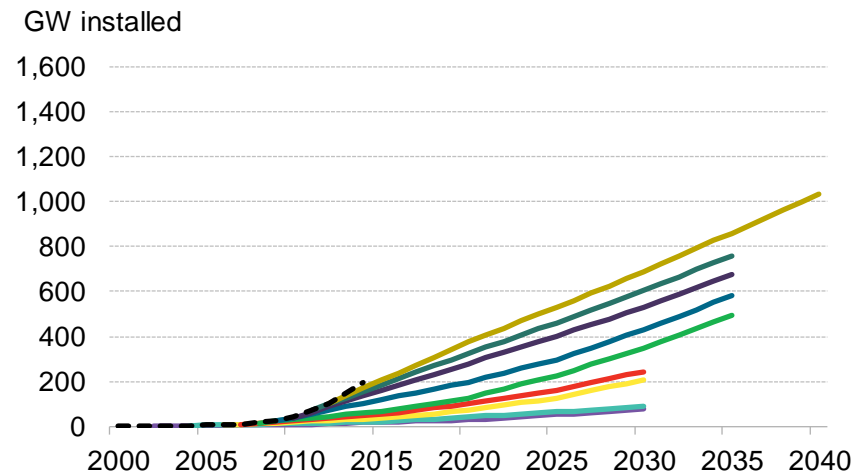
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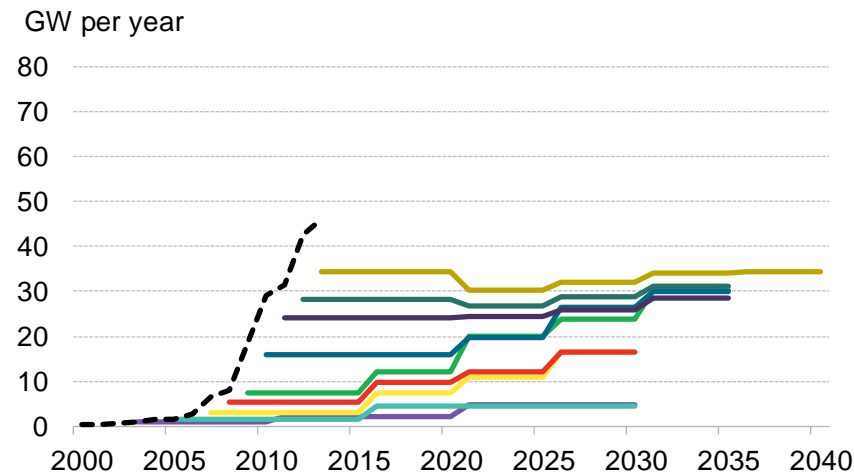
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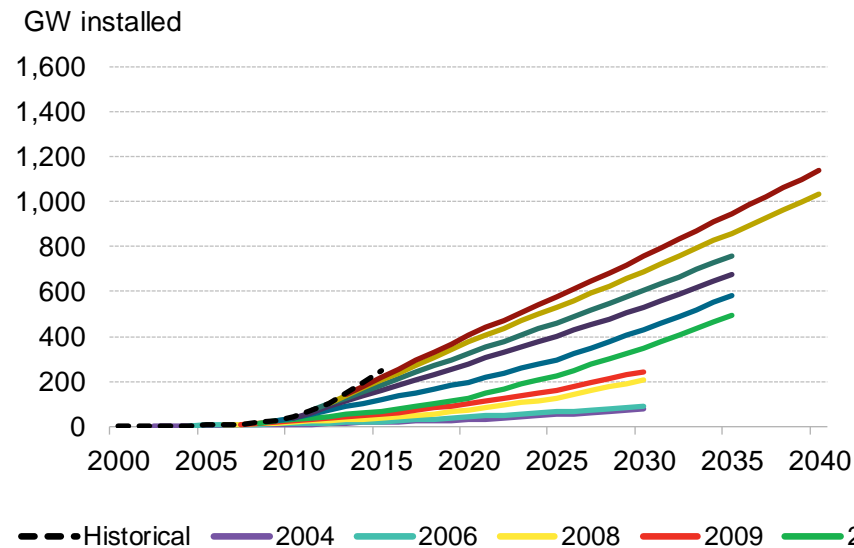
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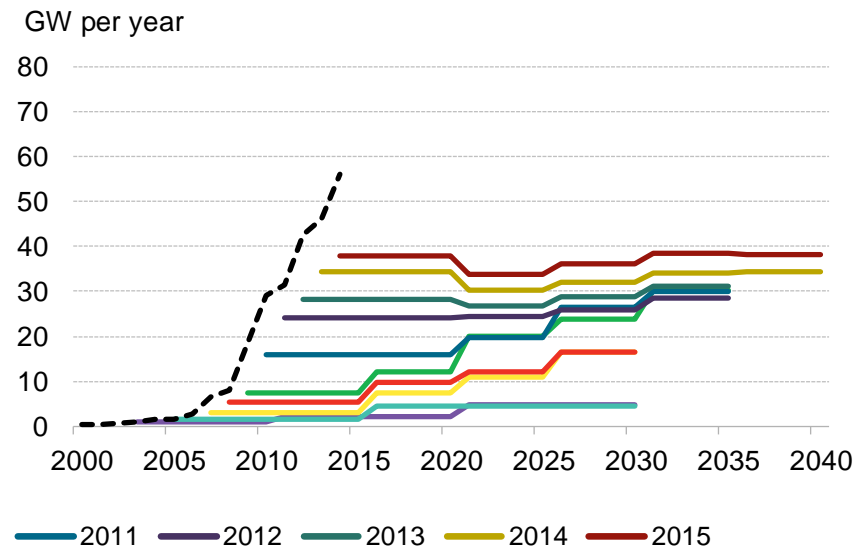
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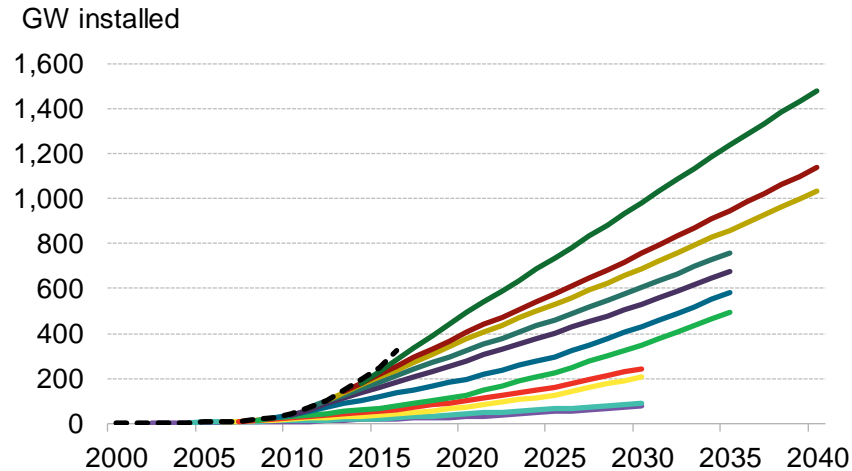


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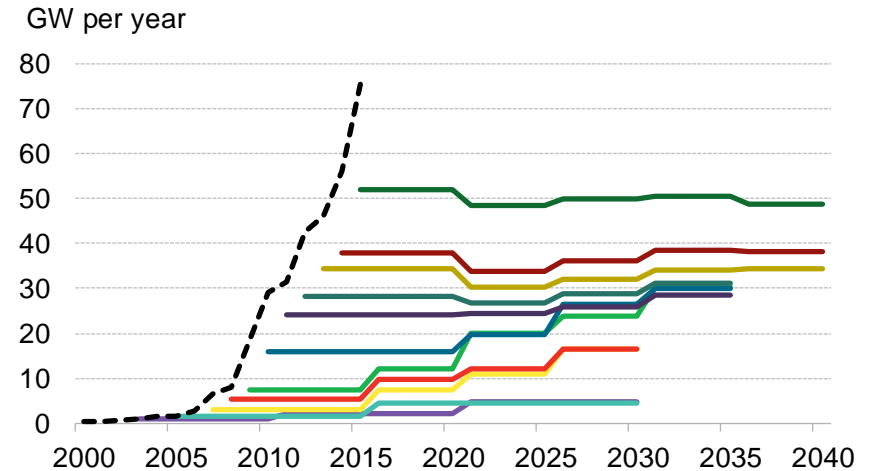
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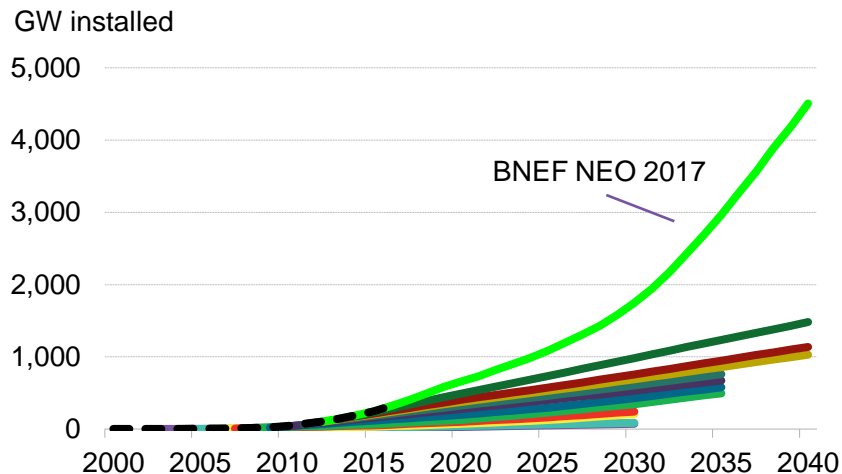
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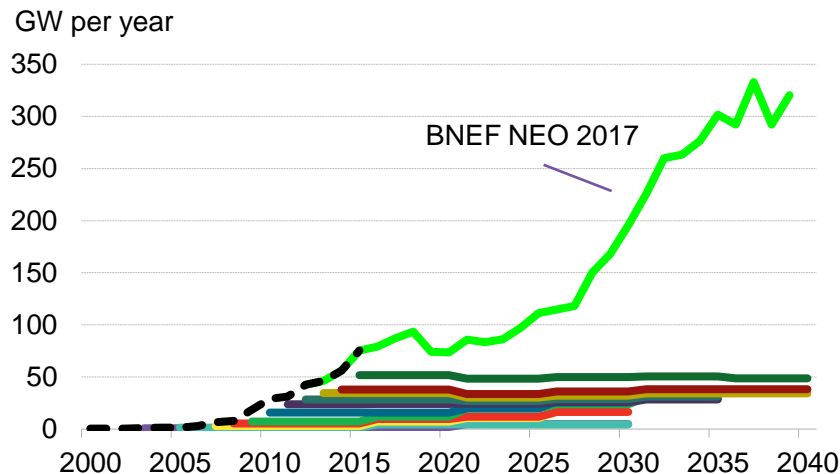
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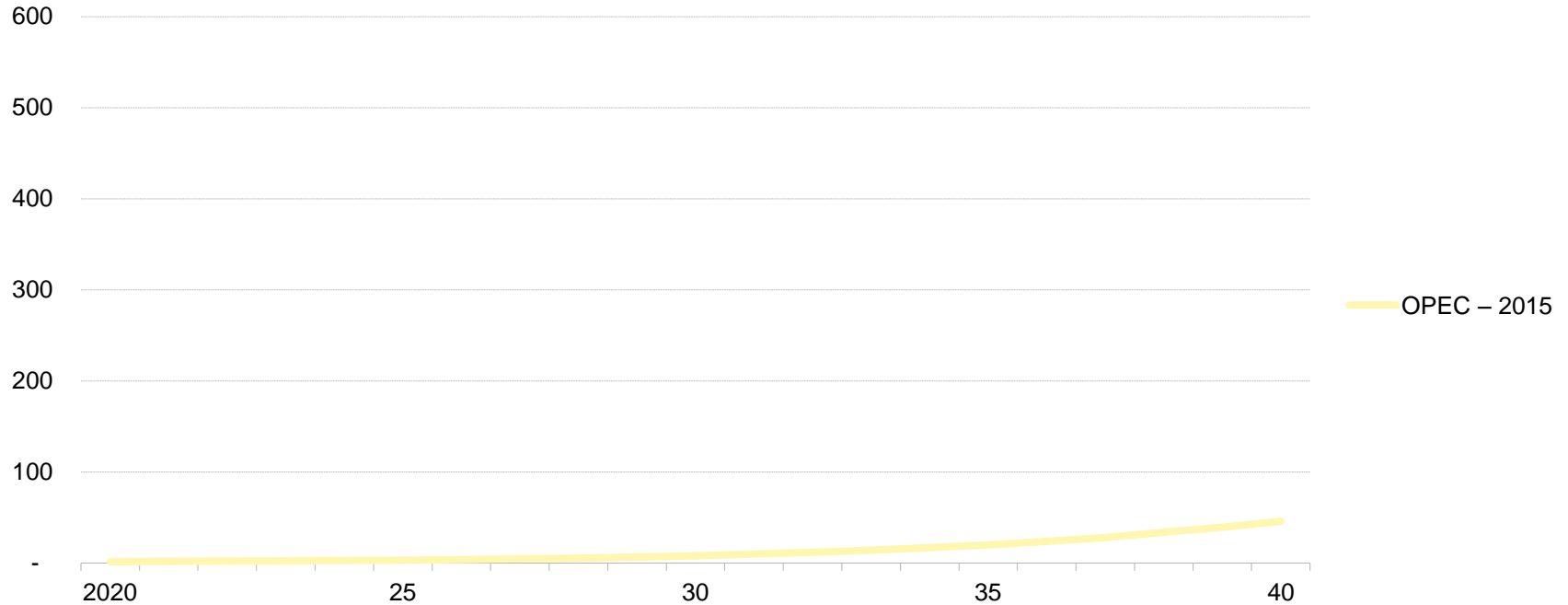
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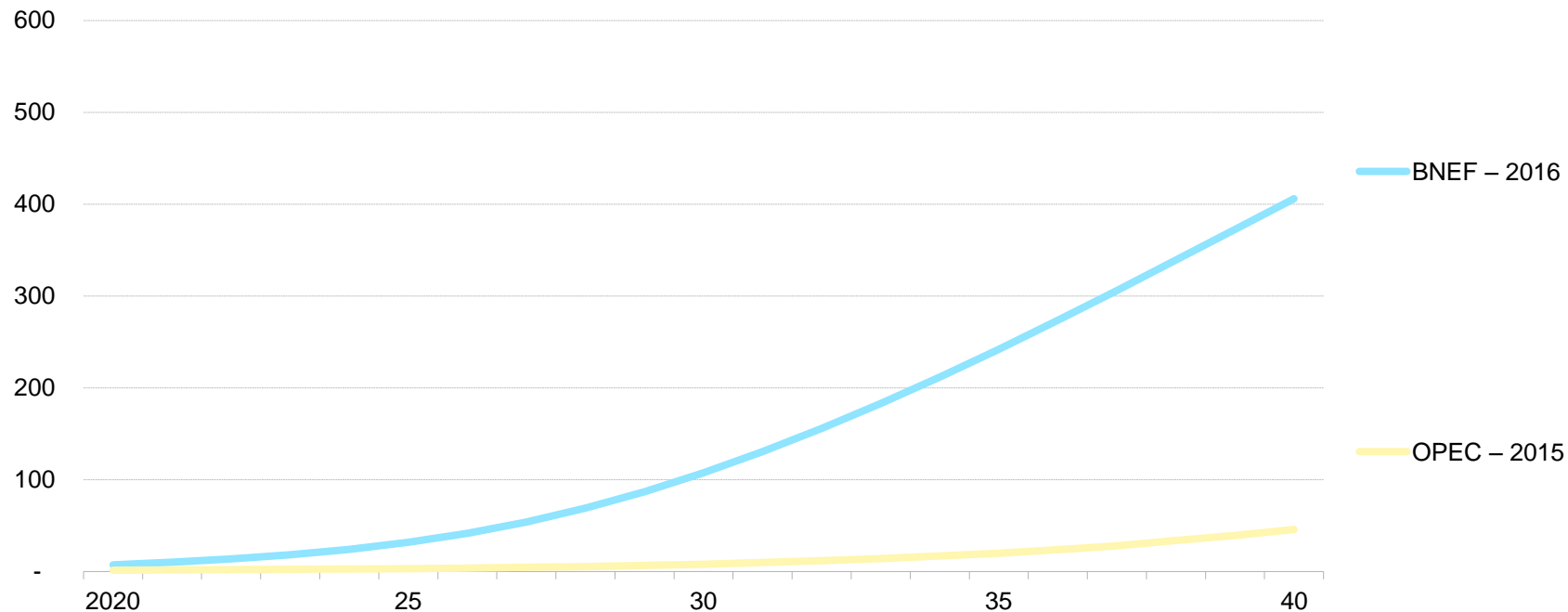
# Electric vehicle projections

EV fleet size - millions



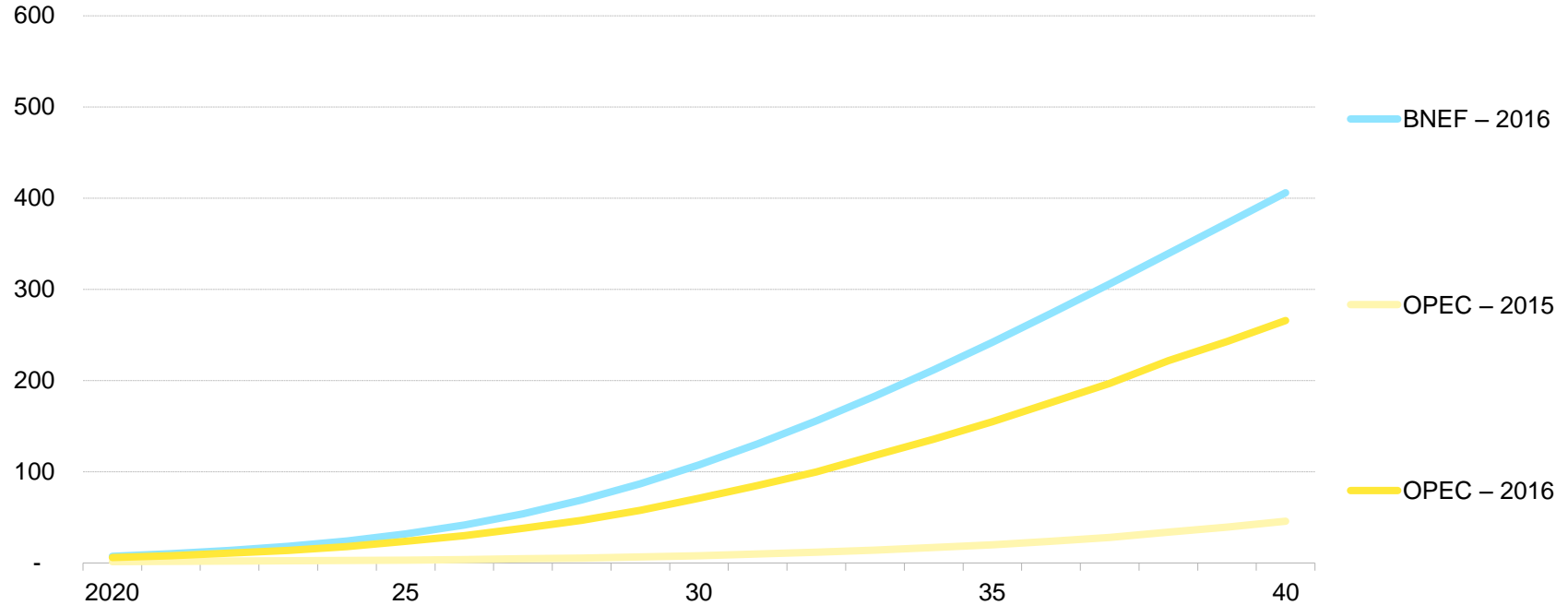
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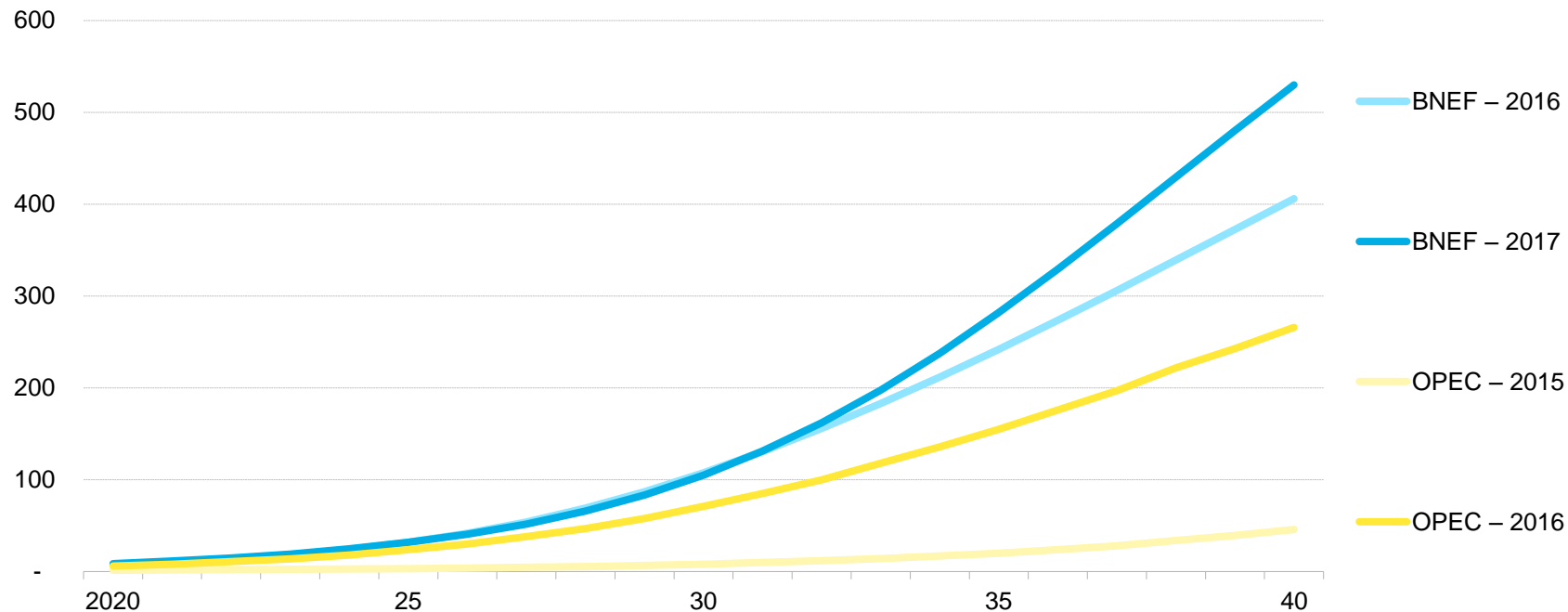
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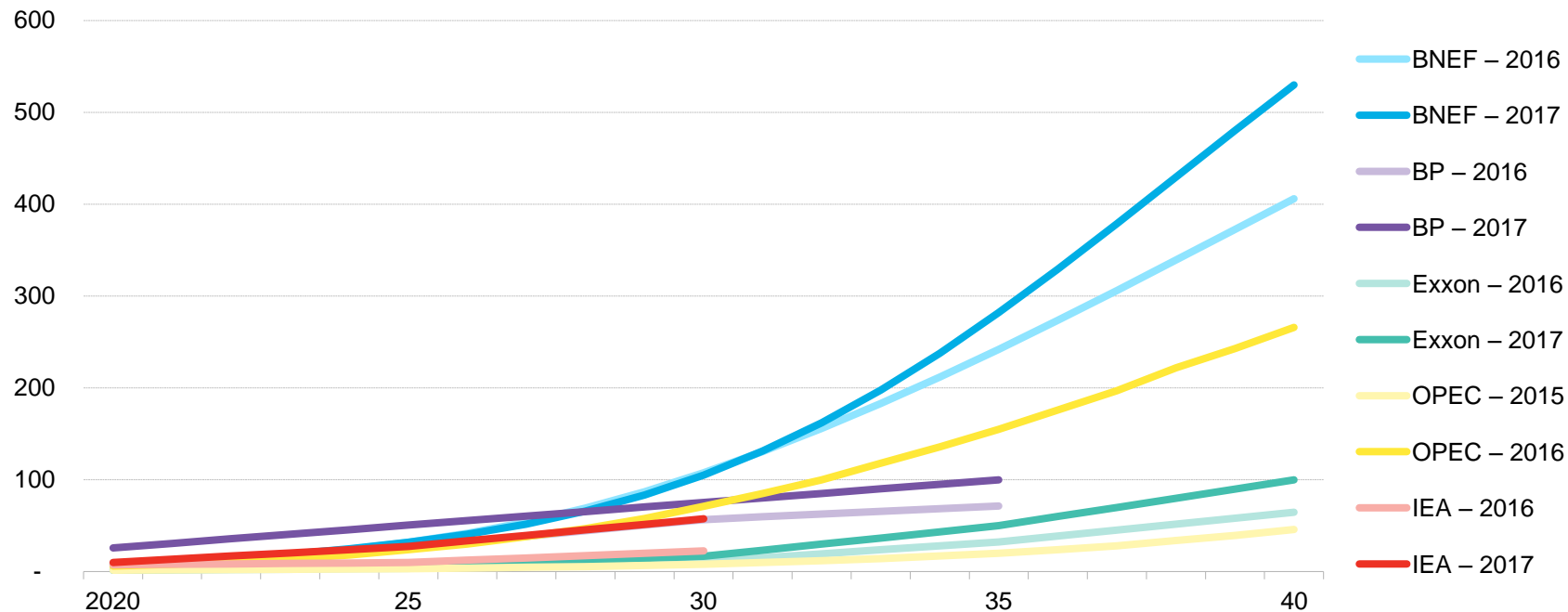
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# Which Paris targets pose the greatest risk for business?

Country	2014 emissions* (MtCO2e/yr)	NDC permitted % change in emissions 2014-30	2014 emissions intensity (ktCO2e/PJ)	2030 projected NDC consistent emissions intensity (ktCO2e/PJ)	10-year historical trend in emissions intensity (% change yoy)	Projected NDC consistent trend in emissions intensity (% change yoy to 2030)	Minimum shift from historical to NDC trend (% change yoy)
1. Philippines	96	-67% to +9%	48.0	7.6 to 25.3	+1.0%	-3.9% to -10.9%	-4.9%
2. Canada	555	-32%	47.3	30.4	+0.2%	-2.7%	-2.9%
3. Japan	1,189	-23%	64.3	56.5	+1.8%	-0.8%	-2.6%
4. Australia	374	-26% to -28%	71.3	42.0 to 43.2	-0.9%	-3.1% to -3.4%	-2.2%
5. South Korea	568	-7%	50.5	34.6	-0.4%	-2.3%	-1.9%
6. U.S.	5,176	-27% to -30%†	55.8	36.8 to 38.4	-0.5%	-2.3% to -2.6%	-1.8%
7. India	2,020	+85% to +91%	58.5	58.8 to 60.6	+1.7%	0.0% to +0.2%	-1.5%
8. Brazil	476	+12%	37.5	33.5	+0.6%	-0.7%	-1.3%
9. South Africa	437	-20% to +24%	71.1	40.9 to 63.1	+0.2%	-0.7% to -3.4%	-0.9%
10. Mexico	431	-6% to +14%	54.8	39.0 to 47.4	-0.3%	-0.9% to -2.1%	-0.6%
11. Vietnam	143	+145% to +180%	51.4	52.5 to 60.0	+1.3%	+1.0% to +0.1%	-0.4%
12. China	9,135	+4% to +19%	71.2	65.0 to 74.3	+0.4%	+0.3% to -0.6%	-0.1%
13. E.U.	3,160	-24%	48.2	41.8	-0.9%	-0.9%	0.0%
14. Indonesia	437	+34% to +76%	46.2	41.8 to 54.8	+0.8%	+1.1% to -0.6%	+0.3%
15. Saudi Arabia	507	+34% to +64%	56.7	55.4 to 67.7	+0.1%	+1.1% to -0.1%	+1.0%
16. Thailand	244	+28% to +37%	43.2	42.5 to 45.3	-1.1%	+0.3% to -0.1%	+1.4%
17. Russia	1,468	+3% to +37%	49.3	63.0 to 83.7	-1.1%	+3.4% to +1.5%	+4.4%
ROW	5,968	+41% to +57%	54.6	39.5 to 43.9	+0.2%	-1.4%	-1.5%
<b>World</b>	<b>32,381</b>	<b>+7% to +18%</b>	<b>56.5</b>	<b>47.1 to 52.4</b>	<b>+0.2%</b>	<b>-0.5% to -1.2%</b>	<b>-0.6%</b>

↑ Greater risk  
↓ Lesser risk

Source: Bloomberg New Energy Finance Note: \*energy-related emissions only. † U.S. 2030 target is extrapolated based on target trend to 2025

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[sales.bnef@bloomberg.net](mailto:sales.bnef@bloomberg.net)

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@BloombergNEF

Nat Bullard

[nbullard@bloomberg.net](mailto:nbullard@bloomberg.net)

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