

The Room Where It Happens:


Economics' Predictions for Climate Change

MPHP 441 Climate Change and Health

April 21, 2021

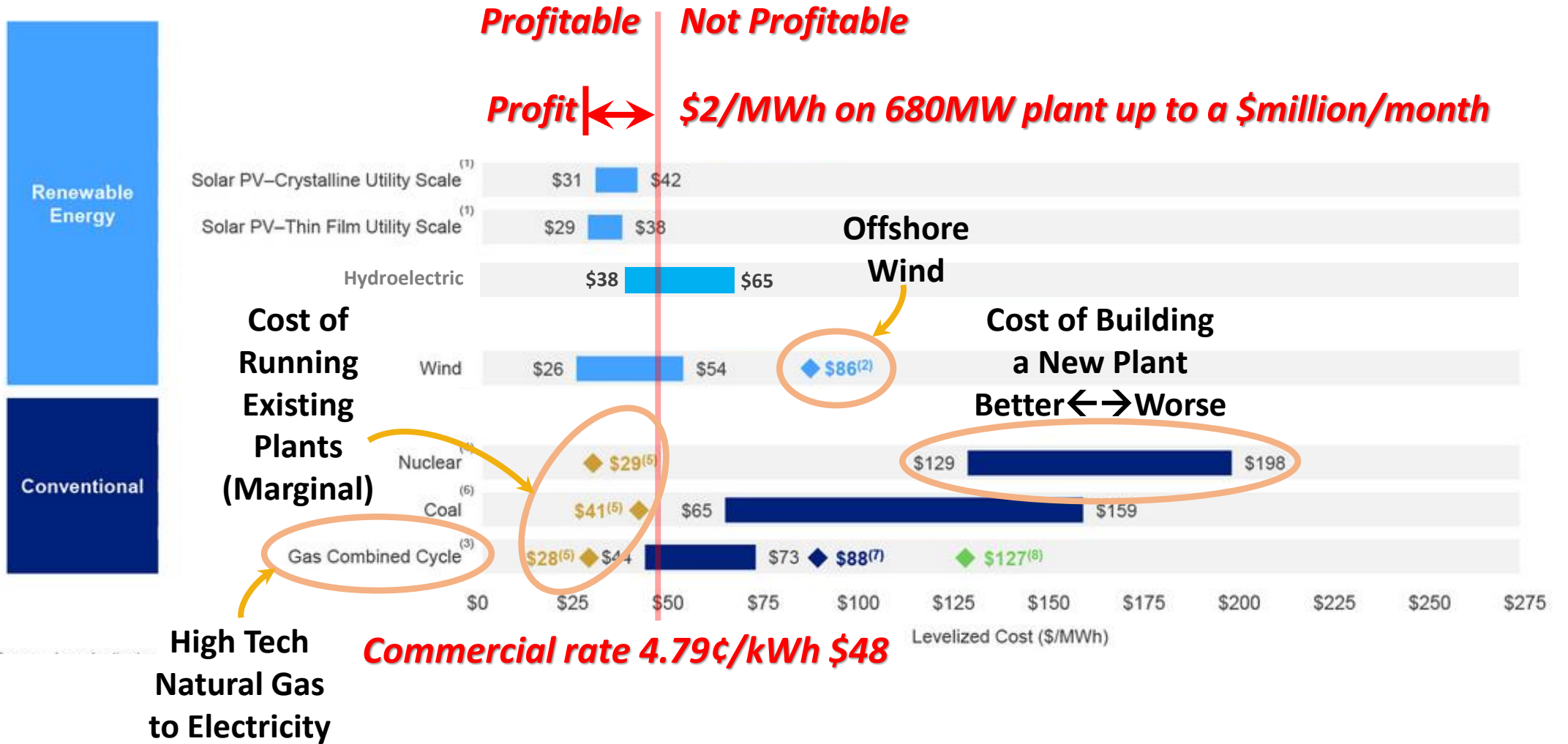
Mark E. Stewart, Ph.D.

Three People Walk into a Room...

- Who? Electric company president, a US senator, and a scientist
 - What? Committing to a new electric power plant
 - A plant built now, will likely be running in 2040
 - Can they consider wind power? Solar power?
 - Why not keep existing plants?
 - What will government subsidize or tax?
 - Risks? Technology, government policy, ...
 - Secret Sauce: LCOE Levelized Cost of Energy,
 - Estimate of life cycle cost of electricity
 - Cost of equipment, capital, operation & maintenance, fuel...
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Levelized Cost of Energy Comparison—Unsubsidized Analysis

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances

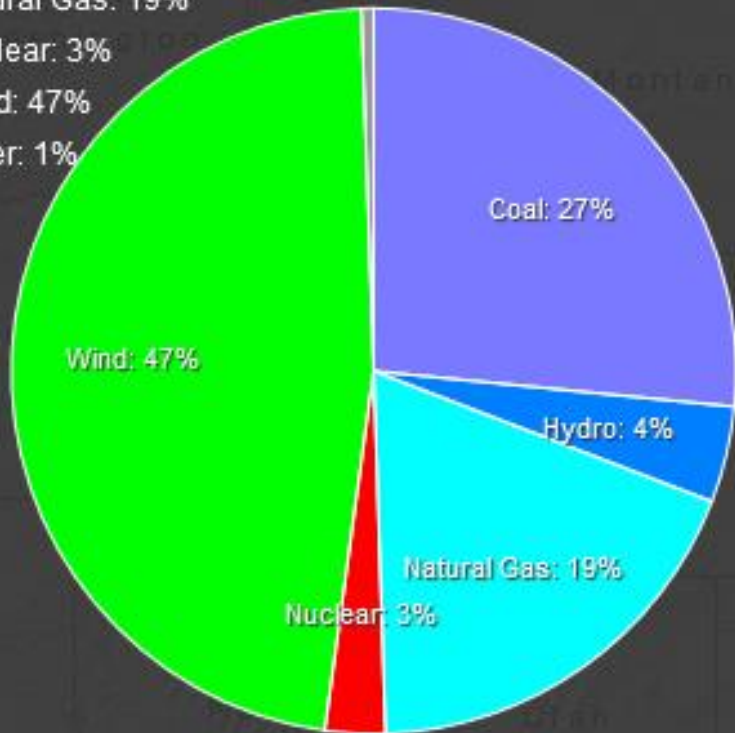


US— Annual Average Wind Speed at 100 m

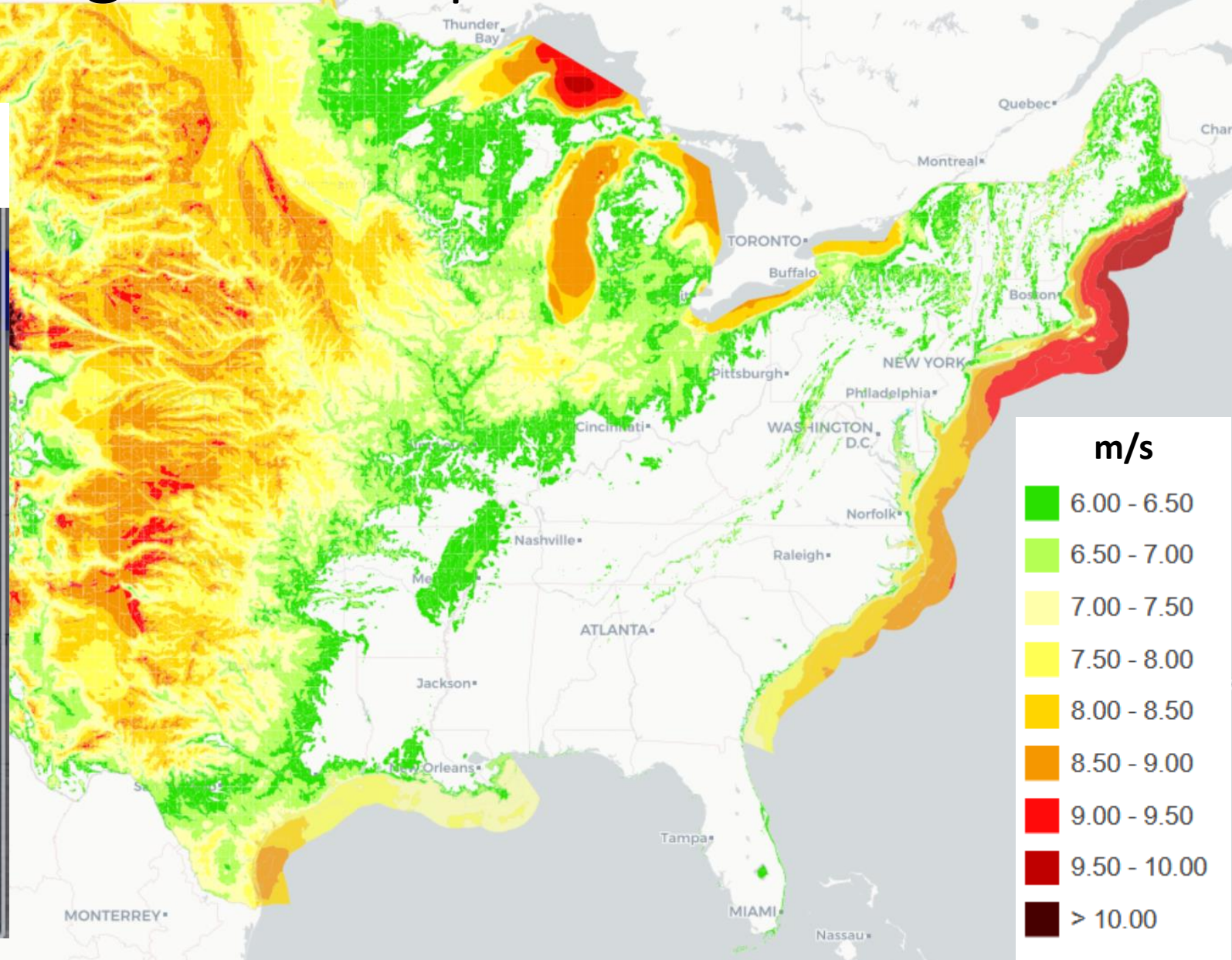
SPP (Southwest Power Pool) Generation Mix

Total: 30,009 MW

- Coal: 27%
- Hydro: 4%
- Natural Gas: 19%
- Nuclear: 3%
- Wind: 47%
- Other: 1%



Interval: 4/20/2021, 1:40:00 PM



US – Solar Photovoltaic Potential

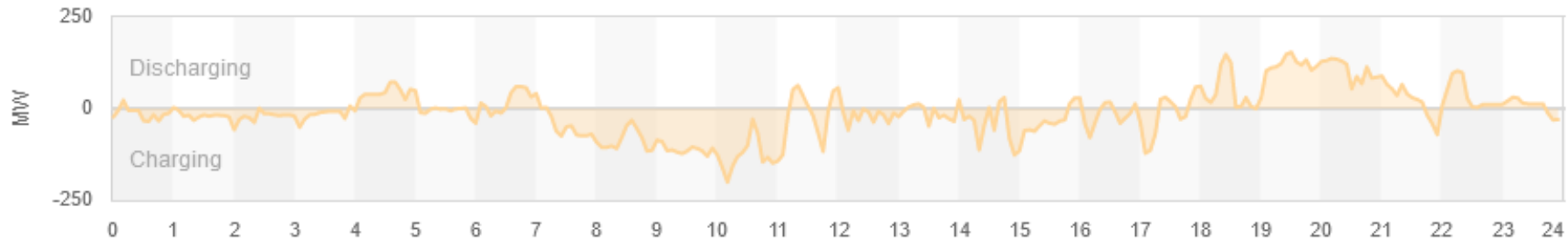
California ISO April 19, 2021

Batteries trend

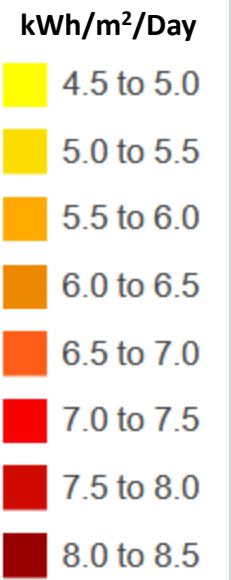
Energy in megawatts in five-minute increments.

04/19/2021

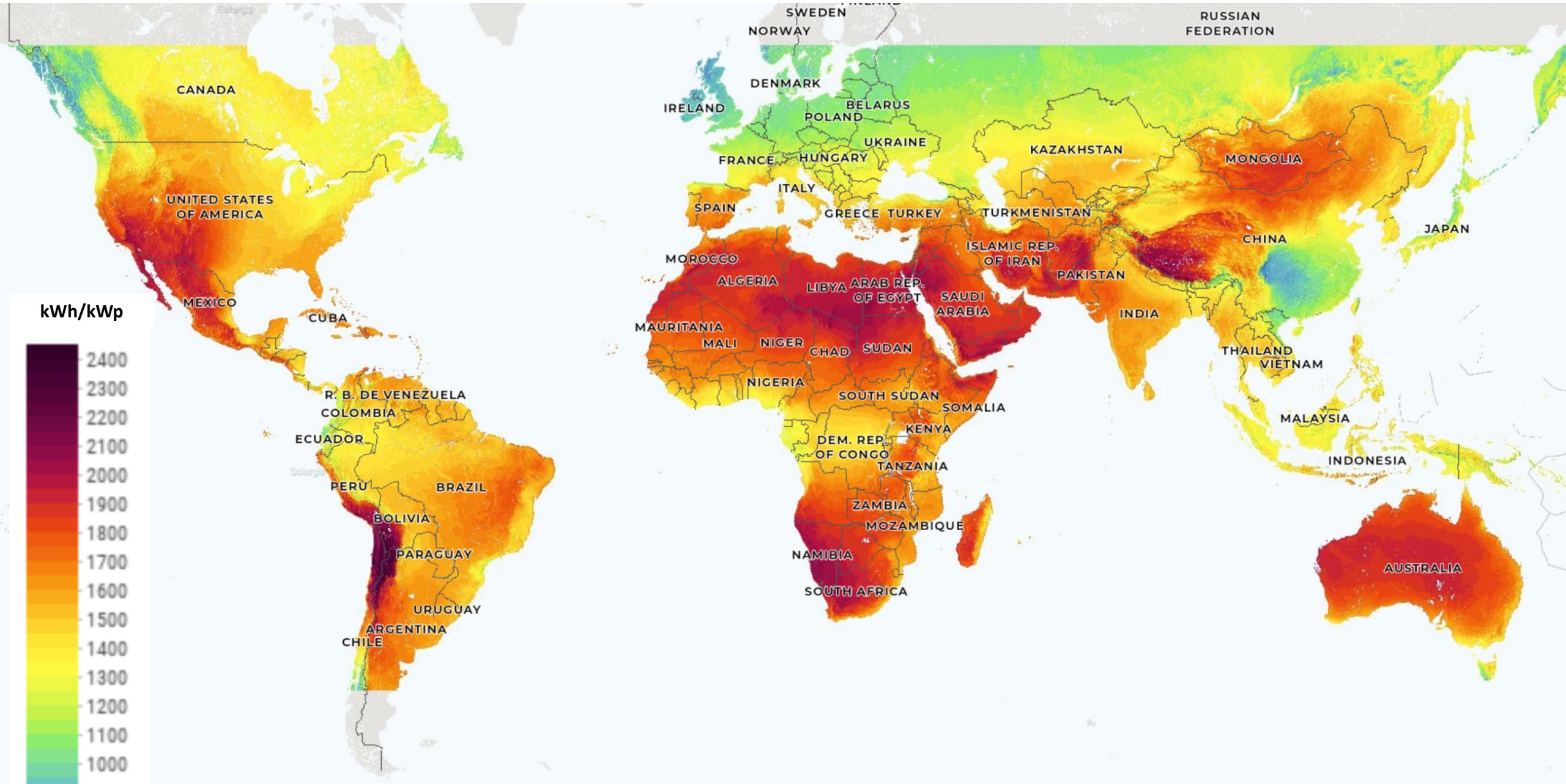
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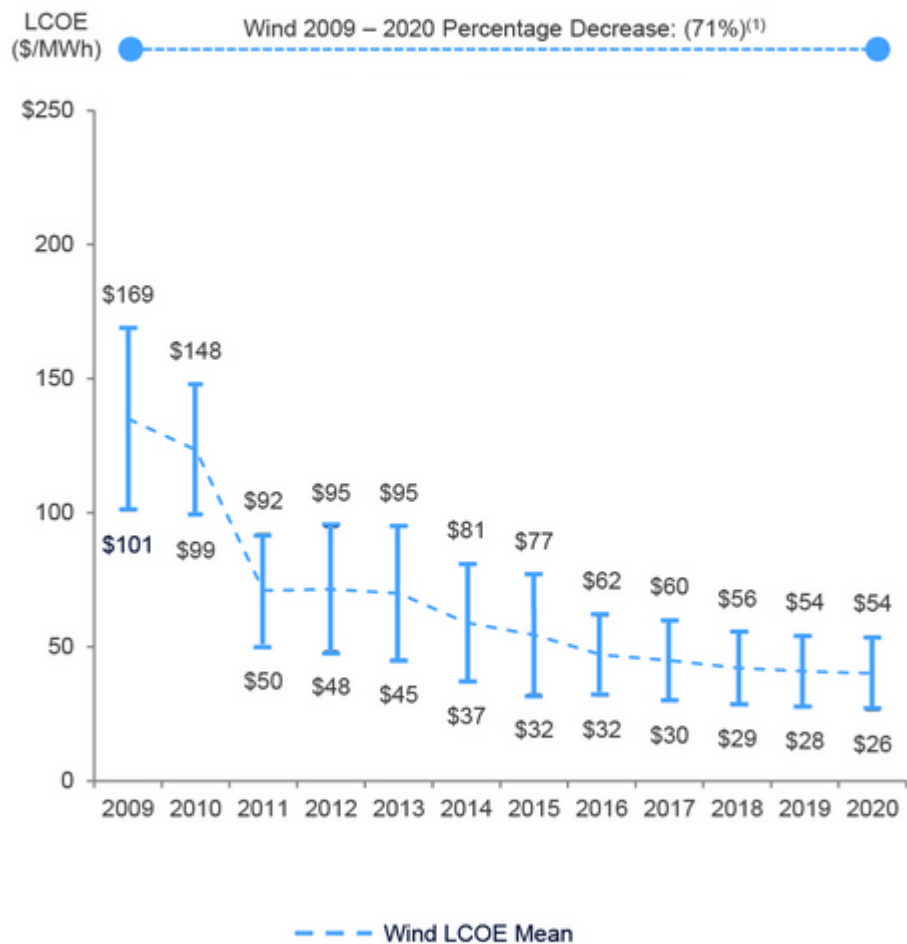
Batteries



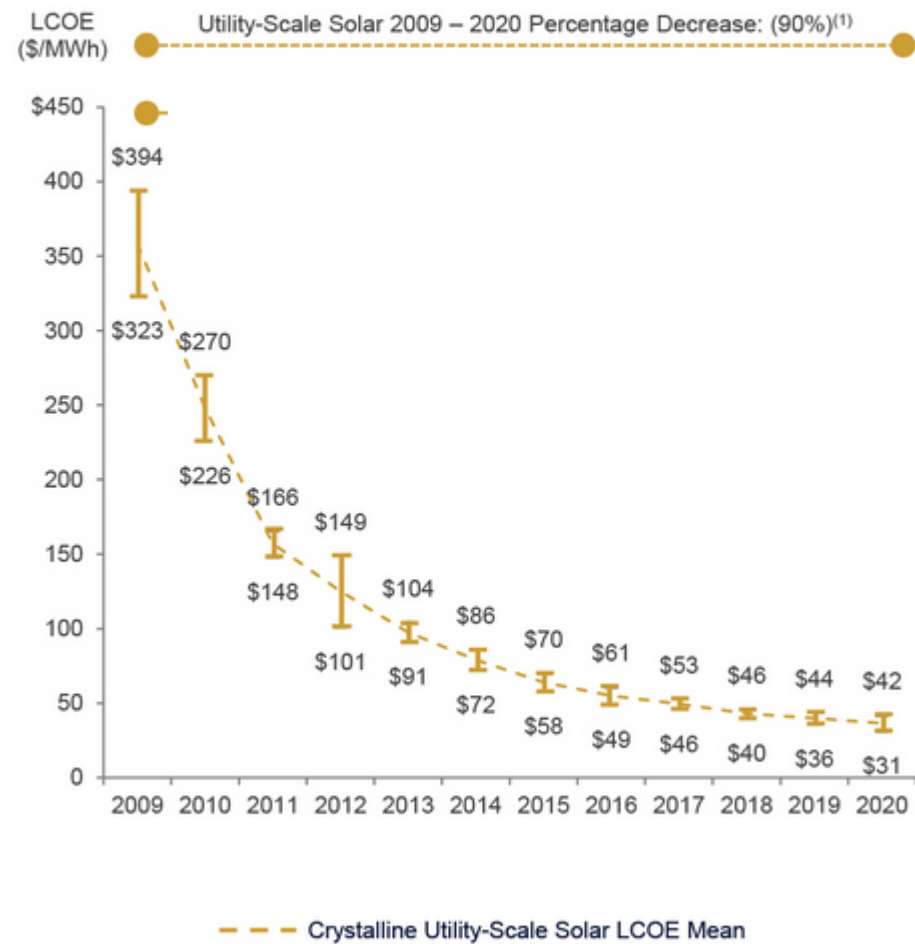
World – Solar Photovoltaic Potential



Unsubsidized Wind LCOE

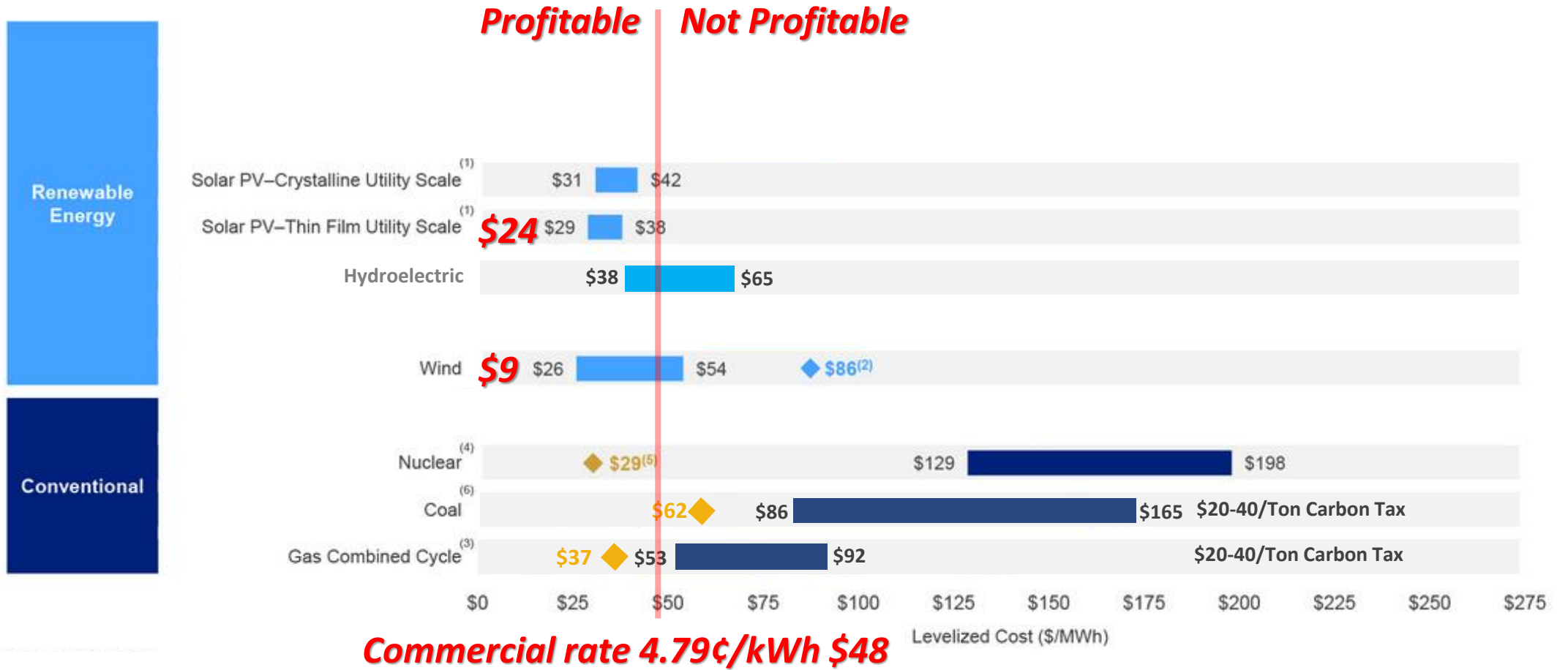


Unsubsidized Solar PV LCOE



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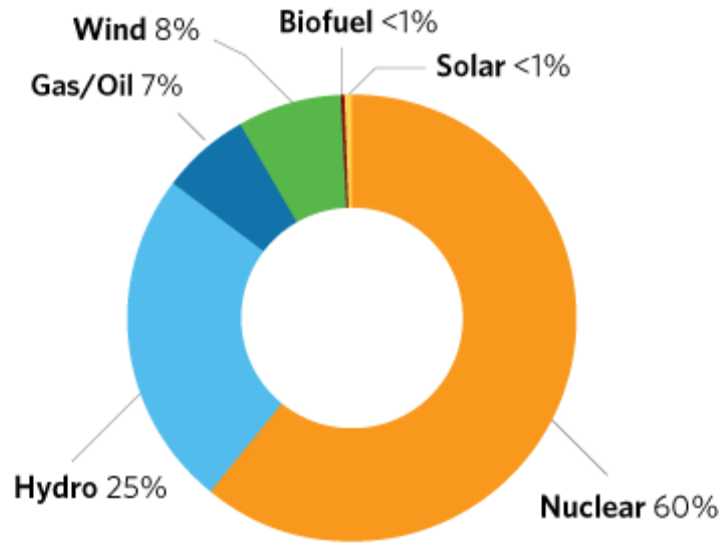


Conclusions...

- Economics helps predict the progression of climate change
- Government policy can hasten these changes



Ontario ISO Year 2020 Output



Nuclear	87.8 TWh or 60%
Hydro	36.9 TWh or 25%
Gas/Oil	9.7 TWh or 7%
Wind	11.8 TWh or 8%
Biofuel	0.4 TWh or <1%
Solar	0.8 TWh or <1%

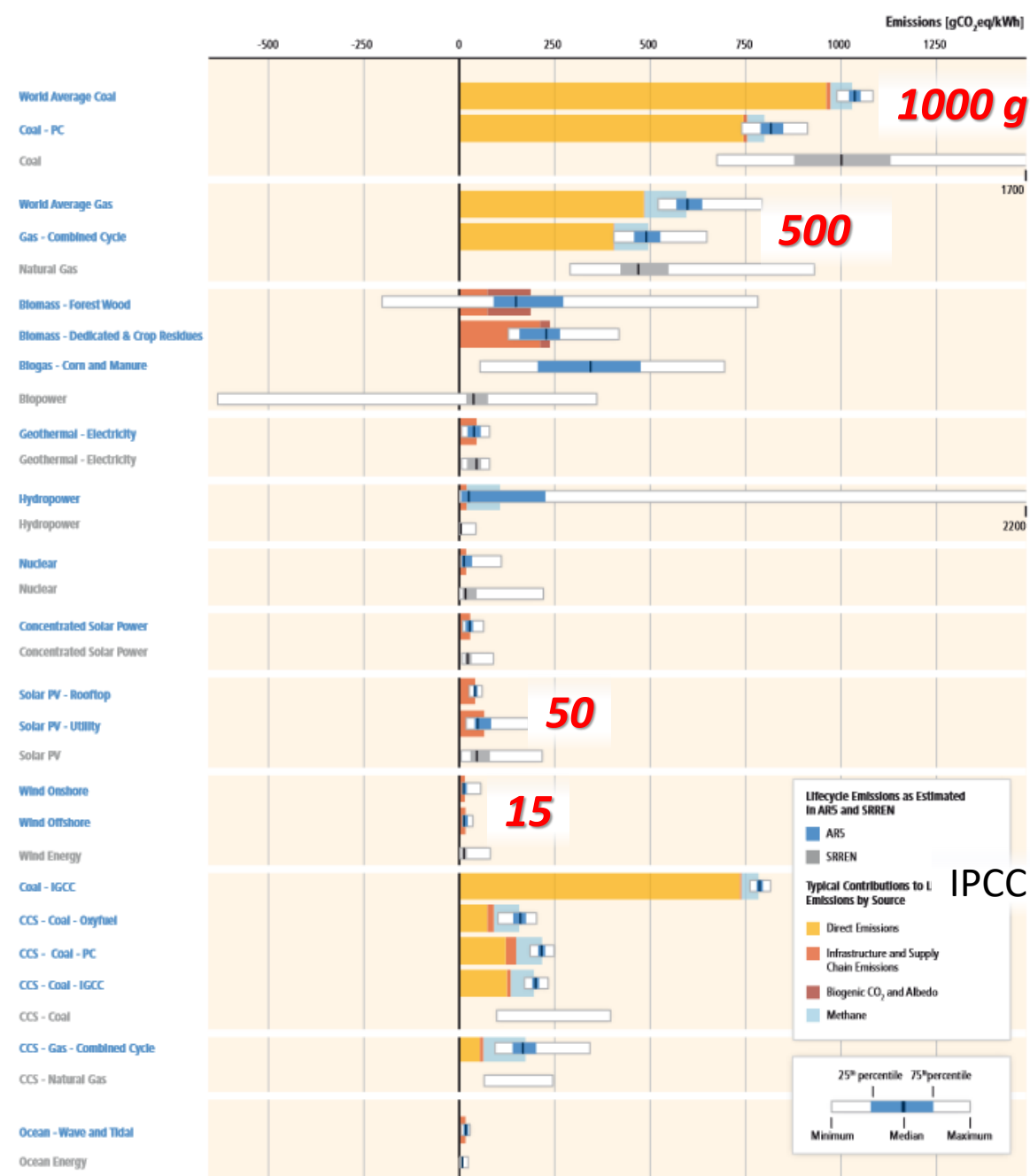
World Coal: 50X

World Gas: 25X

Nuclear: 1X

Solar PV: 3X

Wind: 1X



1000 gCO₂eq/kWh

500

50

15

IPCC AR5 WG3 chap. 7, p. 539

Figure 7.6 | Comparative lifecycle greenhouse gas emissions from electricity supplied by commercially available technologies (fossil fuels, renewable, and nuclear power) and projected emissions of future commercial plants of currently pre-commercial technologies (advanced fossil systems with CCS and ocean energy). The figure shows distributions of lifecycle emissions (harmonization of literature values for WGIII AR5 and the full range of published values for SRREN for comparison) and typical contributions to lifecycle emissions by source (cf. the notes below). Note that percentiles were displayed for RE and traditional coal and gas in the SRREN, but not for coal CCS and gas CCS. In the latter cases,