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The Paris Research Agenda

Findings from the First Implications of Paris Workshop

"Assessing Transformation Pathways Post-Paris
and Implications for IA Research"

Snowmass, CO
July 22, 2016

Background—The Implications of Paris Project

- Started back in February 2015, focused on the research questions that might be important following an agreement.
- Partnership between those of us at PNNL and our partners at the University of Maryland
  - Use workshops to identify the key research needs.
  - Undertake relevant research to push forward the boundaries of knowledge.

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The JGCRI held the first of a series of workshops in May 2016

- The first workshop, May 3-4 at the University of Maryland in conjunction with the UMD Climate Summit
- Brought together 44 international leaders from
  - research,
  - government,
  - finance,
  - NGOs, and the
  - private sector
- Discussed key research questions raised by the Paris agreement.

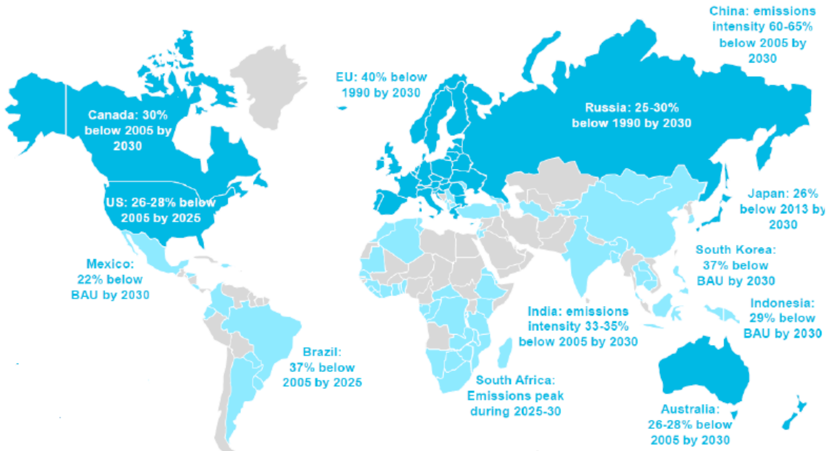
COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

What follows are some highlights from that discussion

- How will national circumstances, institutions and goals influence the implementation of NDCs and what are their emissions implications?
- Can new international institutions make NDCs more effective?
- What are the best measures of progress toward long-term objectives—2 degrees /1.5 degrees—for the Global Stocktake?
- Can Sustainable Development Goals be achieved simultaneously with the goals of the Paris Agreement?
- What roles will technology and control of non-energy emissions play in achieving NDCs and the long-term Paris goals?

Modeling the actual policies and measures used to implement NDCs

- Many NDCs are not framed in terms of an explicit emissions limit
  - China's peak emissions in 2030 goal
  - India's goal of reduced emissions per unit GDP
- Such emissions mitigation goals introduce inherent uncertainty into the emissions implied by a successfully implemented NDC.
- NDCs are different than the policies and measures that are used to implement their NDC
  - At this point few nations have prescribed the full set of policies and measures that they intend to use to implement their
- How can NDCs be meaningfully compared?



Source: Bloomberg New Energy FInance

Modeling the actual policies and measures used to implement NDCs

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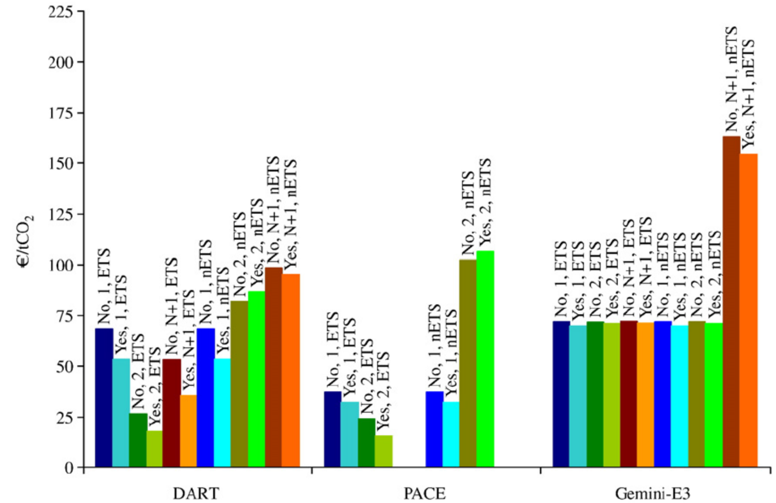
- Key Question: *How will national circumstances, institutions and goals influence the implementation of NDCs and what are their energy, emissions, land-use, trade, economic and other implications?*

- While economists favor taxes or cap and trade, political processes favor instruments that are politically feasible.

- EMF showed that the EU 202020 policy, which uses a suite of policy tools, including cap and trade, but also regulatory instruments.
  - Produced lower carbon tax
  - Had higher overall costs (welfare loss)
  - Different energy mix

Source: Böhringer, Christoph, Andreas Löschel, Ulf Moslener, and Thomas F. Rutherford. "EU climate policy up to 2020: An economic impact assessment." *Energy Economics* 31 (2009): S295-S305.



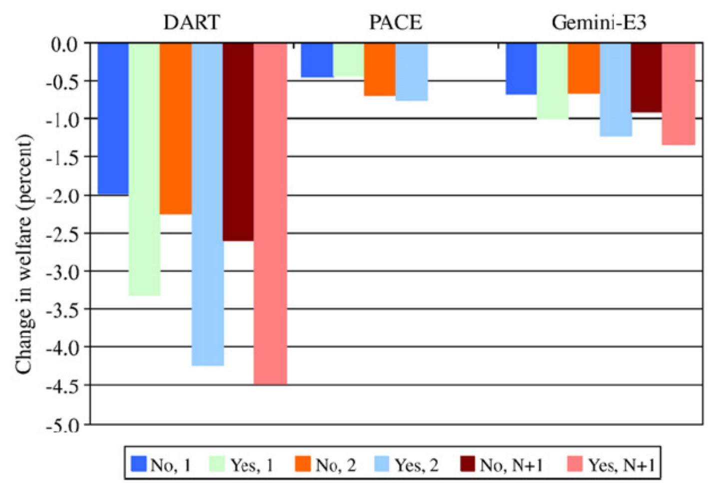


Fig. 5. The change in welfare in the European Union in 2020 according to three different models; no = no target for the share of renewables in energy supply; yes = target for the share of renewables in energy supply; 1 = uniform price for ETS and non-ETS emissions; 2 = separate prices for ETS and non-ETS emissions; $N+1$ = one Europe-wide price for ETS emissions, different prices for non-ETS emissions in different Member States.

Can new international institutions make NDCs more effective?

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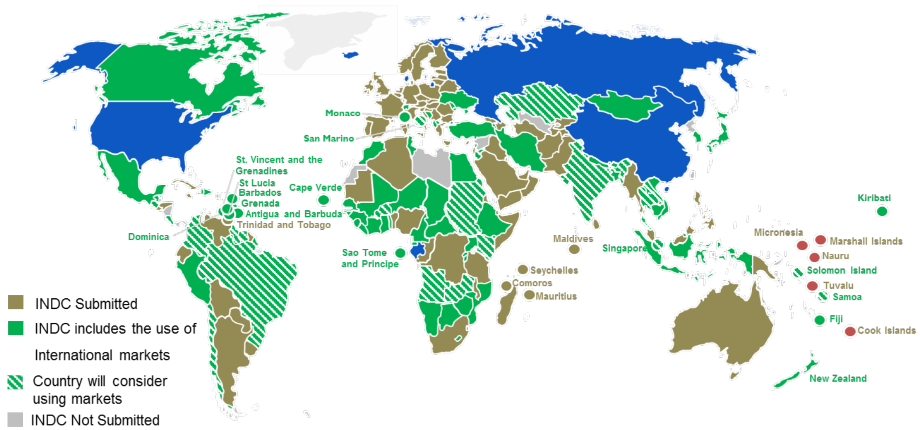
- Article 6 provides for
  - Cooperative approaches through “internationally transferred mitigation outcomes” (para 2)
  - Rules for carbon market accounting, particularly avoidance of double-counting (para 2 & 5)
  - Sustainable development & mitigation crediting mechanism (para 4)

- **Not at all clear how this will work.**
- **How to trade when goals are stated in terms many different metrics?**

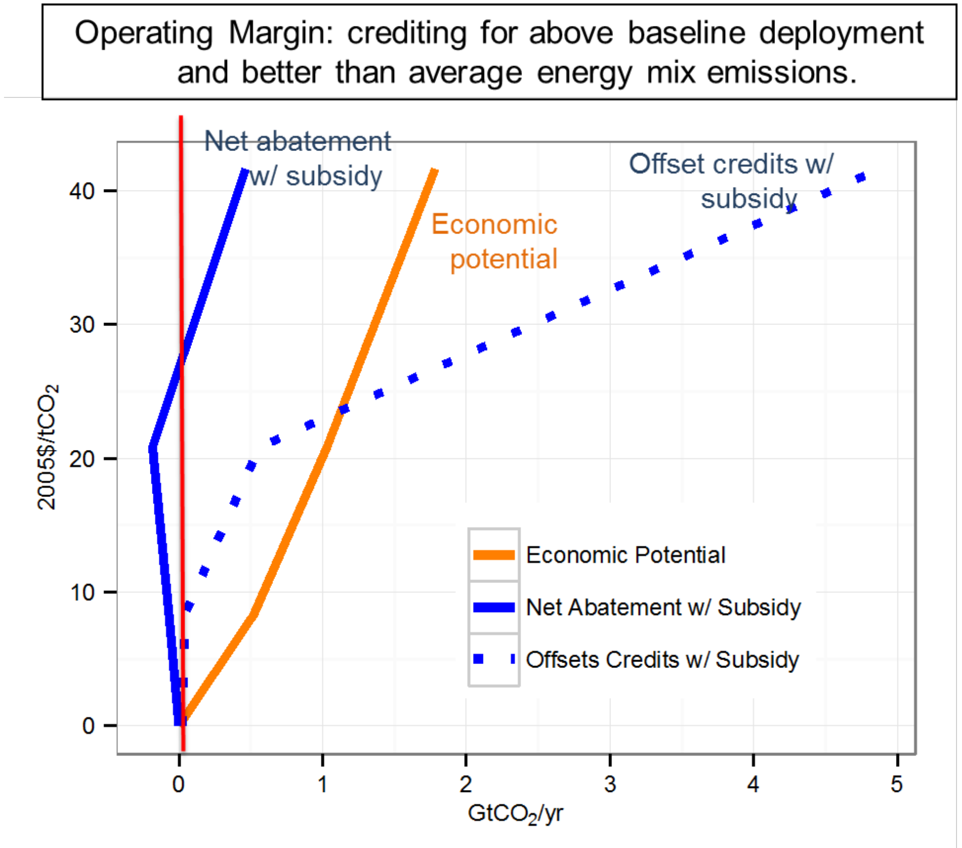
INDC’s Signal Interest in Market Cooperation



SOURCE: IETA/EDF “Carbon Pricing: The Paris Agreement’s Key Ingredient,” April 2016

System Design Matters

- An important research frontier is the examination of international carbon market architecture, for example.
  - The economics of offsets depends critically of the implementation mechanisms and crediting baselines
  - The design of international carbon markets when the markets cover only part of an economies emissions needs to be examined explicitly.



Source: Calvin, Katherine, Steven Rose, Marshall Wise, Haewon McJeon, Leon Clarke, and Jae Edmonds. "Global climate, energy, and economic implications of international energy offsets programs." *Climatic Change* 133, no. 4 (2015): 583-596.

Measuring progress toward 2 degrees /1.5 degrees—for the Global Stocktake

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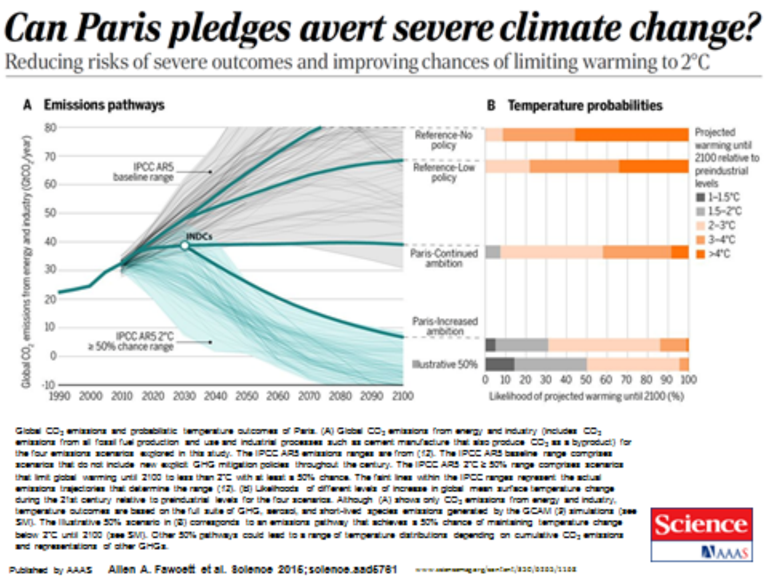
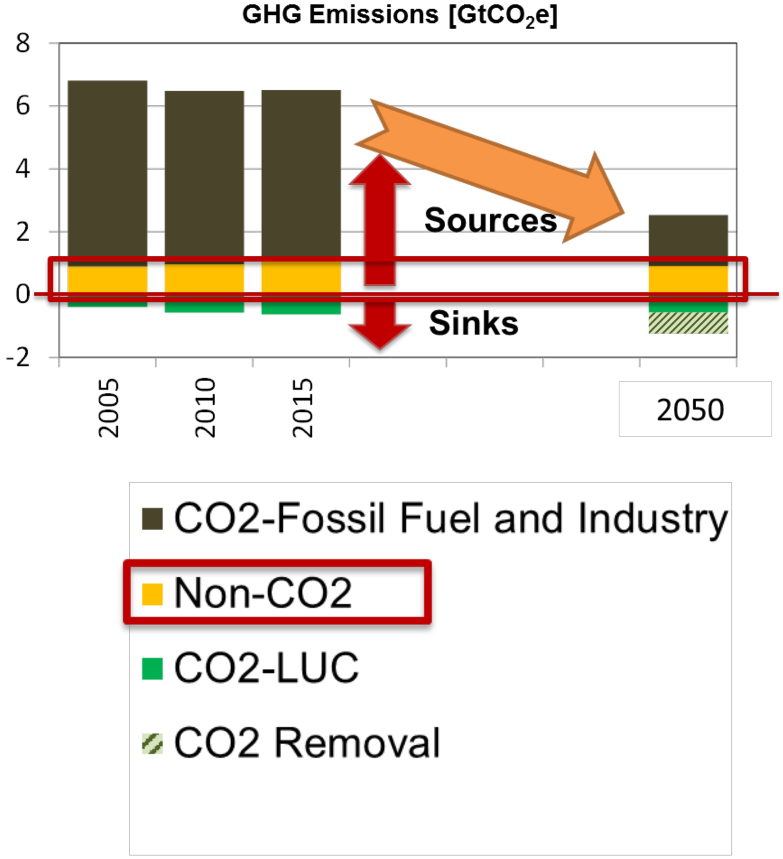
- What are the best measures of progress toward long-term objectives—2 degrees /1.5 degrees—for the first Global Stocktake in 2018?
- If successfully implemented NDCs will reduce the likelihood of the worst climate outcomes, but without an increase in ambition, would provide only a modest possibility of limiting climate change to 2 degree.
- Creating a 50-50 chance of staying below 2 degrees in 2100 means global emissions decline rapidly after 2030.
- Key research question is how to know if nations individually and in aggregate are on track to take the post-2030 emissions deep dive?
- And, are there technically **and** politically feasible paths to remain below 1.5 degrees?



Measuring progress toward 2 degrees / 1.5 degrees—for the Global Stocktake

- Tracking emissions were recognized as insufficient
- Need for leading indicators
  - E.g. committed emissions from existing plant and equipment
- Can near-term actions be designed to facilitate long-term goals?
- What strategies can nations use to address the Mid-Century problem?
  - How big are irreducible sources?
  - How big are sequestration opportunities?



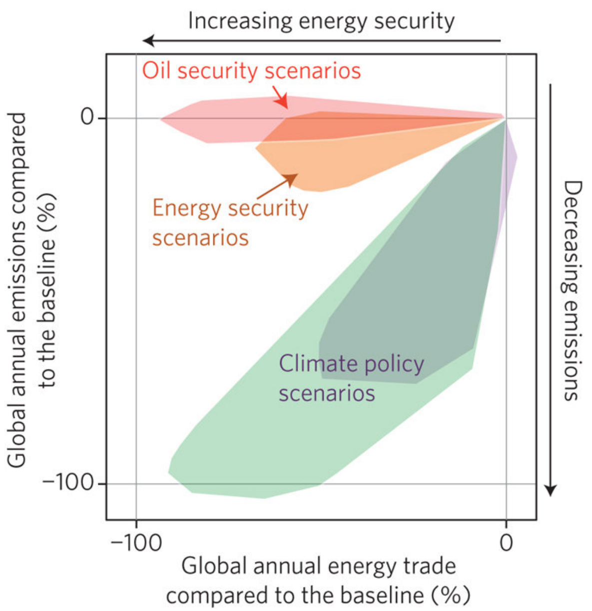
Source: Iyer, et al. Mid-Century Pathways, Snowmass presentation.

Sustainable Development Goals (SDGs) and the Paris Agreement?

- ***Can Sustainable Development Goals (SDGs) be achieved simultaneously with the goals of the Paris Agreement?***

- 17 SDGs—all extremely ambitious

- Interactions will matter.
  - Does local air quality go first?
  - Simultaneous mitigation and adaptation—potentially highly interactive in both bioenergy and water domains
  - Looking at Paris through alternative lenses—food security, energy security, urban, and so forth.



Source: Chaturvedi, Vaibhav. "Energy security and climate change: Friends with asymmetric benefits." *Nature Energy* 1 (2016): 16075.

2° C and SDGs: united they stand, divided they fall?

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- AMPERE project looked at interactions between a 2 degree climate goal and some SDGs
- Divided interactions into synergies and trade-offs
- Left interactions with many SDGs unexamined.

Figure 5. Percentage changes in SD risk dimensions that can be linked to a set o[...] sustainable energy objectives in constrained 2 °C pathways relative to optimal pathways (assuming immediate mitigation with full availability of miti[...] technologies and conventional energy demand growth). The different shapes denote different short-term climate pol[...] while the different colours denote different technology cases (see table 3). As the figure aims at showing trends in syne[...] trade-offs of alternative clusters of 2 °C pathways rather than an exact quantitative analysis, results are plotted in loga[...] table S4 for the underlying data).

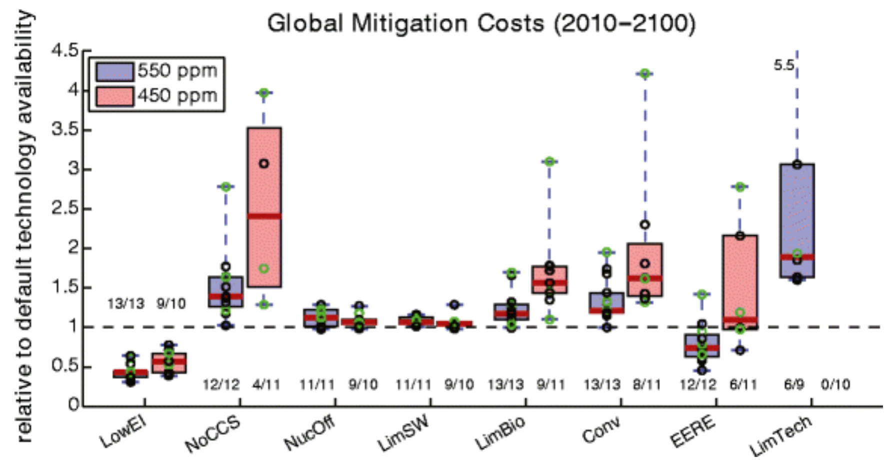
Source: von Stechow, Christoph, Jan C. Minx, Keywan Riahi, Jessica Jewell, David L. McCollum, Max W. Callaghan, Christoph Bertram, Gunnar Luderer, and Giovanni Baiocchi. "2° C and SDGs: united they stand, divided they fall?." *Environmental Research Letters* 11, no. 3 (2016): 034022.

Technology and non-energy emissions

- What roles will technology and control of non-energy emissions play in achieving NDCs and the long-term Paris goals?

- Are negative emissions essential to achieving 2 or 1.5 degrees?
- Will new technologies be needed to address the Mid-Century problem?
- To what extent can technology improvement substitute for policy ambition?

- Are there limits on emissions reductions for non-CO_2 GHGs?



Source: Kriegler, Elmar, John P. Weyant, Geoffrey J. Blanford, Volker Krey, Leon Clarke, Jae Edmonds, Allen Fawcett et al. "The role of technology for achieving climate policy objectives: overview of the EMF 27 study on global technology and climate policy strategies." *Climatic Change* 123, no. 3-4 (2014): 353-367.

EMF 27 found that there are many potential technology mixes, but IMPROVED technology performance and a wider set of options lowered costs.

Moving Forward

- **Europe—hosts NTNU and University of Oslo**
- **ASIA—host NIES**
- Support for the project is open to government, private sector, finance, research and NGO institutions.
- For further information contact Jae Edmonds at jae@pnnl.gov.

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DISCUSSION