

Near-Term Policy Priorities to Enable Deep Decarbonization

Richard Schmalensee

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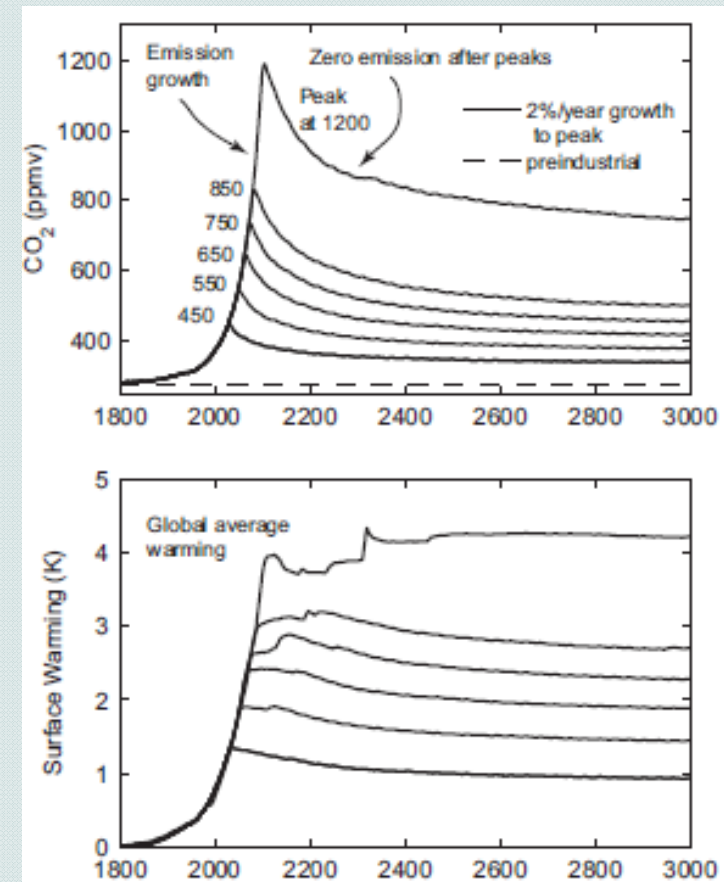
Deep, Rapid Decarbonization is Essential

Figures show CO₂ concentration, warming after emissions go to zero in a representative model (others confirm).

CO₂ declines slowly & some remains; ocean heat uptake declines with warming.

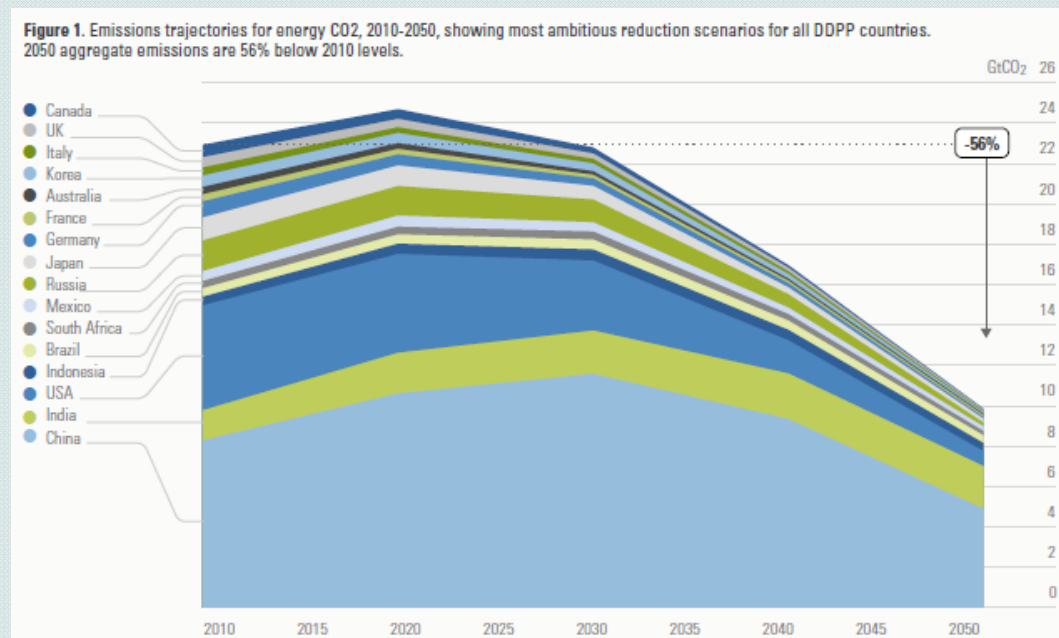
The change in temperature from an incremental ton of CO₂ is roughly constant over 1,000 years and more.

Total warming over 1,000+ years thus depends on total CO₂ emissions before net zero global emissions is reached.



Source: Solomon et al, *PNAS* 106, 1704-09.

Lots of Deep Decarbonization Studies, But...

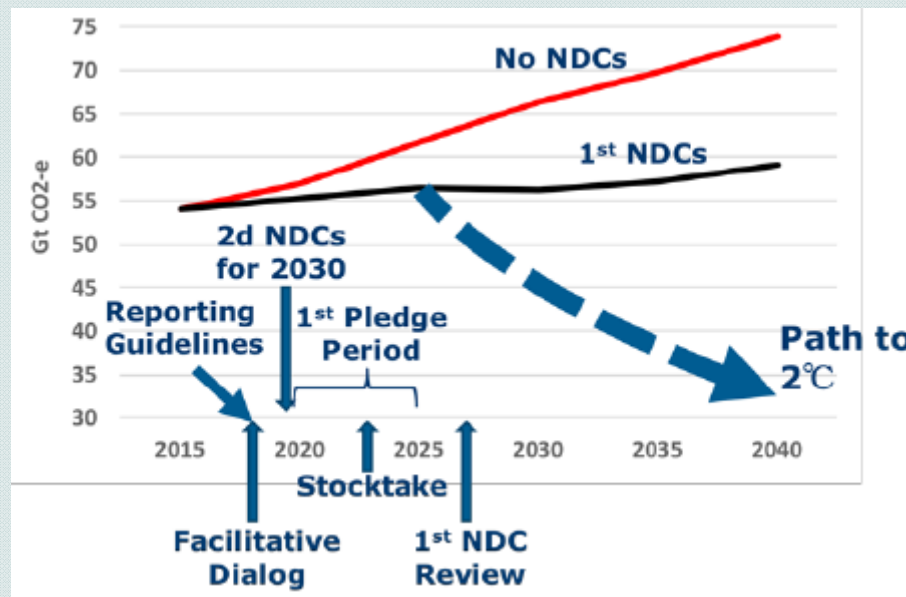


Source: DDPP 2015 Report

- Generally call for decarbonizing electricity supply, more electrification, and greater energy efficiency
- Generally focus on technical possibility, rarely past mid-century, don't get to net zero emissions
- **Rarely pay much attention to policy design or political economy**

Why not Just Focus on Getting Paris Done?

Paris is a wonderful, essential development, but Paris commitments won't even begin cutting emissions:



Source: H. Jacoby et al, MIT Joint Program, 2017

More importantly, policies that focus only on getting Paris done may make deep decarbonization more costly than necessary and hence less likely to happen quickly.

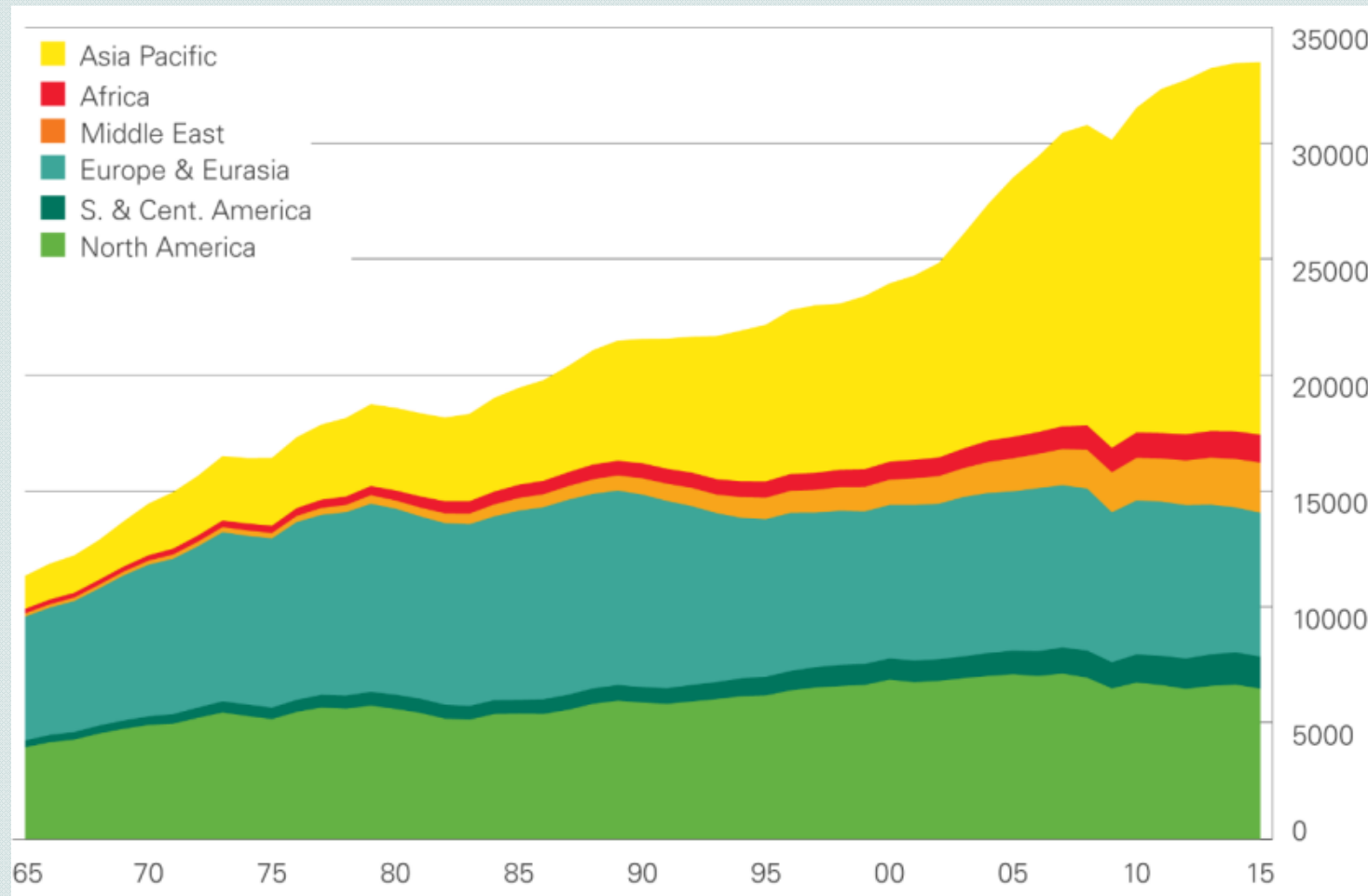
Near-Term Policies Can Have Long-Term Effects

- Asset Durability: Many investment decisions during the 1st Paris commitment period (e.g., urban design, mass transit) will matter long after 2050.
- Technical Change: Many policies that affect the rate and direction of technical change (e.g., R&D spending levels & priorities) are likely to have long-term effects.
- Policy Inertia: Policy architectures – legal and administrative approaches – tend to build support and be very long-lived. (E.g., investment tax credit for solar in the US, US and EU electricity pricing regimes)

Will discuss three challenges that seem particularly important in this context and some responses to them.

Challenge 1: The South Is Trying to Get Rich the Same Way the North Did

Carbon Dioxide Emissions (millions of tonnes)



Source: BP Statistical Review of World Energy, 2016

How Serious Is the Problem?

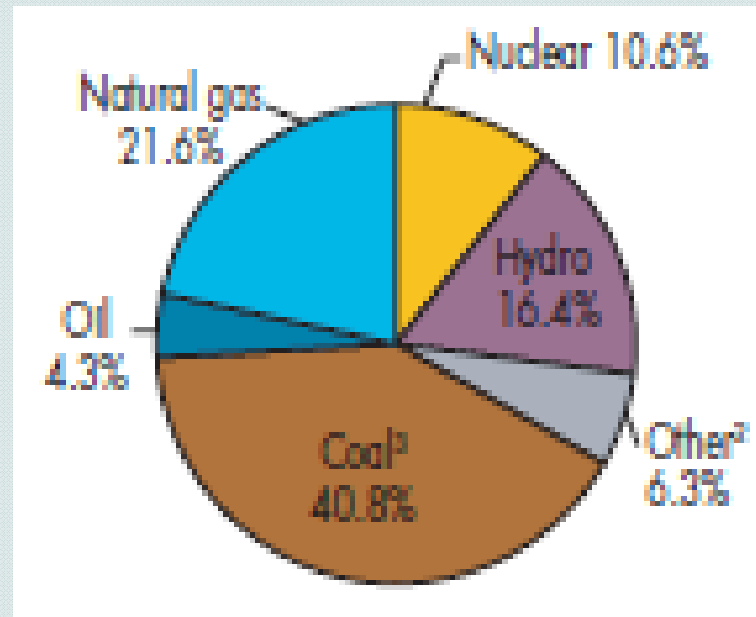
- The 39 IMF advanced economies (AE) account for about 42.4% of global PPP GDP, 14.6% of population (IMF), and 32.1% of emissions CO₂ (NEAA), so
 - ROW emissions/\$ of GDP are 1.56 times as high, but
 - ROW GDP/capita is only about 22.3% of the G-7 average
- ROW emissions intensity will surely decline, but political pressures for growth will surely not; even with serious efforts to reduce emissions intensity the consequences could be dire
 - E.g., if ROW *emissions/\$ of GDP decline substantially* to the AE average, but ROW *GDP/capita rises* to only 50% of the AE average, *with no growth in population or AE emissions...*
 - **Global emissions would rise by 37.6%**
- To achieve deep decarbonization before too much damage, the South cannot get rich even approximately the way the North did

Responding to the Challenge Now

- Preaching by the North will not likely reduce pressures for growth in GDP and, possibly, population in the South.
- If the South will get rich no matter what, to get global emissions to zero in a timely fashion, it must do so by following a much less carbon-intensive path than the North followed.
- Pressures for growth in the South (& much of the North) will lead to resistance against large-scale use of more expensive energy technologies – e.g., massive substitution of today's solar for coal.
- Need **new** low/no carbon energy supply technologies & efficient energy-using technologies that are economically competitive & thus politically acceptable. Because bringing new technologies to market takes time, starting R&D now is an important priority.
- But government R alone rarely leads to new commercial technologies: private firms need market incentives to do D.

Challenge 2: Decarbonizing Electricity Supply Will Actually Not Be Easy

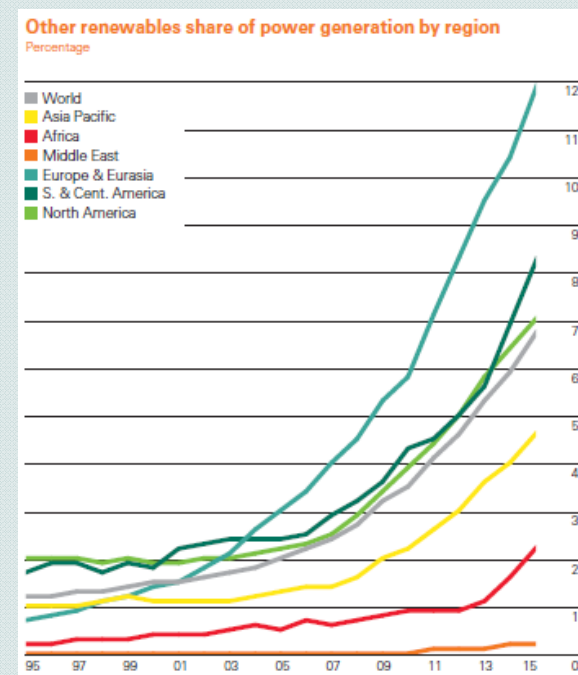
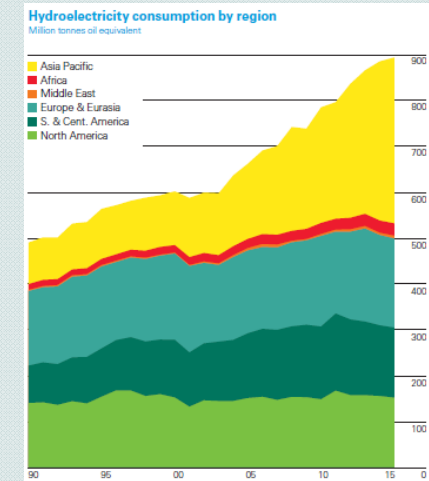
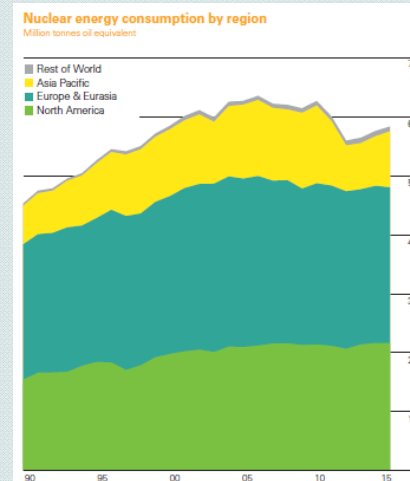
Fossil Fuels accounted for about 2/3 of world electricity generation in 2014 (IEA, Key World Energy Statistics 2016):



Switching *all* coal to natural gas would cut emissions about 20.4%. At the US EIA projected rate of growth to 2040, electricity generation would grow by 20.4% every 10 years. **Gas is at most a short bridge.**

Wind & Solar Would Likely Dominate

- There is widespread opposition to nuclear
- Hydro, geothermal, waste only work some places
- Biofuels hard to do at scale for electricity
- CCS untried, likely very expensive
- Wind and, esp., solar have enormous resources and are growing (with subsidies)

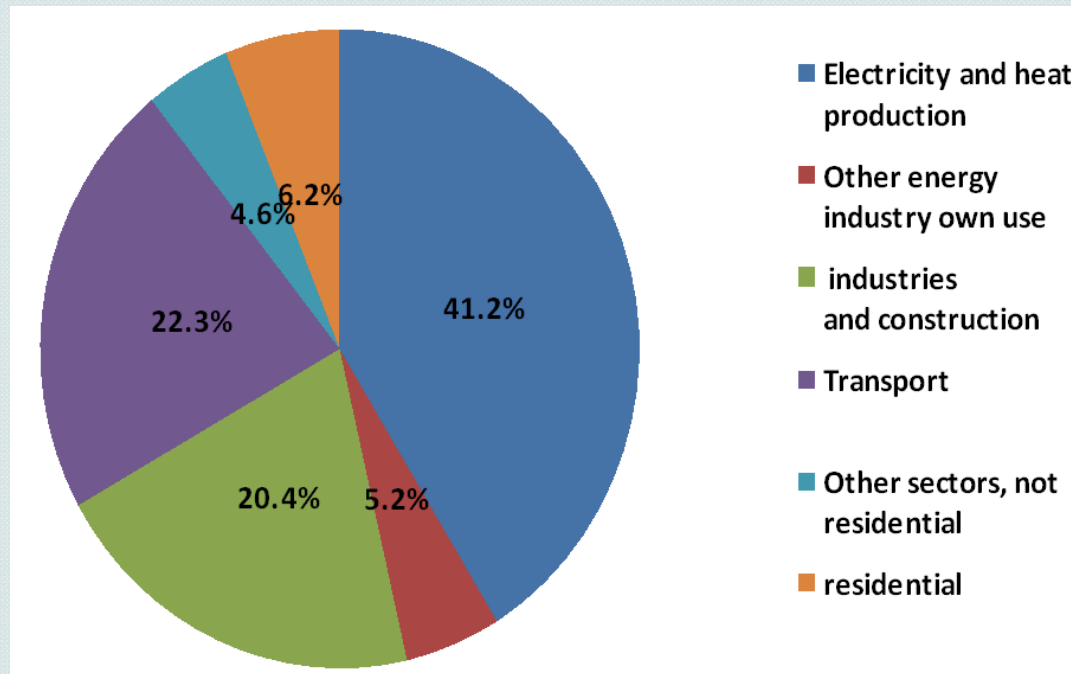


Preparing Now for Wind/Solar Dominance

- R&D to enable cheap bulk storage and/or cheap CCS should be a priority now, *but success is not assured*.
- Given policy inertia, should push now – in both the North & the South – for pricing systems that give the right signals for consumption, production, & investment, e.g.:
 - To deal with variability efficiently, use smart meters for real-time pricing with automated response
 - For investment efficiency, more socially valuable kwh should be compensated more: better subsidy designs, move to LMPs
 - And extra subsidies to distributed generation removed
 - Storage, distributed generators should be enabled to participate efficiently in bulk power markets
 - Flexible capacity must be viable despite long periods of zero prices – well-designed capacity markets or ...?

Challenge 3: Electricity Supply is the Easy Part

Global CO₂ Emissions (Without Land Use) 2010 (IEA)



Electricity generation is the most important source of CO₂ emissions, but it accounts for less than half the total. Decarbonizing electricity is necessary but far from sufficient.

Diverse Sources Require Price-Based Policies

- Now generally recognized that carbon tax or cap-and-trade are the theoretically best ways to deal with diverse sources
- But democracies favor policies with concentrated benefits & diffuse costs (e.g., taxing income or electricity to subsidize renewables), & many politicians distrust markets
- Thus in EU & California, focused “ancillary policies” have been added to cap and trade systems
- But these policies distort the pattern of abatement, thus raise costs, and discourage necessary investment & innovation by reducing the carbon price faced by diverse sources
- Because of asset durability and policy inertia, must begin work now to remove “ancillary policies” & raise carbon prices.

Some Conclusions

- Today's CO₂ emissions will shape the climate for centuries, & today's policy choices may determine the cost of deep decarbonization decades hence.
- In order to make deep decarbonization politically compatible with growth, we should begin now to develop technologies that can cut the cost involved.
- To cut the cost of building & operating an electricity supply system dominated by wind & solar, we should begin now to do focused R&D and remove distortions from electricity prices.
- To reduce the cost of deep reductions in emissions from other sources, we should begin to work now to dismantle “ancillary policies” that reduce carbon prices.