



Strategic clean technology policies

Carolyn Fischer

Resources for the Future
Vrije Universiteit – Amsterdam
University of Ottawa

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Economists want to “get the prices right”

Global Carbon Pricing We Will If You Will

Peter Cramton, David J.C. MacKay, Axel Ockenfels, and Steven Stoft

[Linked Table of Contents](#)

Includes recent climate policy papers by

David J. C. MacKay

Richard Cooper

Joseph Stiglitz

William Nordhaus

Martin L. Weitzman

Christian Gollier & Jean Tirole

Stéphane Dion & Éloi Laurent

Peter Cramton, Axel Ockenfels & Steven Stoft

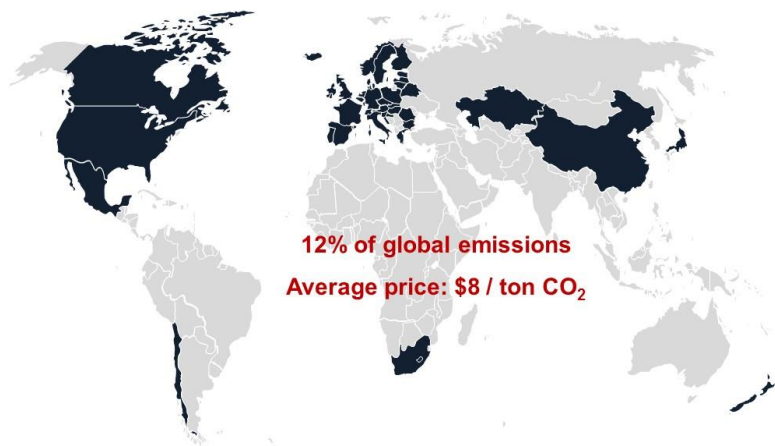
Version 1.12 — 22 October 2015

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carbon-price.com

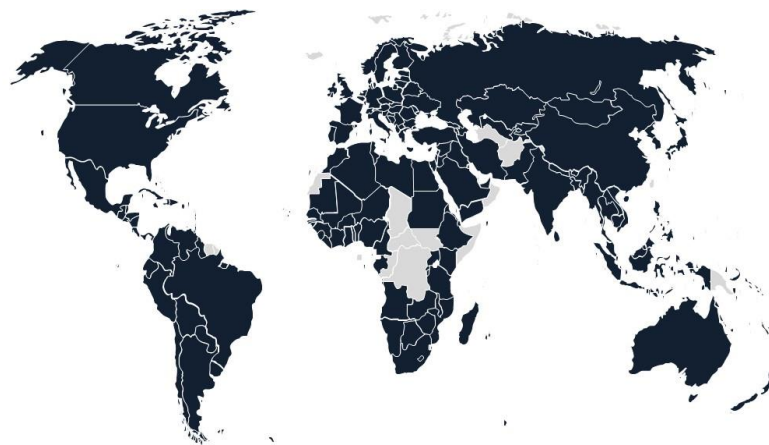
Carbon pricing is less popular than technology-oriented interventions

Jurisdictions with carbon pricing



Countries with a national or provincial ETS or carbon tax implemented or scheduled, as of early 2015 (Source: World Bank 2015)

Jurisdictions with renewable policies



Countries with national or provincial renewable energy policies or targets in place, as of early 2015 (Source: REN21 2015)

EU Targets

	2020	2030
Emissions reductions (from 1990)	20%	40%
Renewables (share of energy consumption)	20%	27%
Energy efficiency improvement	20%	27%



Complementary policies

Green Energy Act, 2009

made Ontario the first jurisdiction in North America to completely phase out coal as a source of energy. The Act also created financial incentives for development of renewable energy.



- Ontario

- Quebec

In April 2016, the Government of Québec announced its 2030 Energy Policy. The policy sets the following targets for 2030:

- Enhance energy efficiency by **15%**
- Reduce the amount of petroleum products consumed by **40%**
- Eliminate the use of thermal coal
- Increase overall renewable energy output by **25%**
- Increase bioenergy production by **50%**



The targets are relative to 2013 levels and build on Québec's cap and trade market initiative.

Complementary policies

- British Columbia

Clean Energy Act – seeks to make BC self-sufficient in electricity generation by 2016, with a clean and renewable energy target of

93%

Renewable and Low Carbon Fuel Requirements Regulation – requires minimum renewable fuel content by volume



- Alberta

Legislating an emissions limit on the oil sands of:

100 mega tonnes of CO₂/year.

Phasing-out coal-fired electricity by

2030



and replacing two-thirds of existing coal-fired electricity with renewable energy.

Reducing methane emissions from oil & gas operations by:



45% by 2025



The Climate Change and Emissions Management Act & Specified Gas Emitters Regulation place intensity-based limits on industrial GHG emissions.

Some prominent economists are less enthusiastic about overlapping targets...

An Economic View of t x

www.robertstavinsblog.org

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One Economist's Perspective on Environmental and Natural Resource Policy

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AN ECONOMIC VIEW OF THE ENVIRONMENT

Home

Will Europe Scrap its Renewables Target? That Would Be Good News for the Economy and for the Environment

Posted on [January 18, 2014](#) by [Robert Stavins](#)

The European Union is considering scrapping the use of binding renewable energy targets as part of its global climate change policy mix that will extend action from 2020 to 2030. The [Financial Times](#) reported that this move – presumably due to concerns over high European energy costs during the ongoing economic turnaround – will “[please big utility companies but infuriate environmental groups](#).” The [International New York Times](#) framed the story in [similar ways](#).

About the Author
Robert N. Stavins is the Albert Pratt Professor of Business and Government, Director of the Harvard Environmental Economics Program, and Chairman of the Environment and Natural Resources Faculty Group.



Overlapping – and overshadowing – cap-and trade

- Forcing market to use more expensive abatement options
- Driving down allowance prices



Economic rationales for subsidizing green goods

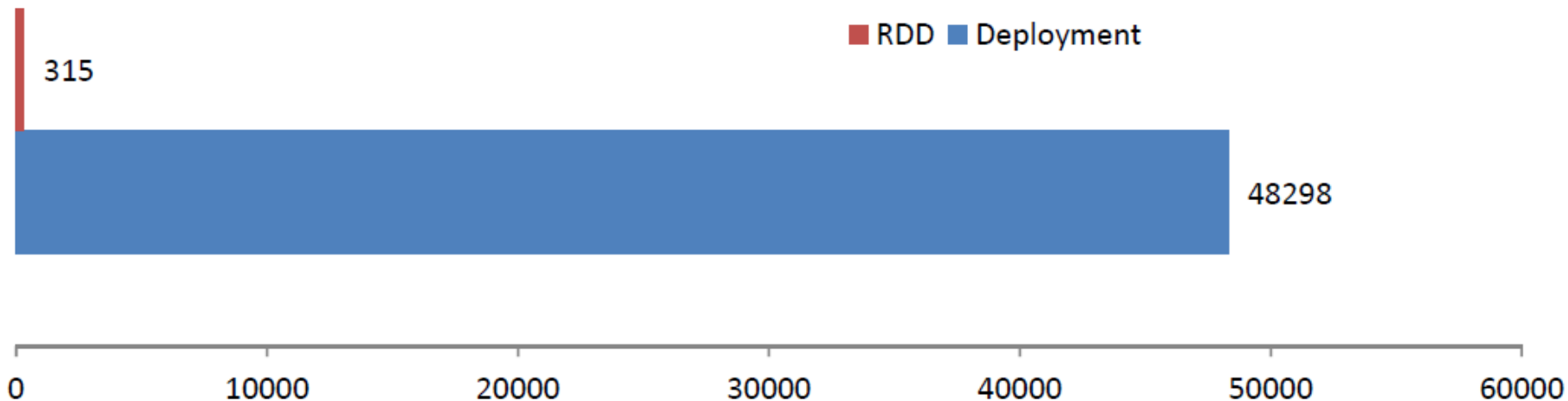
- Upstream market failures
 - R&D spillovers
 - Network / scale / learning externalities
 - Imperfect competition
 - New industries
 - Patented technologies



- Downstream market failures
 - Underpriced emissions
 - including subsidies for fossil fuels
 - Behavioral gaps
- Other goals: jobs and exports

EU policy mix for renewables

Figure 2: Deployment vs. RD&D expenditure for wind and solar in 2010 in six EU countries (in € millions)



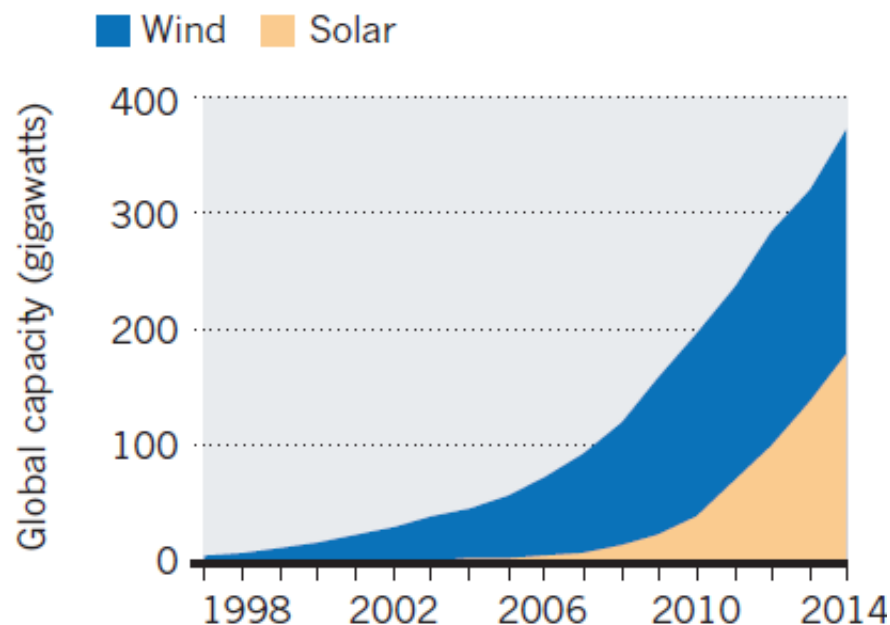
Source: Bruegel calculation based on IEA and datastream.

Note: Net deployment costs are calculated as the difference of the deployment costs¹⁰ and the net present value of the future electricity generated¹¹. The countries are the five largest EU countries (DE,ES,FR,IT,UK) plus the Czech Republic (the largest Central East European country for which we have data)

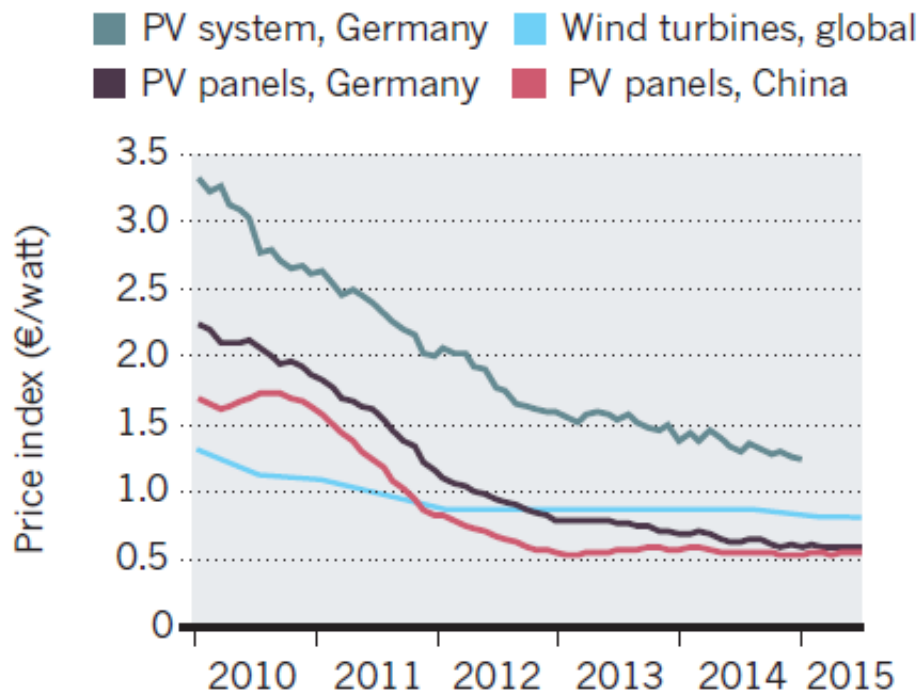
Push renewables to spur carbon pricing

Make wind and solar power even cheaper by opening up access to the electricity grid and ending fossil-fuel subsidies, urge **Gernot Wagner** and colleagues.

1 Consumption and capacity increasing



2 Costs declining rapidly



Why China Is Dominating the Solar Industry

Between 2008 and 2013, China's solar-electric panel industry dropped world prices by 80 percent

By John Fialka, ClimateWire on December 19, 2016

AN INDUSTRY PROPELLED BY TAX CREDITS

- “China bought solar companies and invited others to move to China, where they found cheap, skilled labor. Instead of paying taxes, they received tax credits.”
- “...the federal government was willing to chip in as much as \$47 billion to help build its solar manufacturing into what it calls a ‘strategic industry.’ ”

EU says China guilty of giving illegal aid to solar industry

Tue, Aug 27 2013

By [Robin Emmott](#)

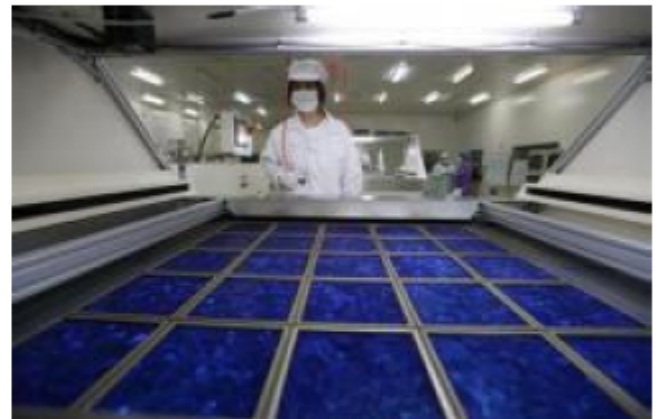
BRUSSELS (Reuters) - The European Union has warned Beijing it has evidence Chinese solar companies benefit from illegal subsidies, people close to the issue said on Tuesday, but Brussels says it will not take action for now following a deal to defuse the row.

European companies accuse Chinese rivals of benefiting from unfair state aid allowing them to dump about 21 billion euros (18 billion pounds) worth of solar panels at below cost in Europe last year, putting European firms out of business.

The solar dispute, by far the biggest between China and the EU, threatened a wider trade war in goods from wine to steel until Brussels and Beijing agreed a minimum price for panels from China in late July and eased tensions.

But a nine-month investigation by the European Commission into China's solar industry has found Beijing broke World Trade Organisation rules by handing out cheap loans, land, interest-free credit lines and tax breaks to companies, people with knowledge of the situation told Reuters.

"There are clear indications that (Chinese) government policy influences the decision-making of the banks when deciding on the terms of financing to solar companies," said one person who declined to be named because the findings are not public.



Many forms of green industrial policy

- Upstream interventions to drive down costs
 - Technology production incentives
 - Tax incentives, preferential finance, below-cost inputs, land, etc.
 - R&D support
 - **Lowers technology prices**
- Downstream incentives to drive up demand
 - Production tax credits, feed-in tariffs, renewable portfolio standards
 - Investment incentives
 - **Pulls up technology prices**
 - Unless scale economies very large

Goal:

Driving down deployment costs globally

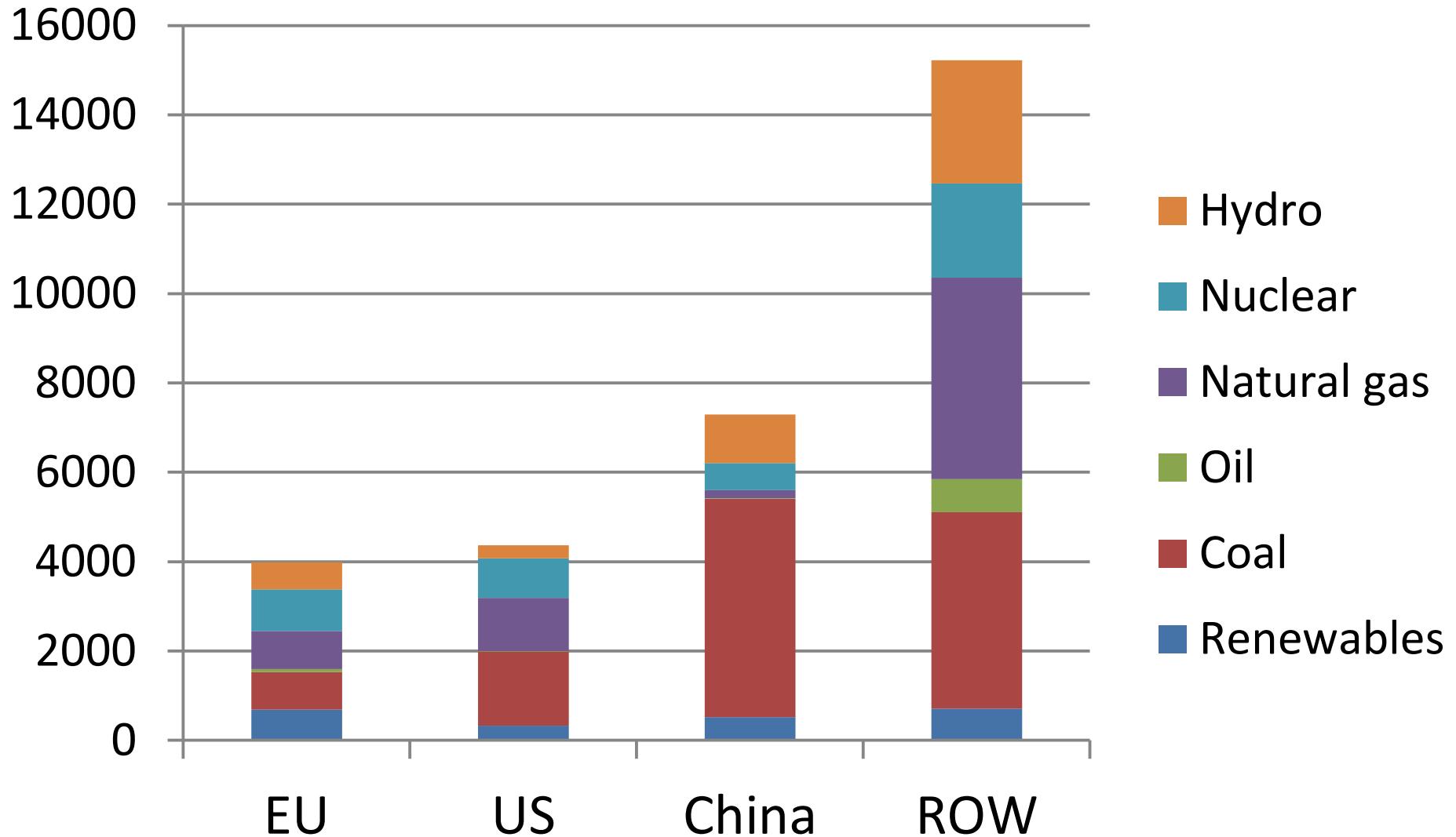
Independent:

“Nearly 50 countries vow to use 100% renewable energy by 2050”



Generation in 2020 by source

(IEO 2014)



Plausible efficient subsidies

- Learning (wind) $\sim 1\text{¢} / \text{kWh}$
- Learning (solar) $\sim 5\text{¢} / \text{kWh}$
- Global deployment $\sim 5\text{¢} / \text{kWh}$
- Scale economies $\sim 5\text{¢} / \text{kWh}$

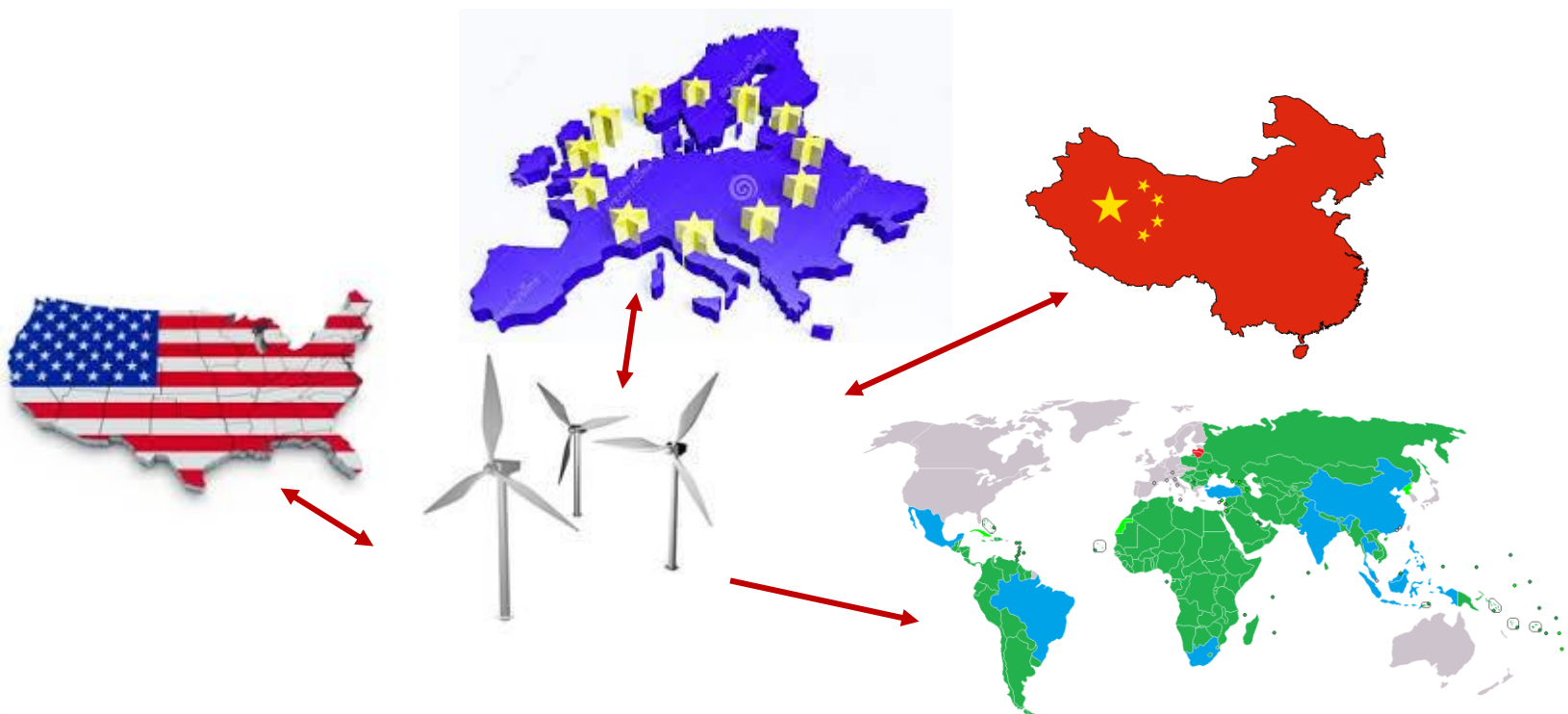
Fischer, C., L. Preonas. and R. Newell. (Forthcoming.) Environmental and Technology Policy Options in the Electricity Sector: Are We Deploying Too Many? *Journal of the Association of Environmental and Resource Economists*.

Fischer, C. 2016. Strategic Subsidies for Green Goods. RFF DP 16-12 and FEEM Nota di Lavoro 2016.030.

Fischer, C. 2017. Environmental Protection for Sale: Strategic Green Industrial Policy and Climate Finance. *Environmental and Resource Economics*. 66 (3): 553–575.

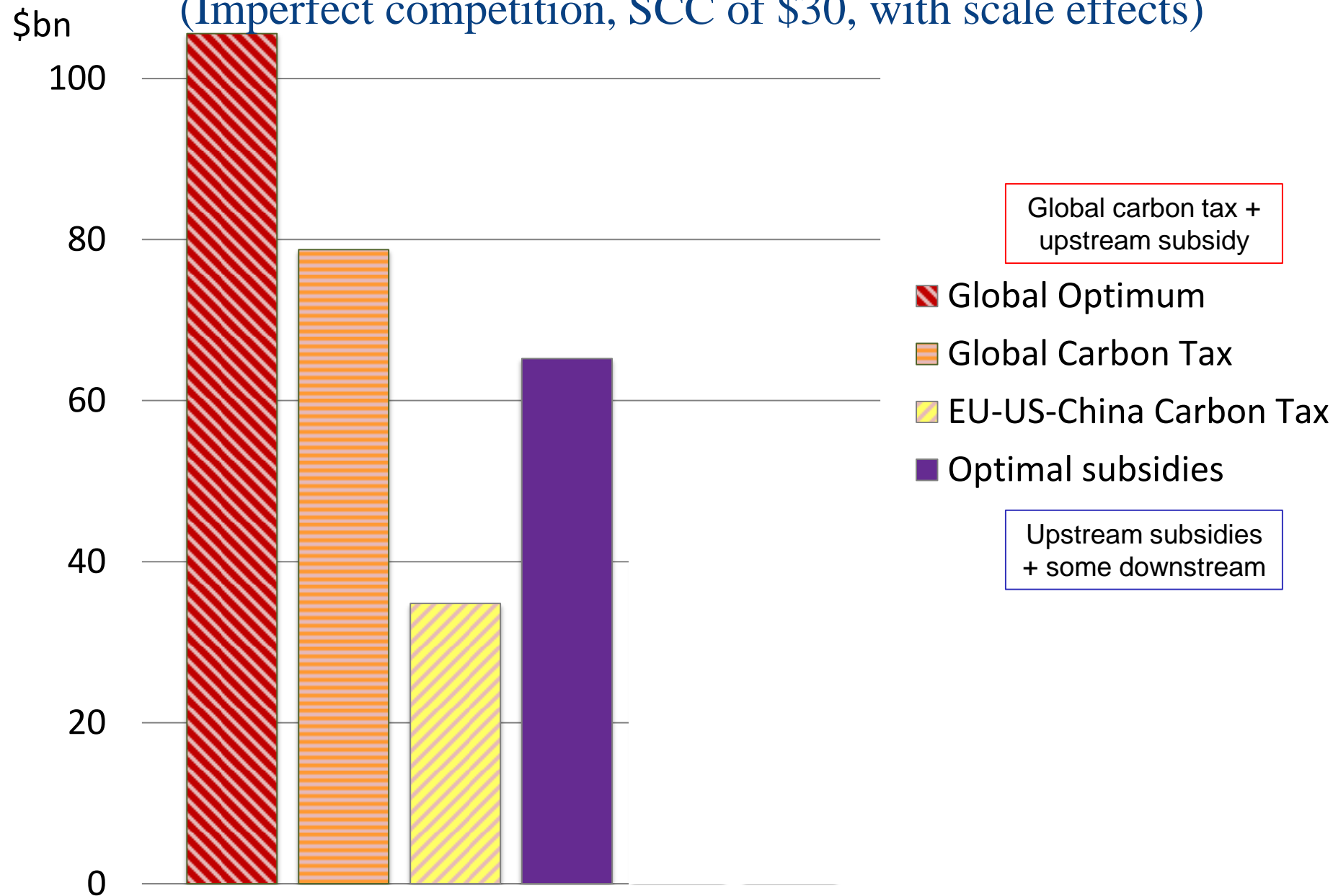
(Numerical model of electricity generation by region and clean tech)

- US, EU, and China manufacture and deploy renewable technologies and export to ROW



Global welfare gains from policy

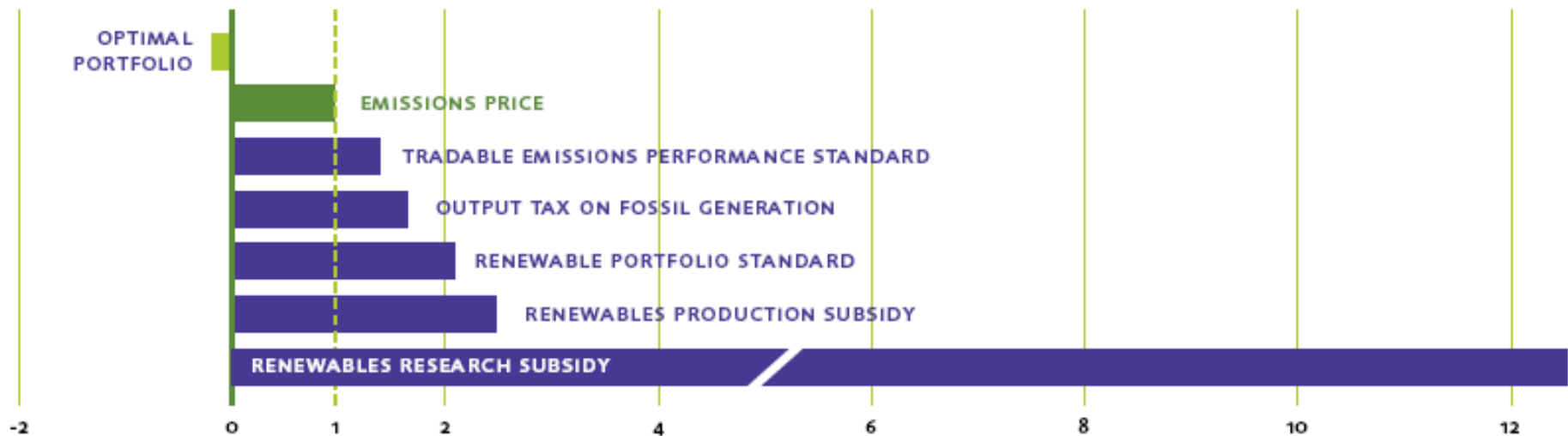
(Imperfect competition, SCC of \$30, with scale effects)



Cost of using technology policy instead of emissions pricing

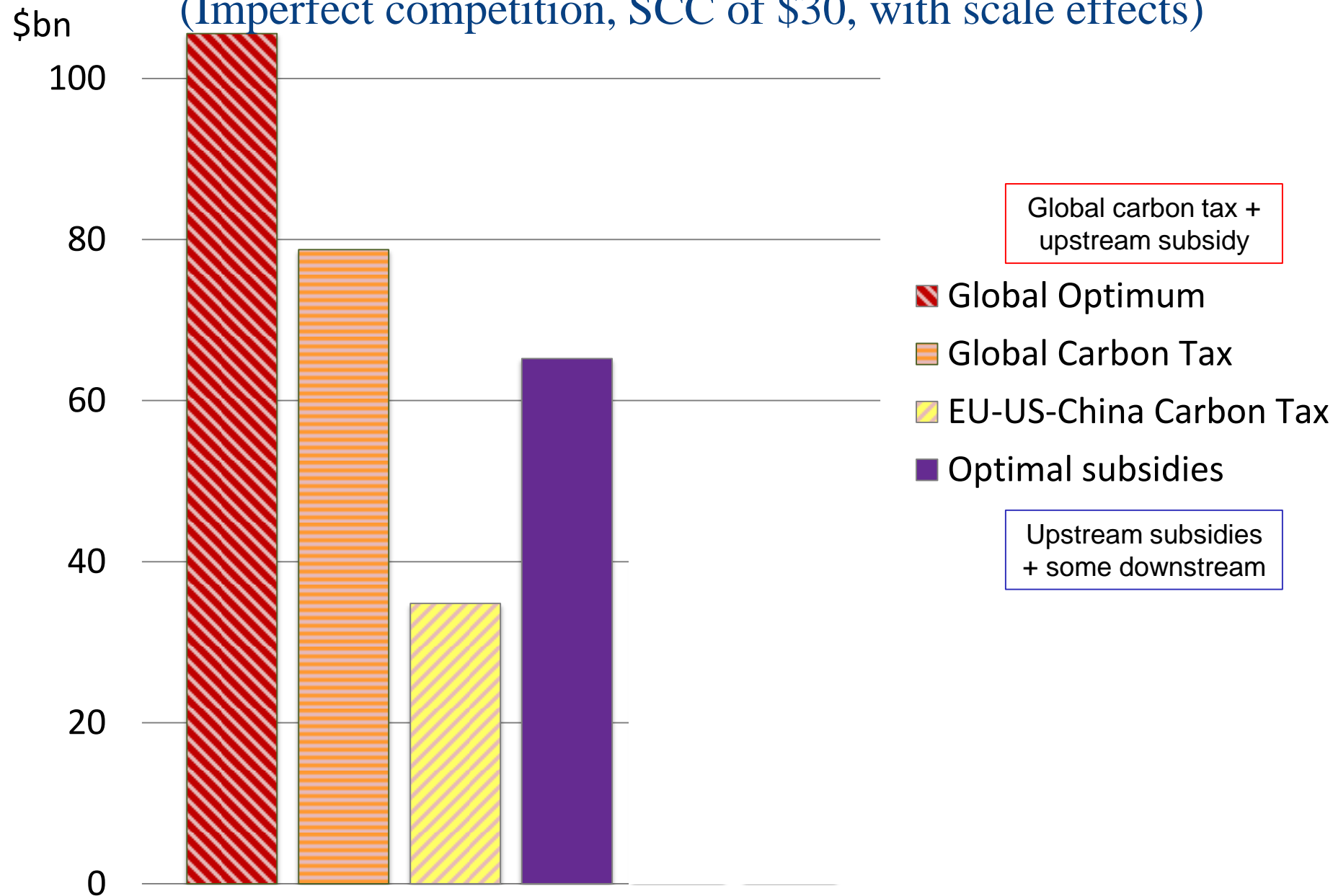
- Optimal policy includes addressing R&D and LBD spillovers, with emissions pricing
- Emissions pricing best single policy

Cost of Policy Scenarios Relative to Emissions Price



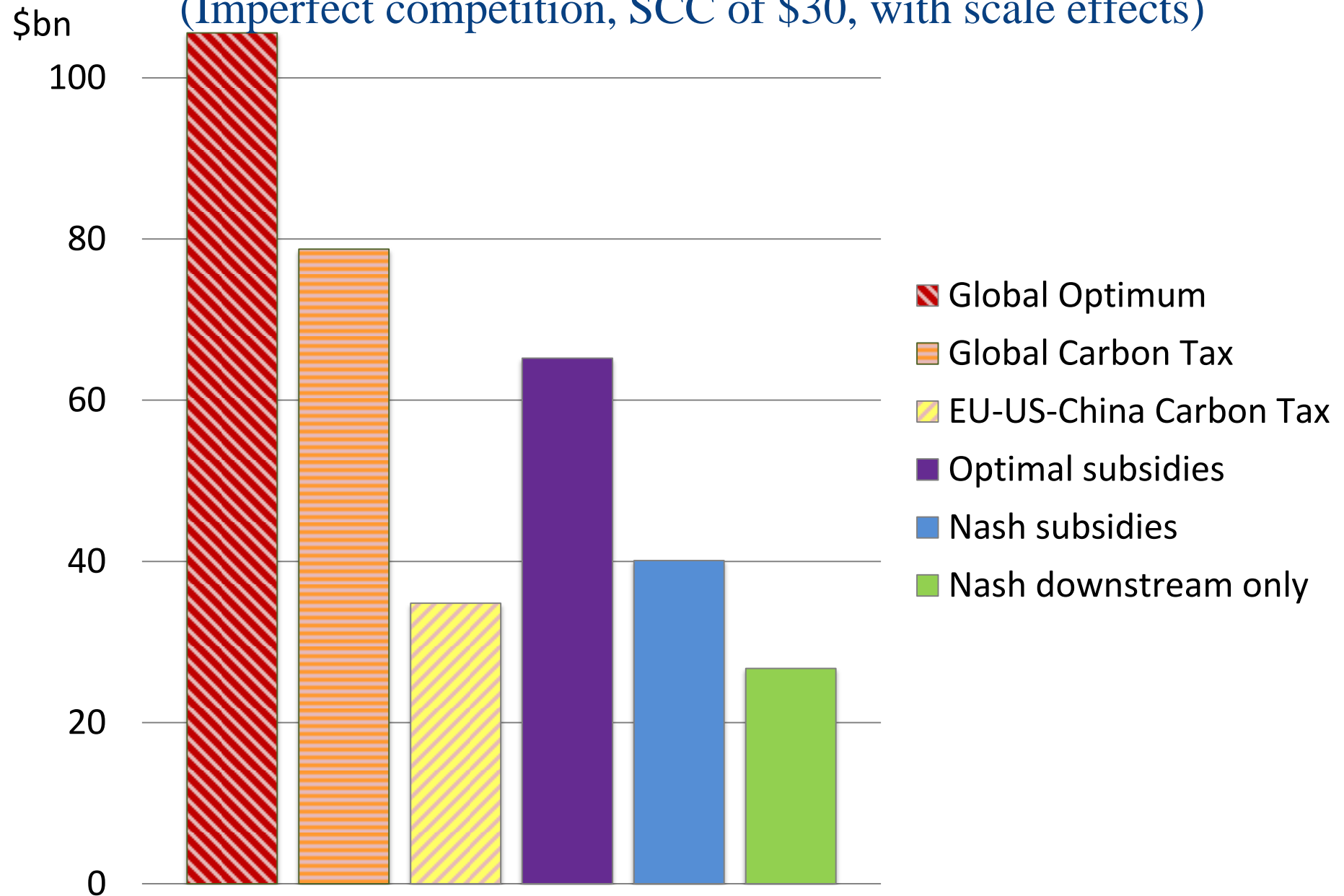
Global welfare gains from policy

(Imperfect competition, SCC of \$30, with scale effects)



Global welfare change from No Policy

(Imperfect competition, SCC of \$30, with scale effects)



Conclusion

- We are in a highly imperfect world
- Requires more nuance from economists and technologists
- Carbon pricing is important but not enough
 - Just as we should address competitiveness effects in carbon pricing to avoid carbon leakage,
 - We should address global effects of technology policies to maximize negative leakage

Thanks!

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