

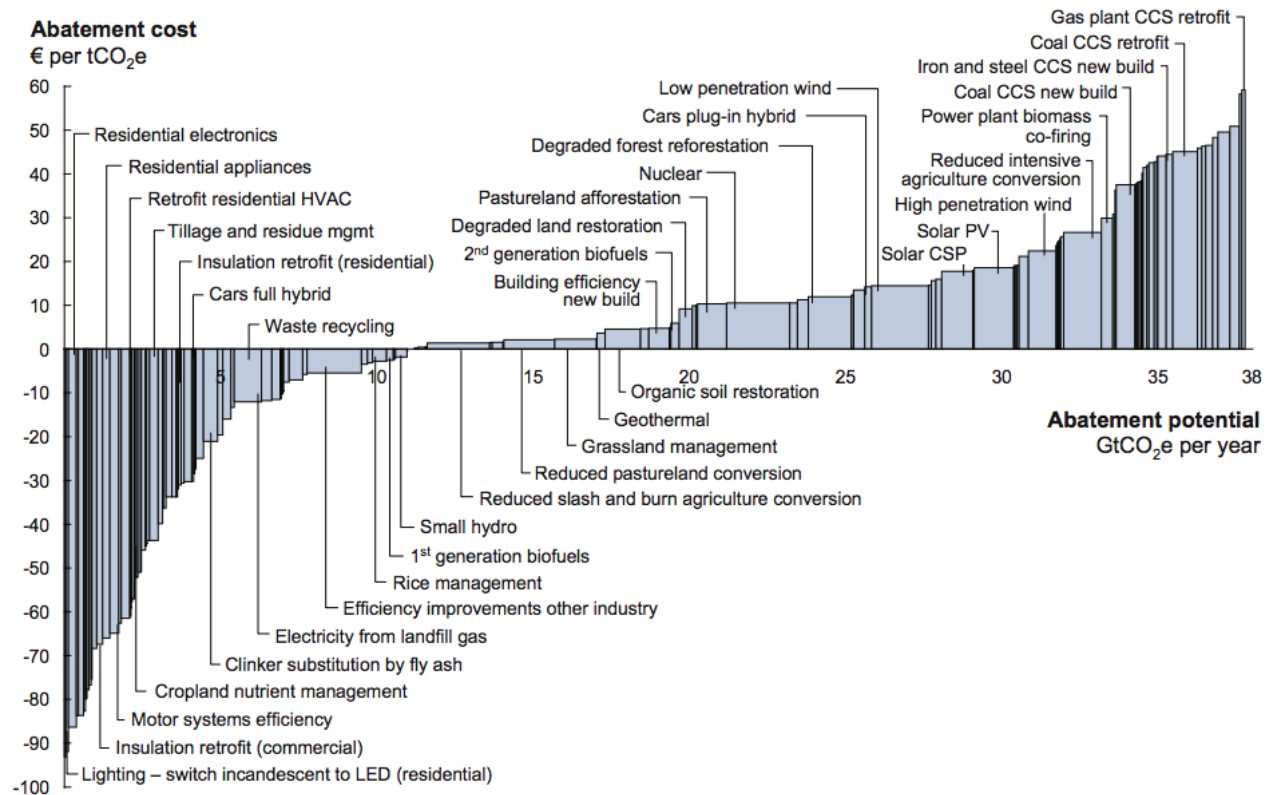
# Climate Change and the National Interest

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Center for Strategic and International Studies  
April 17, 2018

# We have traditionally looked for the lowest-cost next ton

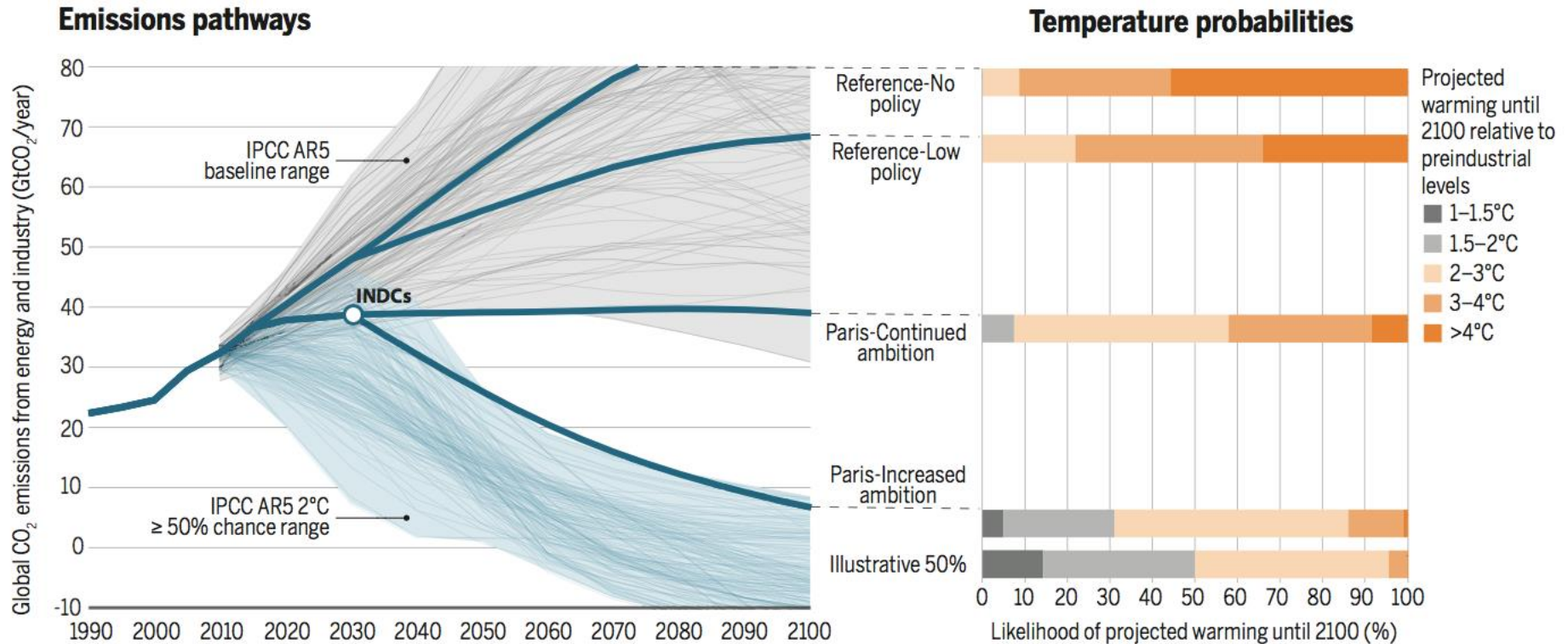
Global GHG abatement cost curve beyond business-as-usual – 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO<sub>2</sub>e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.  
Source: Global GHG Abatement Cost Curve v2.0

- Marginal abatement cost has been the key planning metric.
- Most NDCs reflect this approach, combined with national goals and political constraints.

# But using this technique generates insufficient emissions reductions



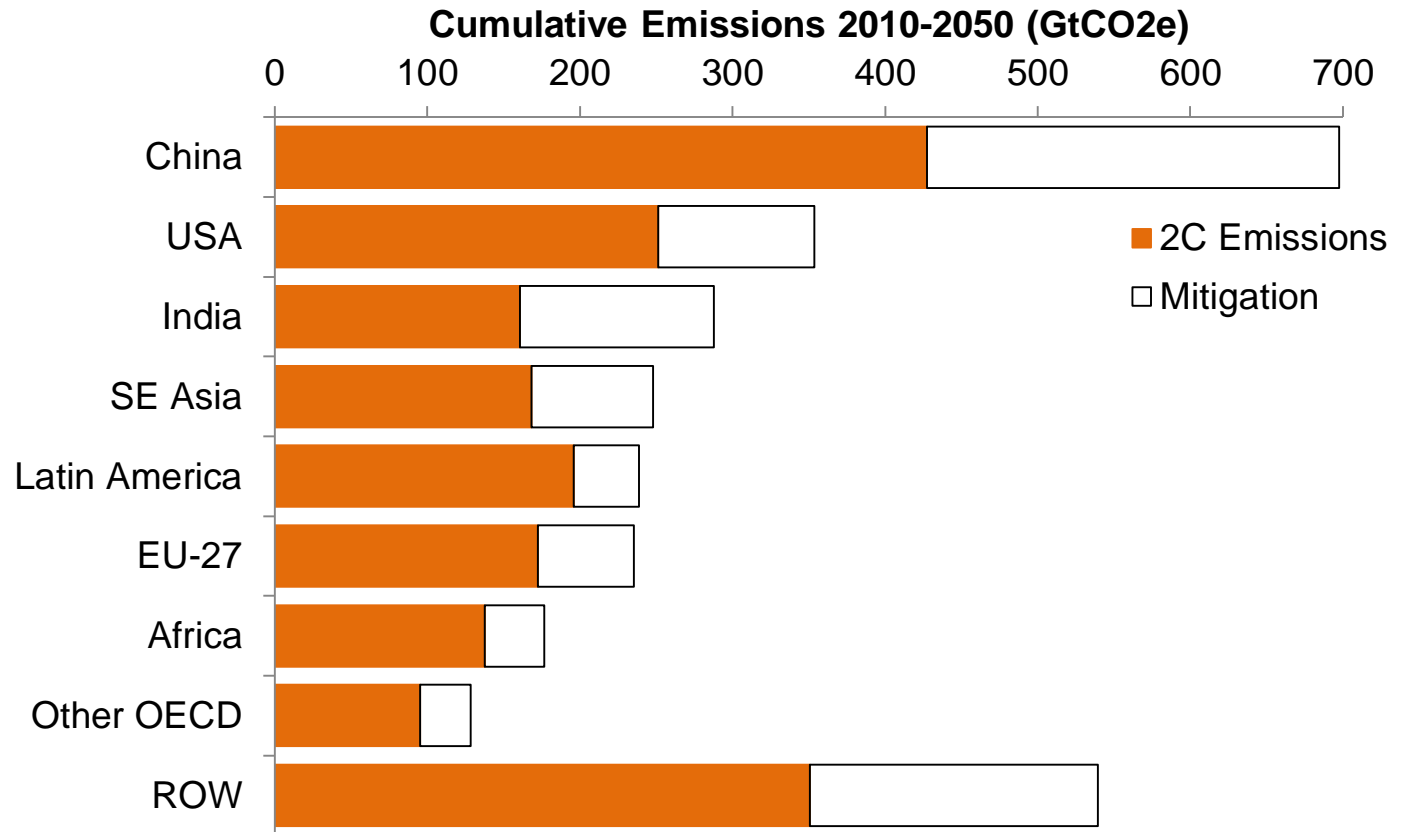
Source: Fawcett, et al., *Science* (2015, v350, i6265)

# 2050 pathways help us understand the required transformation

- Requires us to think about transformation, not incremental improvement.
- Is within reach, but with enough time for capital stock turnover.
- Helps us plan for long-term decisions:
  - Infrastructure investment
  - Technology priorities and R&D investment
  - Institution building
  - Avoiding stranded assets
  - Global competition

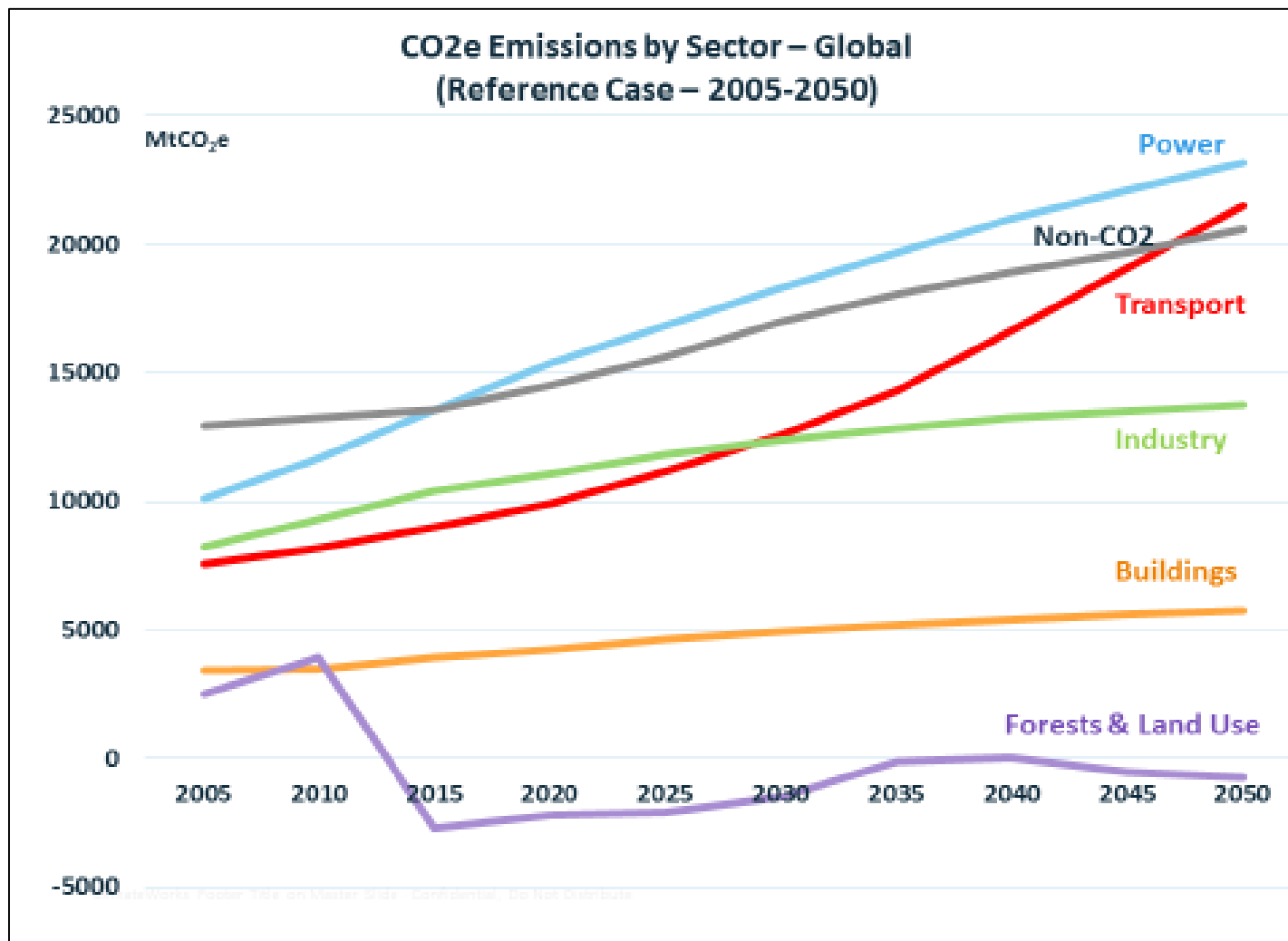


# Abatement Varies by Geography



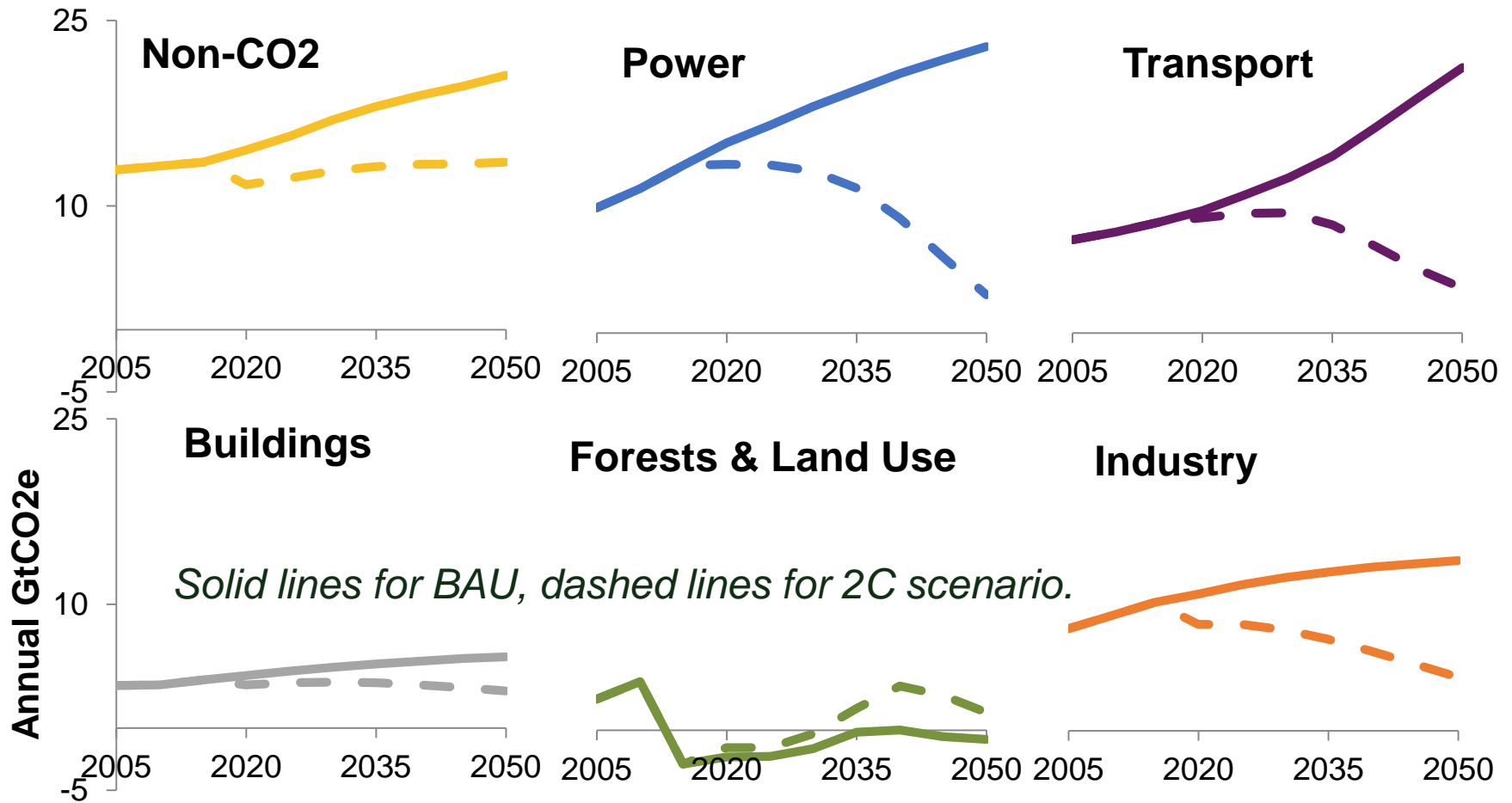
CWF modeling uses uniform global carbon price for all countries and sectors. The 2C scenario emits almost 2,000 GtCO<sub>2</sub>e between 2010 and 2050, requiring negative emissions of almost 15 GtCO<sub>2</sub>e per year net by 2100.

# Global sectoral trends under BaU



Source: ClimateWorks Foundation

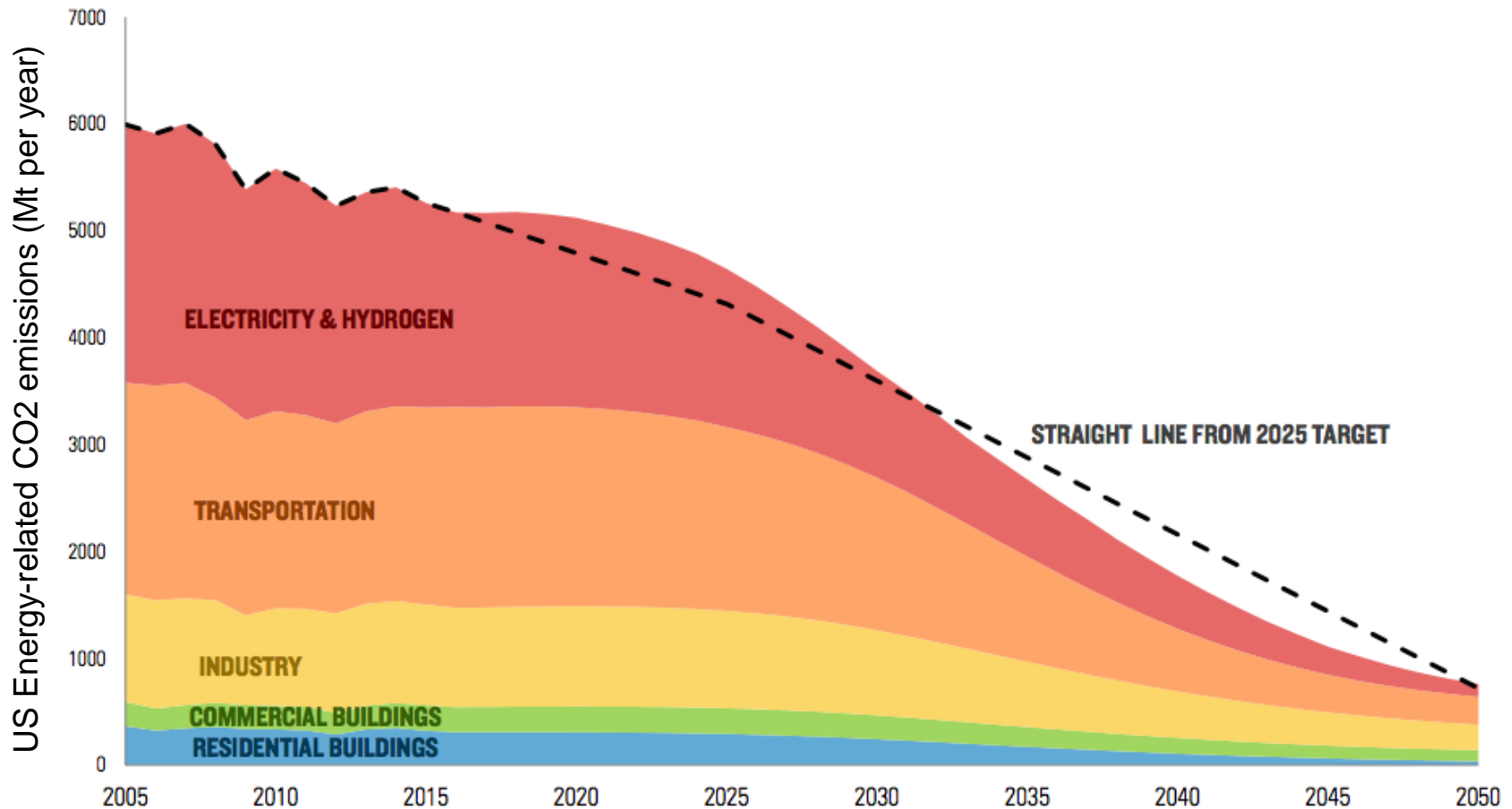
# Every sector must contribute significantly to emissions abatement



Note: Model uses uniform global carbon price for all countries and sectors. The 2°C scenario emits almost 2,000 GtCO<sub>2</sub>e between 2010 and 2050, requiring negative emissions of almost 15 GtCO<sub>2</sub>e per year net by 2100.

Source: ClimateWorks 2050 Pathways Modeling (GCAM v4.2, 2017)

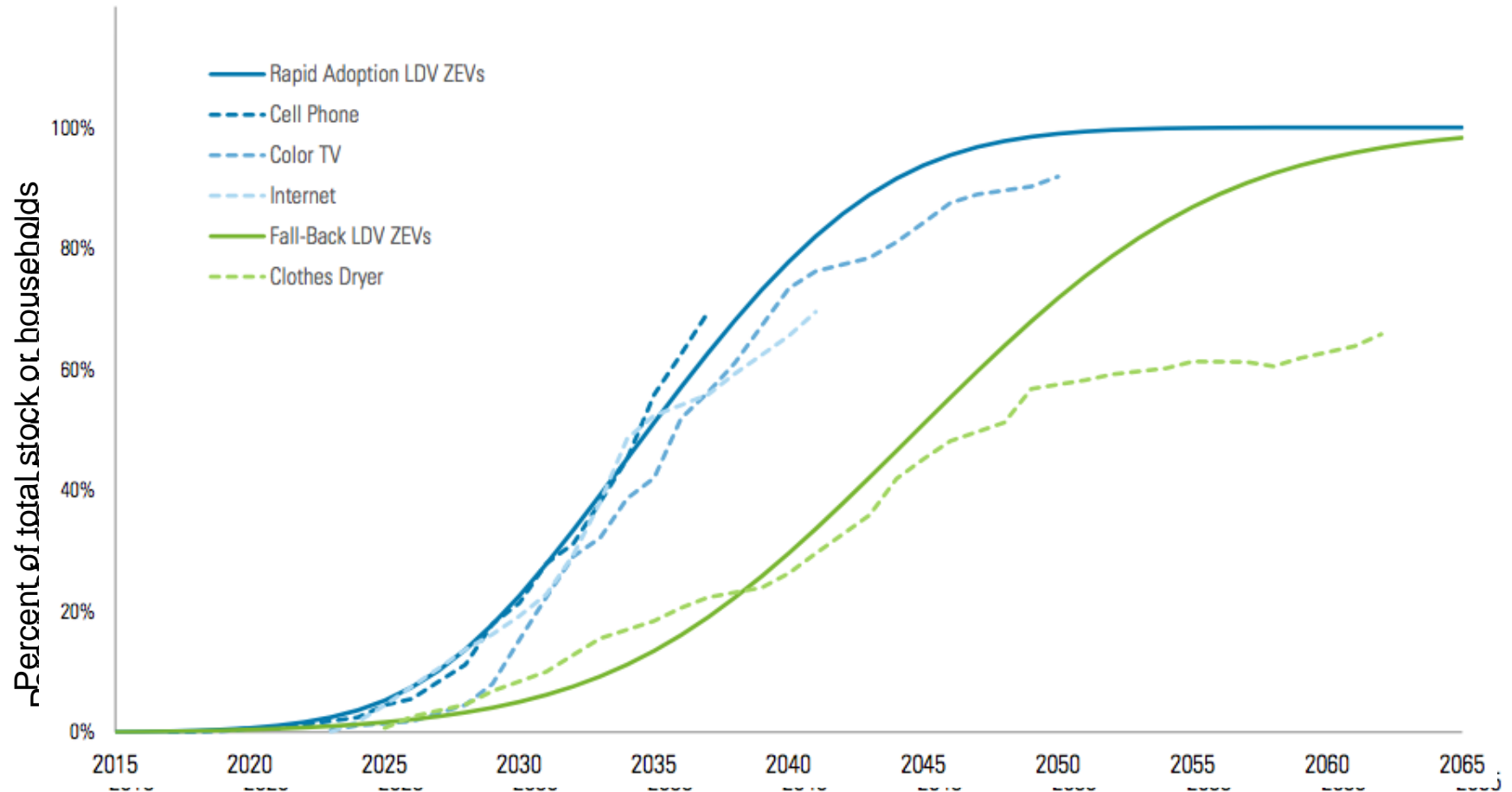
# Clean technology deployment must be very rapid



Source: Rhodium Group Analysis using PATHWAYS

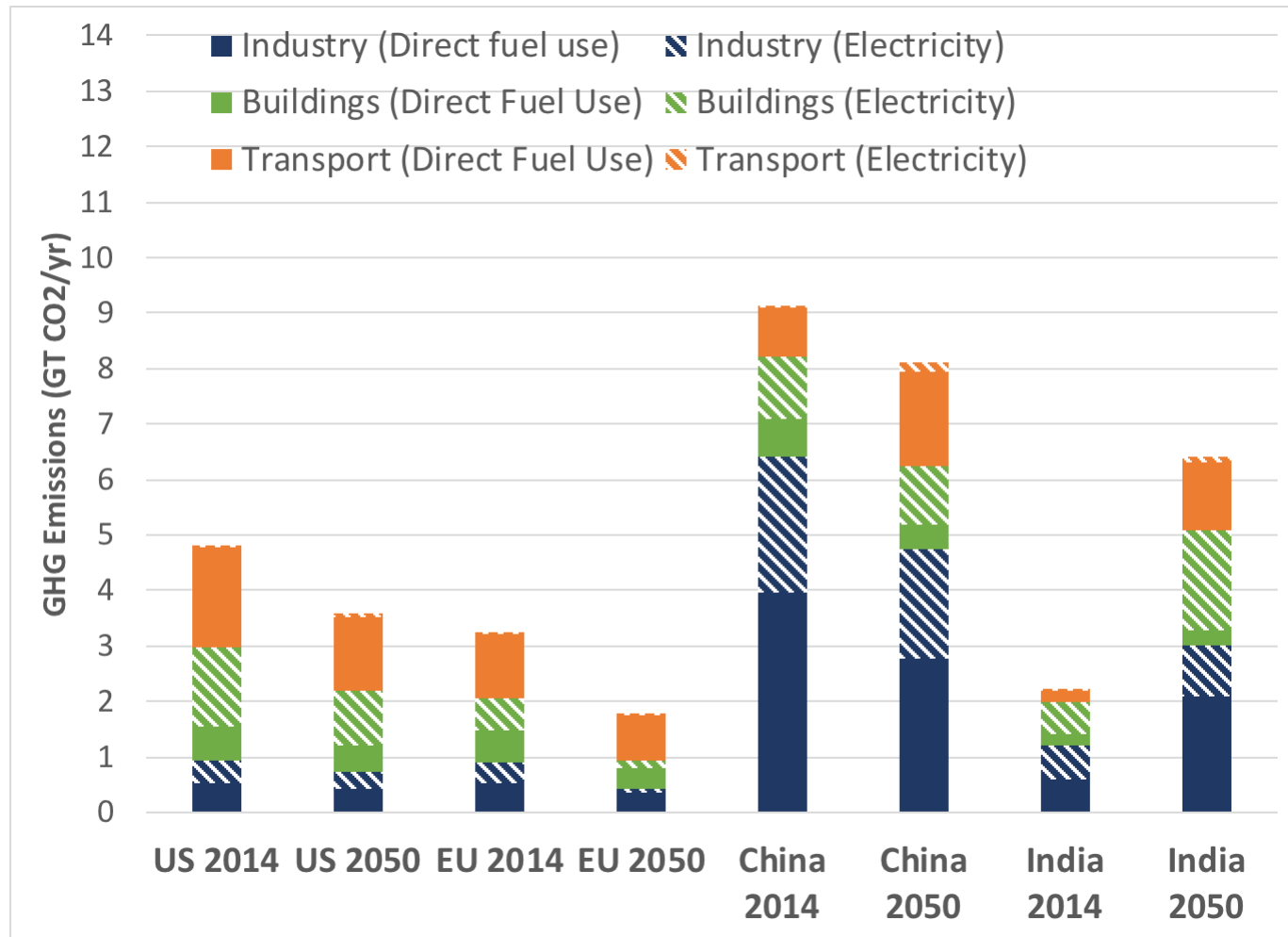


# And there are only a few historic analogues



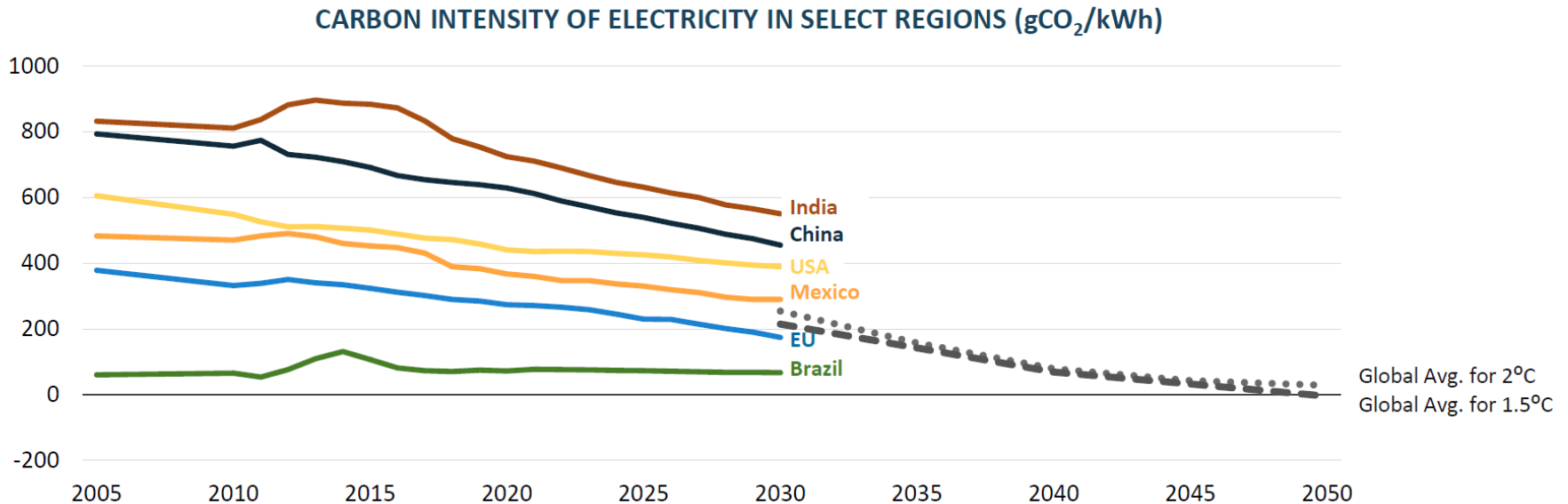
This U.S. 2050 analysis finds that passenger light-duty vehicles must be electrified at the same rate as color TVs, mobile phones, and the internet were adopted.

# Models project significant electrification



Source: LBL end-use calculations using data from Energy Technology Perspectives 2017, Reference Scenario

# But electricity must be decarbonized



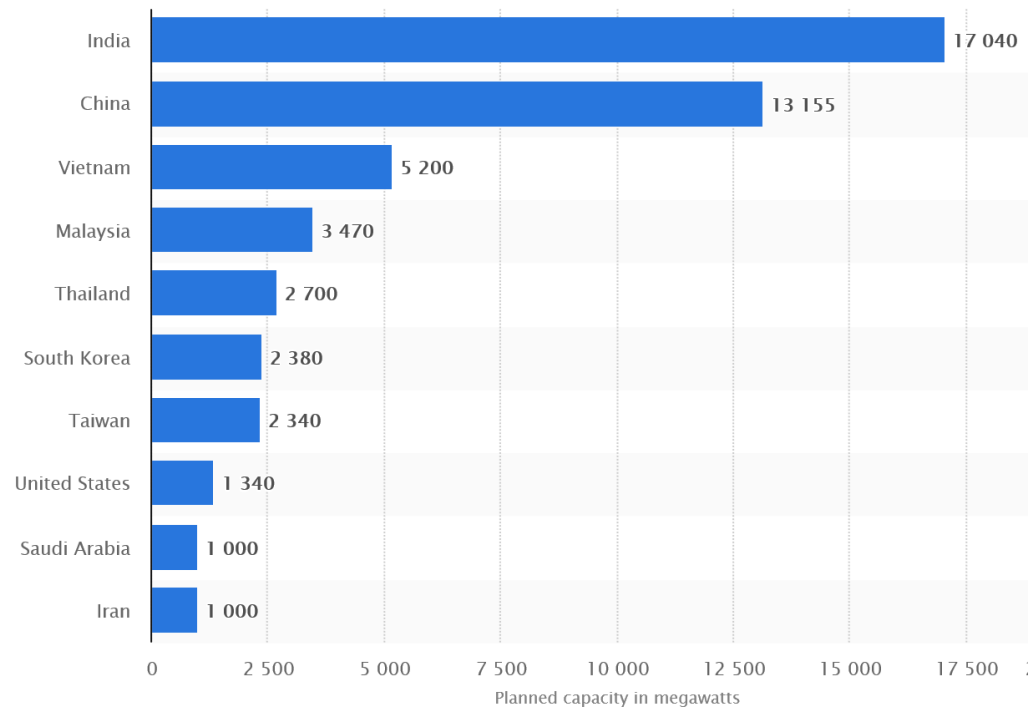
Source: The ClimateWorks Carbon Transparency Initiative feature in Faster & Cleaner II report found at <http://www.climateworks.org/report/fastercleaner2/>

Variable renewable energy can provide upwards of 50-80% of power generation on a properly functioning grid. However, 80-100% decarbonization will require clean “baseload” and/or fast-ramp energy sources for grid stability and reliability. Carbon capture and storage (ccs) and advanced nuclear are possible candidates to fill this gap.



# China leads the world in green electricity, and India leads in new planned PV manufacturing capacity

- In 2015, 26% of China's electricity (1532 PWh) came from carbon free sources. China generated twice the renewable electricity as next largest country (USA).
- In 2016, two-thirds of global planned PV production capacity was in India and China.

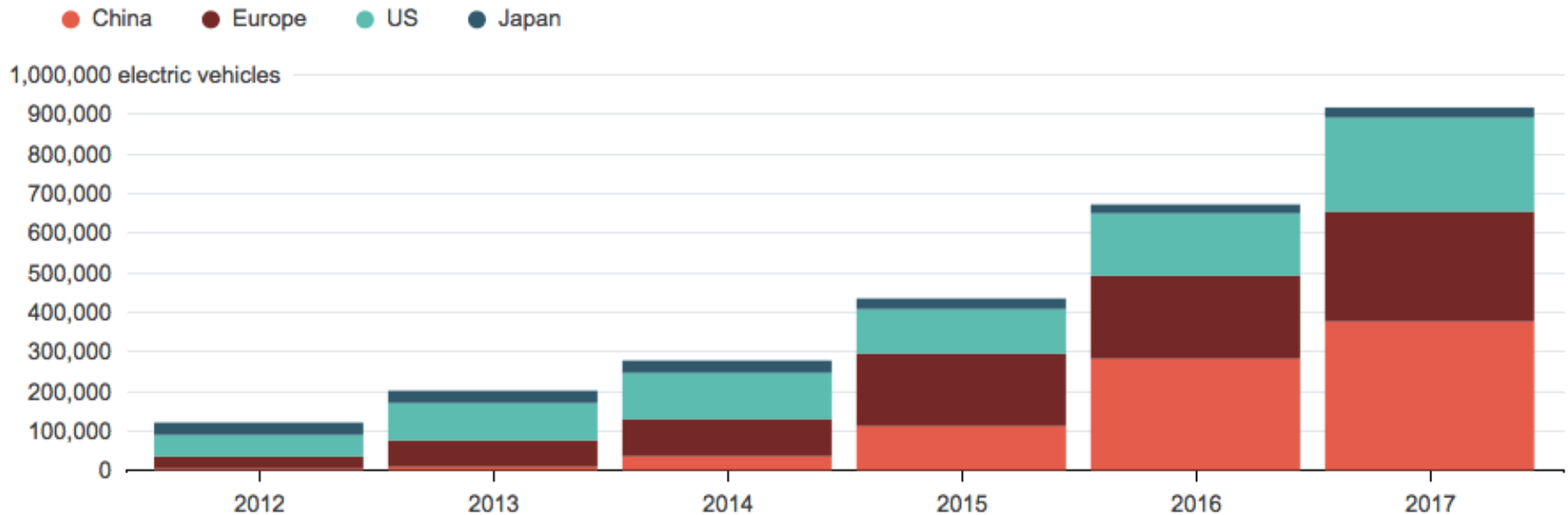


Source: Statista.com

<https://www.statista.com/statistics/510762/capacity-announcements-of-solar-pv-manufacturing-by-key-country/>



# China has a significant lead in EV manufacture...

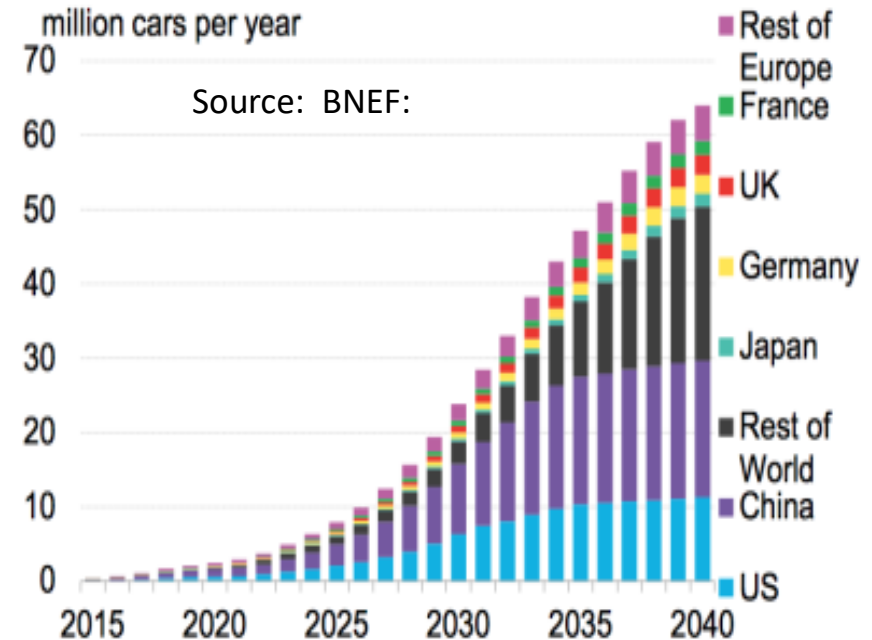
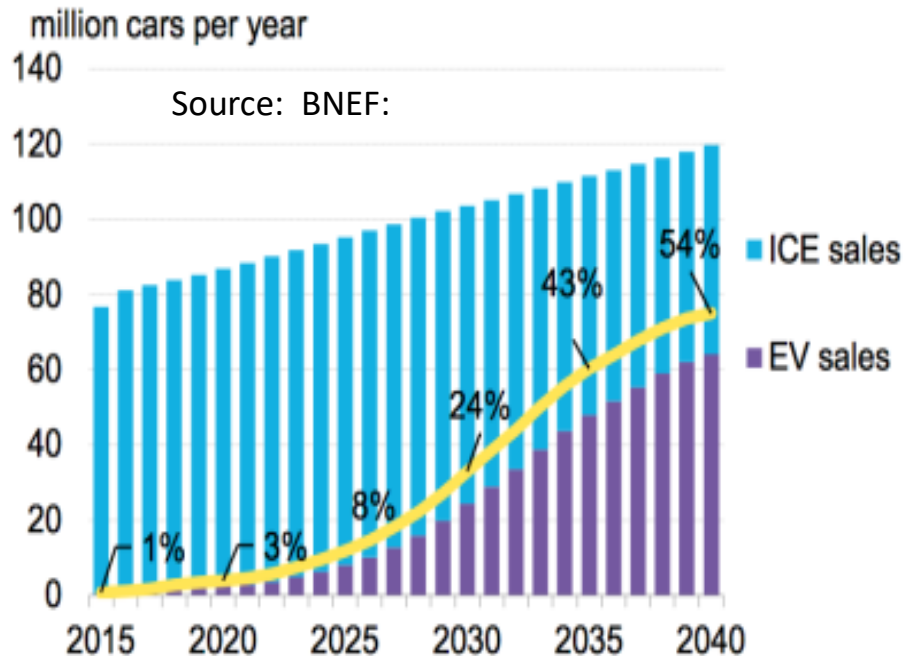


Source: Bloomberg New Energy Finance, automakers, vehicle registration agencies

In 2017, more than 40% of EVs sold around the world are expected to be sold in China.



# ...and the lead is likely to grow

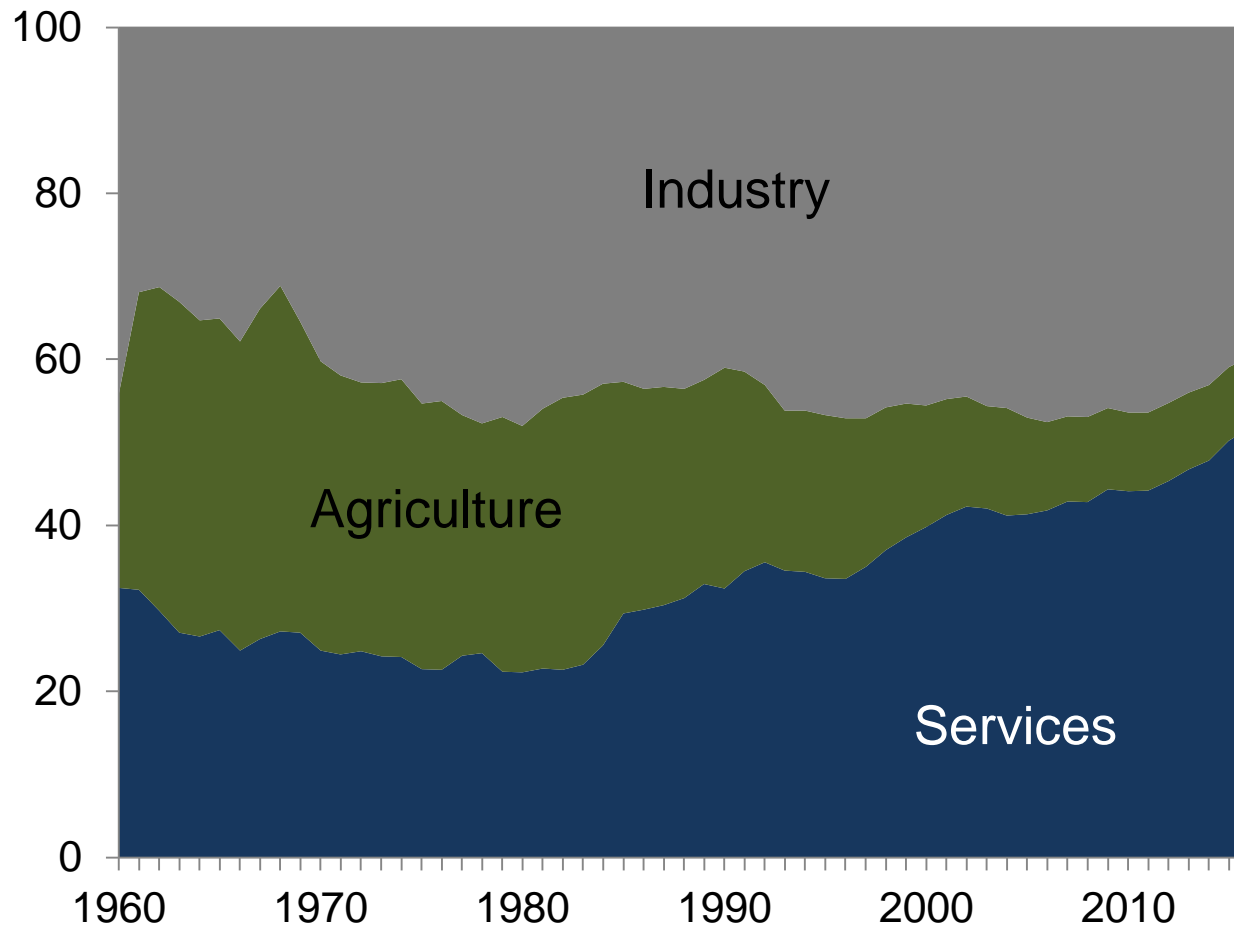


**China:** NEV credit targets of 10% of the conventional passenger vehicle market in 2019 and 12% in 2020; some cities already at 100% E-buses

**EU:** 30% reduction in CO2 from 2021 → 2030, + incentives for EVs

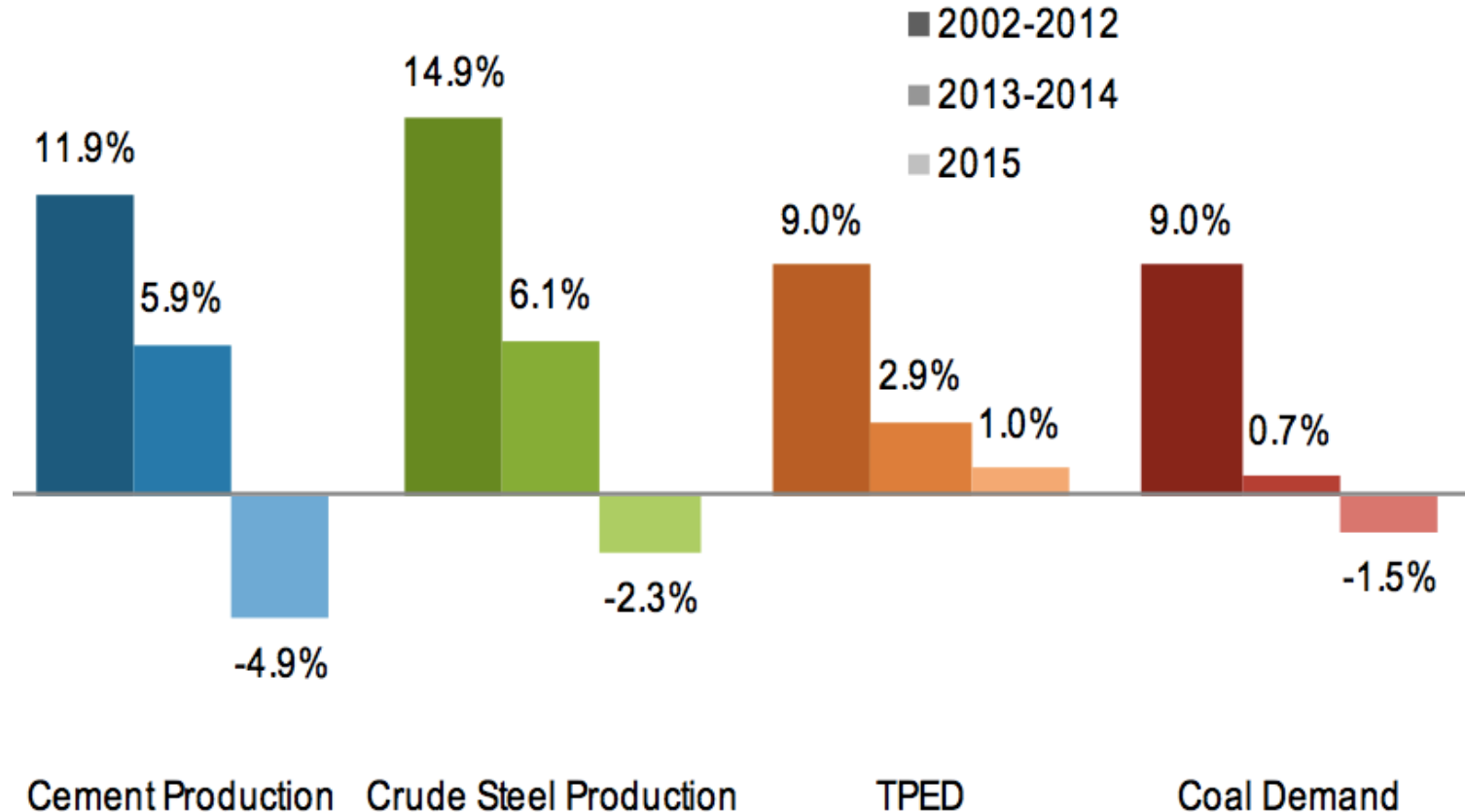
**US:** Proposed roll-back of EPA CAFE standards.

# Composition of China's Economy



Source: World Bank World Development Indicators, 2017. [data.worldbank.org](http://data.worldbank.org)

# Year-on-year Change in Key Chinese Production and Demand Indicators



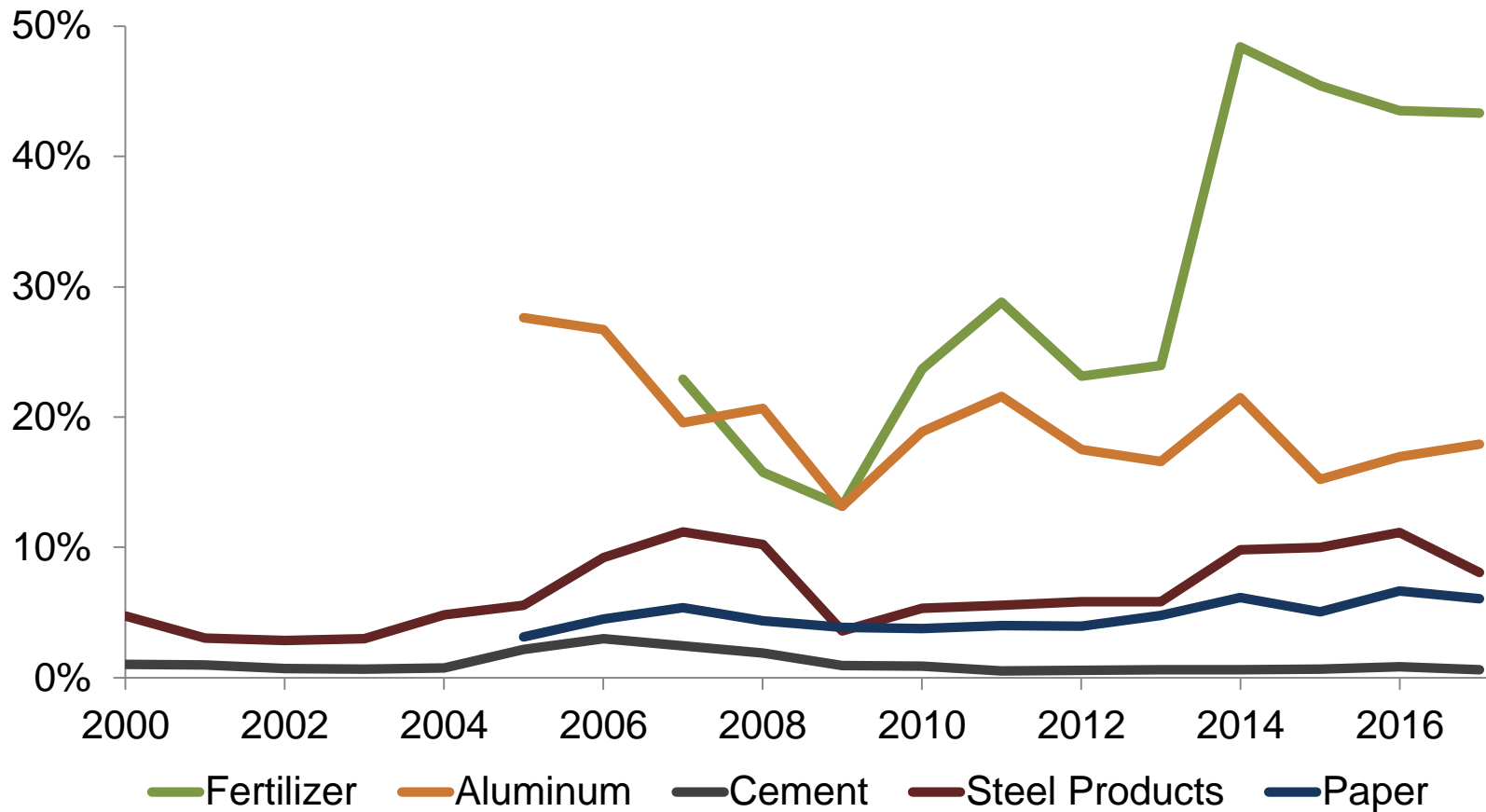
Source: Houser, Bordoff, and Marsters. *"Can Coal make a Comeback?"* Columbia SIPA Technical Report, April 2017. p30.

<http://energypolicy.columbia.edu/research/report/can-coal-make-comeback>



# Exports of some key (and high GHG-emitting) commodities

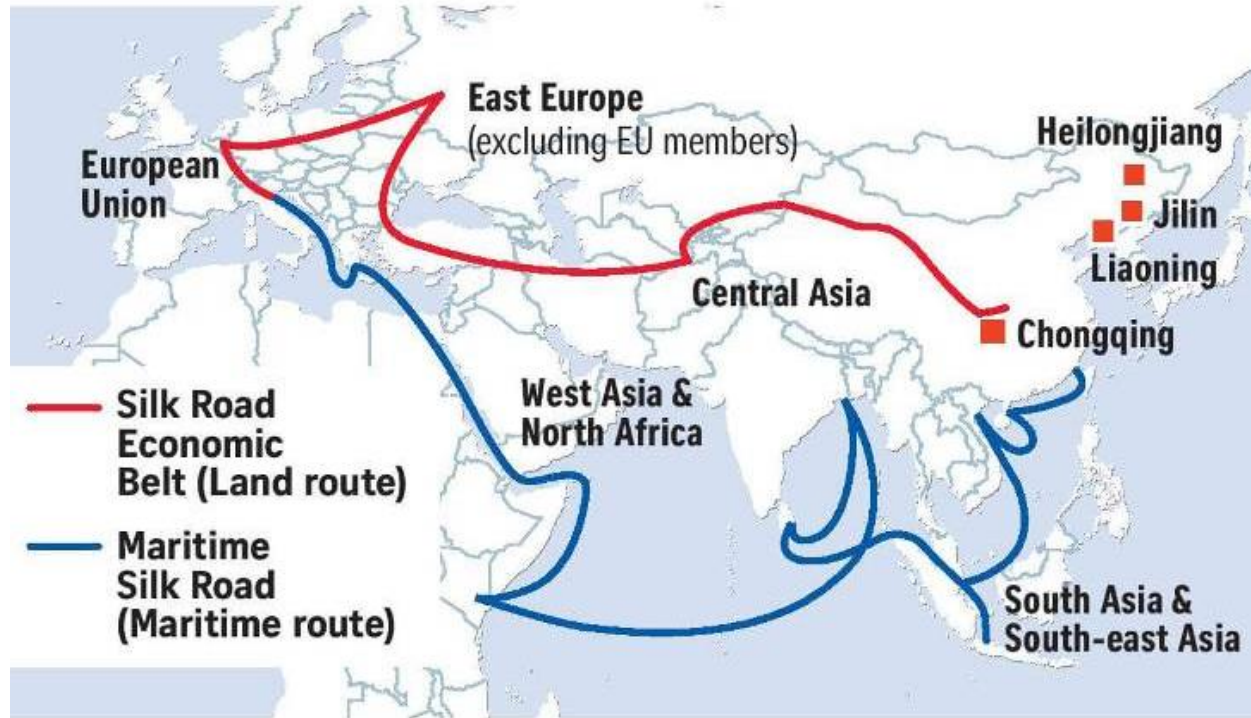
## Exported % of Industrial Production



Source: Chinese Government (National Bureau of Statistics for Production and General Administration of Customs for Export) via CEIC

# The Belt and Road Initiative

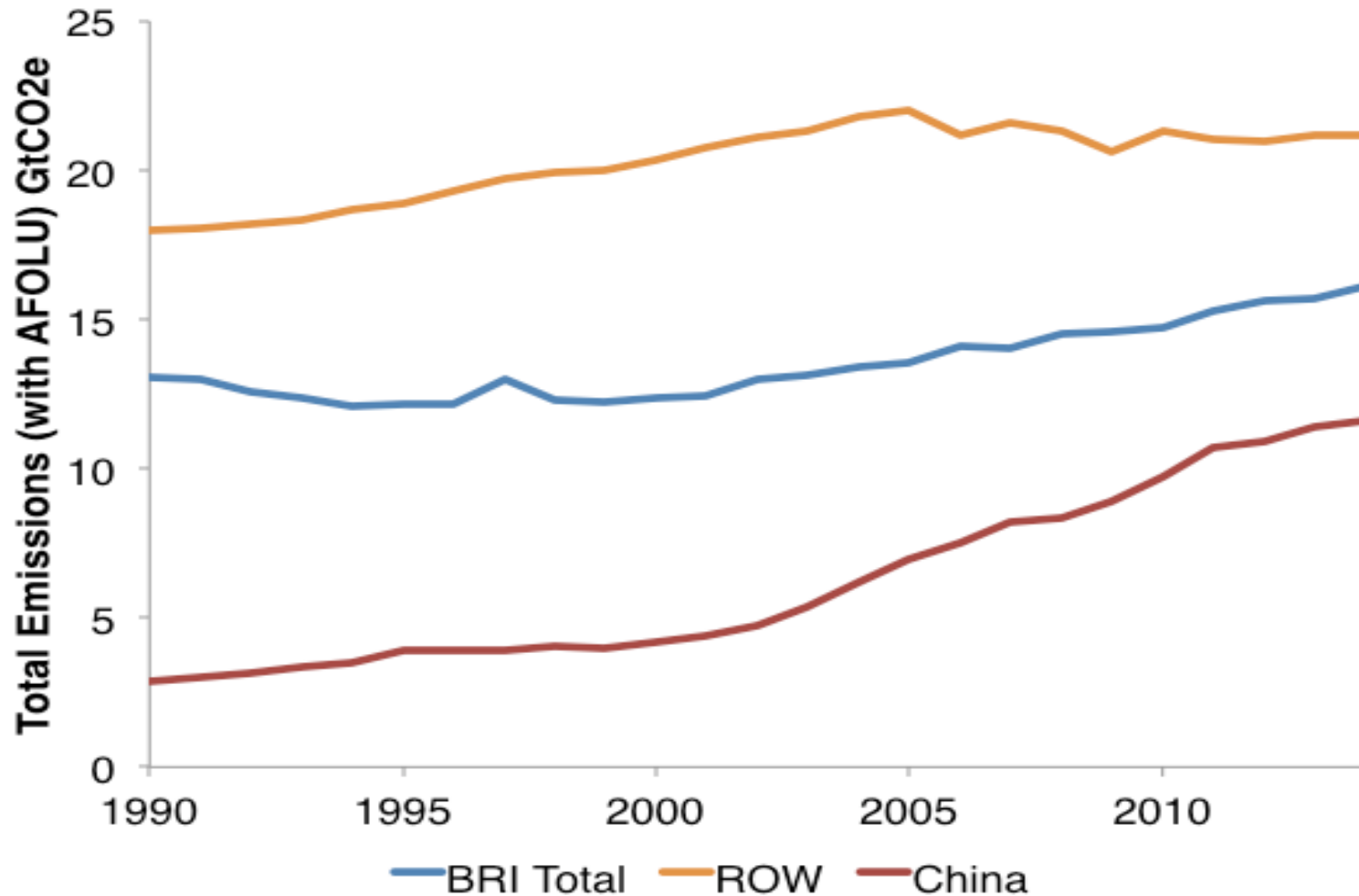
## Growing the Chinese global market



Source: BLOOMBERG STRAITS TIMES GRAPHICS

- 70 countries
- Population of over 4.8 billion people (> ½ global total)
- Economies worth a total ~US\$ 21 trillion (62% of the world's GDP)
- Plans for more than \$1 Trillion in investment

# The BRI countries are incredibly important for climate change



# Clean finance and greening of BRI will be essential for countries to meet their NDC commitments and 2050 goals

**Indonesia:** 26% emissions reduction below BAU, including 23% of primary energy coming from “new and renewable” sources by 2025. *(Virtually all CDB and ChExIm investment, totaling \$7.3B since 2005, has been for coal)*

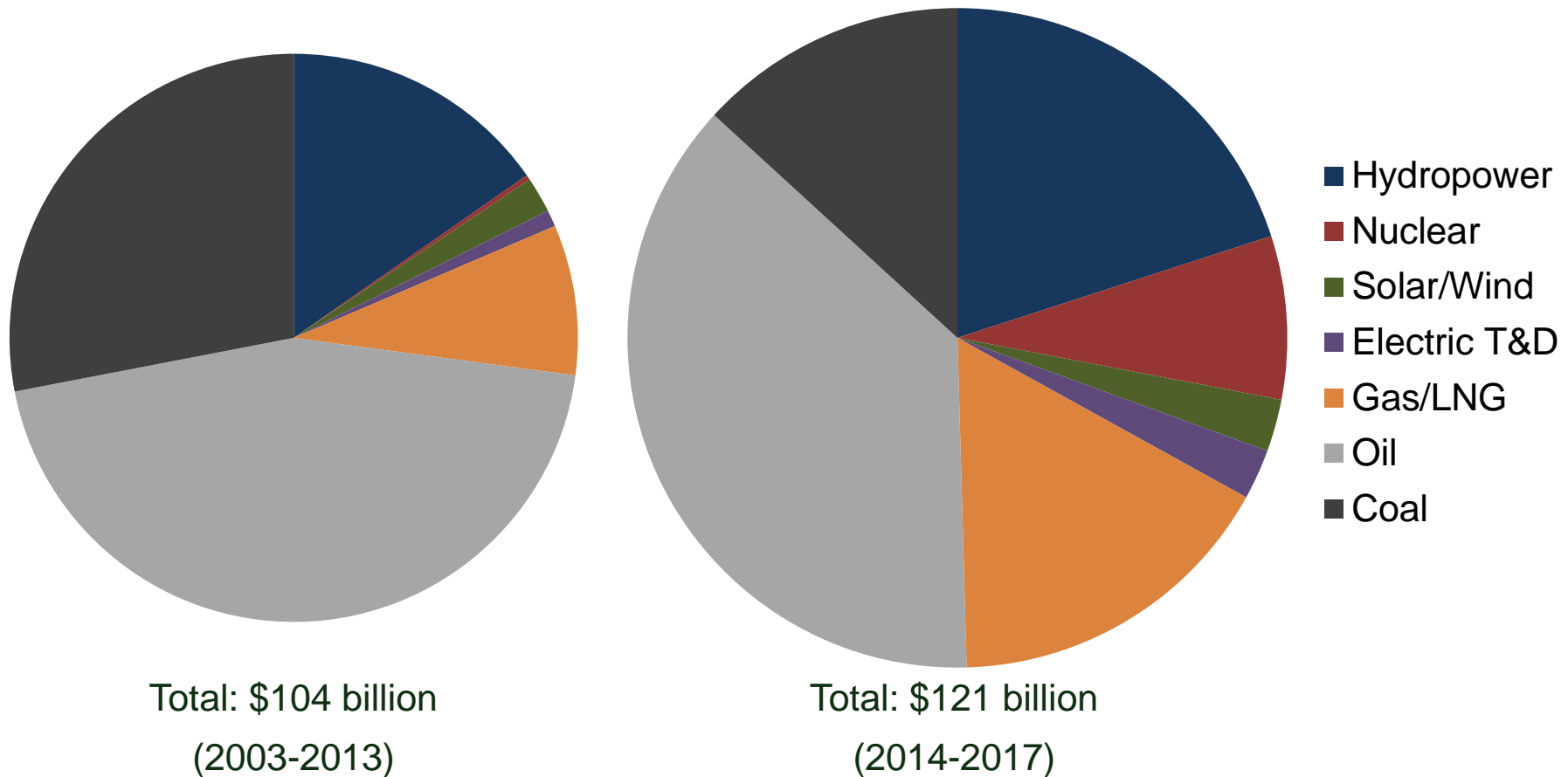
**Vietnam:** 8% emissions reductions below BAU, targeting 25% reductions if international support is available. *(All of \$6.4B since 2007 from CDB and ChExIm investment is for coal)*

**Bangladesh:** 5% emissions reduction below BAU in power, transport, and industry, targeting 15% if international support is available. *(Of \$3.4B from ChExIm since 2013, 60% has been for coal, remainder for oil and gas)*

Source: UNFCCC NDC database (2017); investment statistics from Gallagher, Kevin P (2017), “China’s Global Energy Finance,” Global Economic Governance Initiative, Boston University



# China's overseas development finance is diversifying and getting cleaner



Source: Gallagher, Kevin P (2017), "China's Global Energy Finance," Global Economic Governance Initiative, Boston University

# While China has an explicit policy, others are also investing

**Table 1: Growth of SRI Assets by Region 2014–2016**

Region	2014	2016	Growth over period	Compound Annual Growth Rate
Europe	\$ 10,775	\$ 12,040	11.7%	5.7%
United States	\$ 6,572	\$ 8,723	32.7%	15.2%
Canada	\$ 729	\$ 1,086	49.0%	22.0%
Australia/New Zealand	\$ 148	\$ 516	247.5%	86.4%
Asia ex Japan	\$ 45	\$ 52	15.7%	7.6%
Japan	\$ 7	\$ 474	6689.6%	724.0%
<b>Total</b>	<b>\$ 18,276</b>	<b>\$ 22,890</b>	<b>25.2%</b>	<b>11.9%</b>

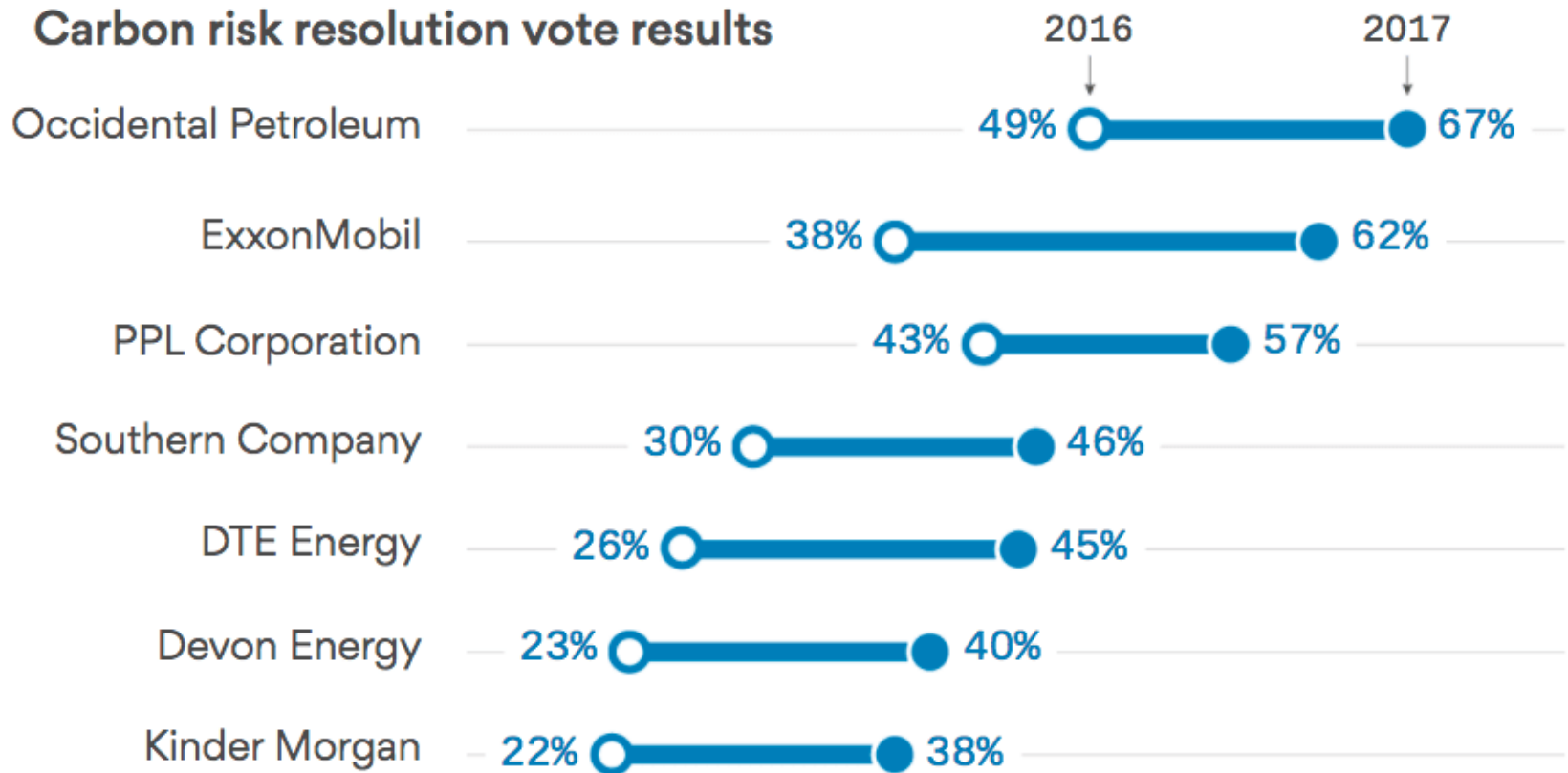
**BUT: The current level of climate-friendly investment is under \$400 billion per year.**

Source: Global Sustainable Investment Review

([http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR\\_Review2016.F.pdf](http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR_Review2016.F.pdf))



# And investors are demanding better climate risk accounting



Data: Ceres. Figures rounded to nearest whole percentage; Chart: Lazaro Gamio / Axios



# Conclusions

- We know the global objective: virtual decarbonization of electricity and transport, and deep reductions in emissions from industry and land use.
- Other countries are leading in the development and domestic penetration of many of the key technologies that will be required.
- Climate risks pose new liabilities, and new technologies represent a huge opportunities; to fail to act is to lose out in the global competition (and the market is paying attention).
- Leadership will be required at home, AND in overseas investment and policy if we are to solve the global problem and compete successfully.

