

Changes in the power generation fuel supply chain:

A future of shifting supply, abandoned coal mines, continuing methane emissions, and disrupted mining communities"

Raymond C. Pilcher, P.G.

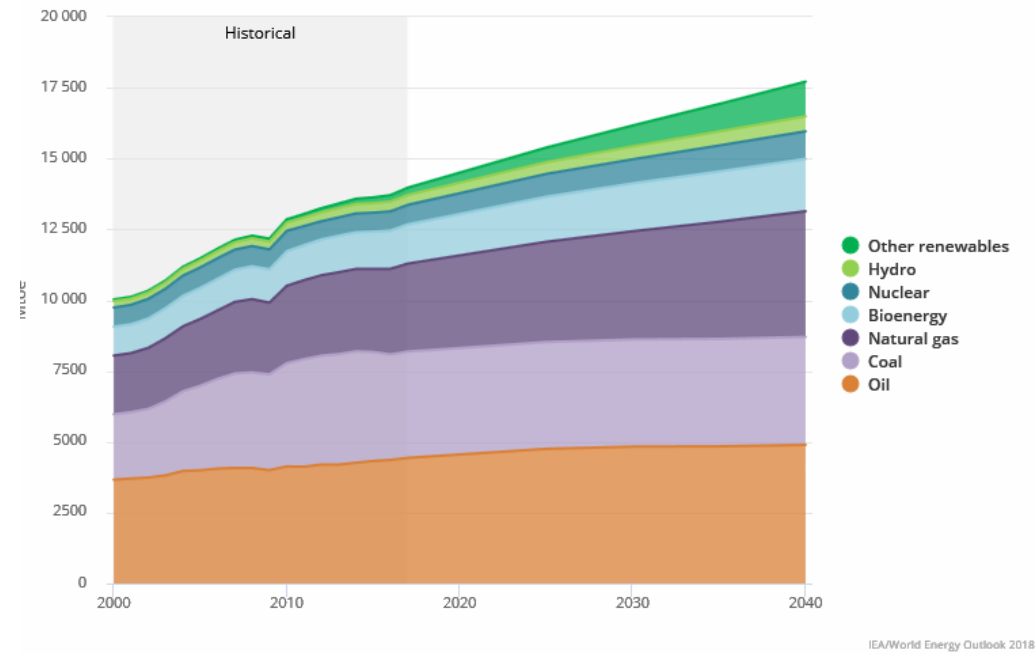
President, *RAVEN RIDGE RESOURCES, INCORPORATED*

Chair, **Group of Experts on Coal Mine Methane**
Vice-Chair, **Committee on Sustainable Energy**
United Nations Economic Commission for Europe

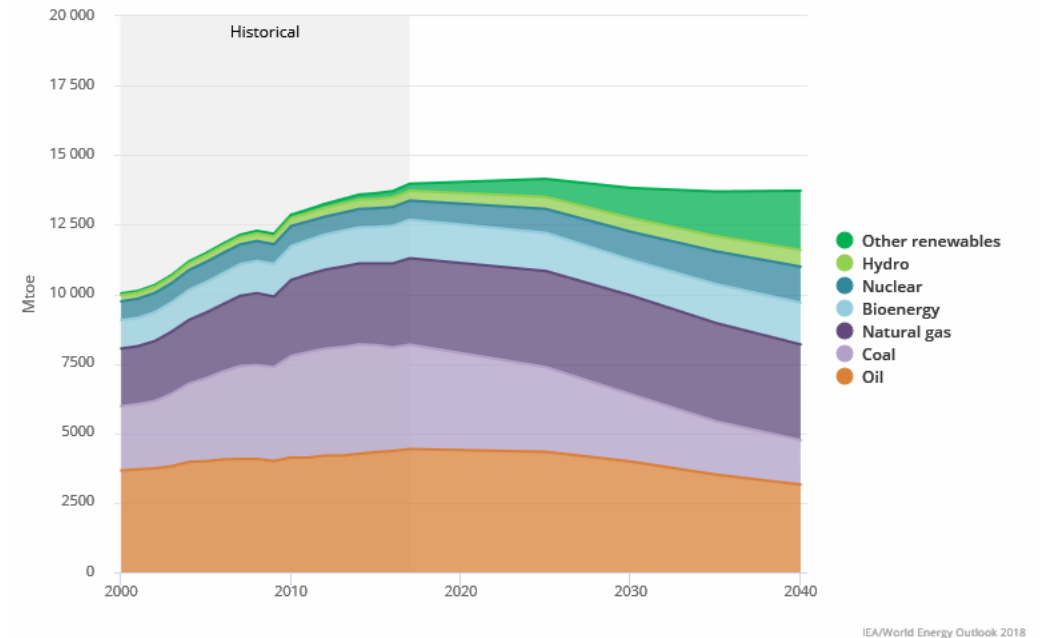
Group of Experts on Cleaner Electricity Systems
5 November 2019
Palais des Nations, Geneva Switzerland

World energy demand under differing policy scenarios

New policies scenario

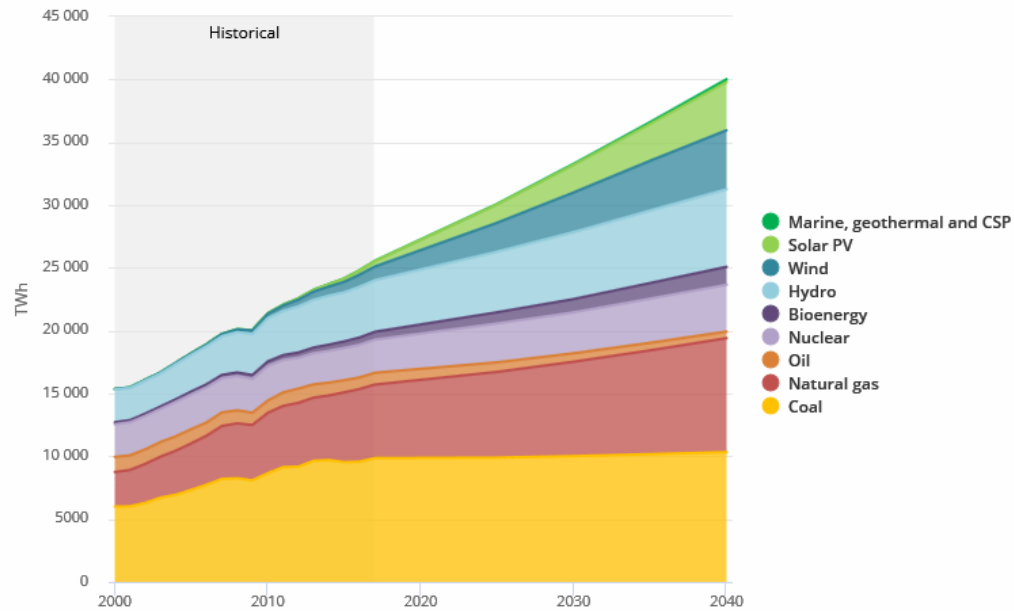


Sustainable development scenario

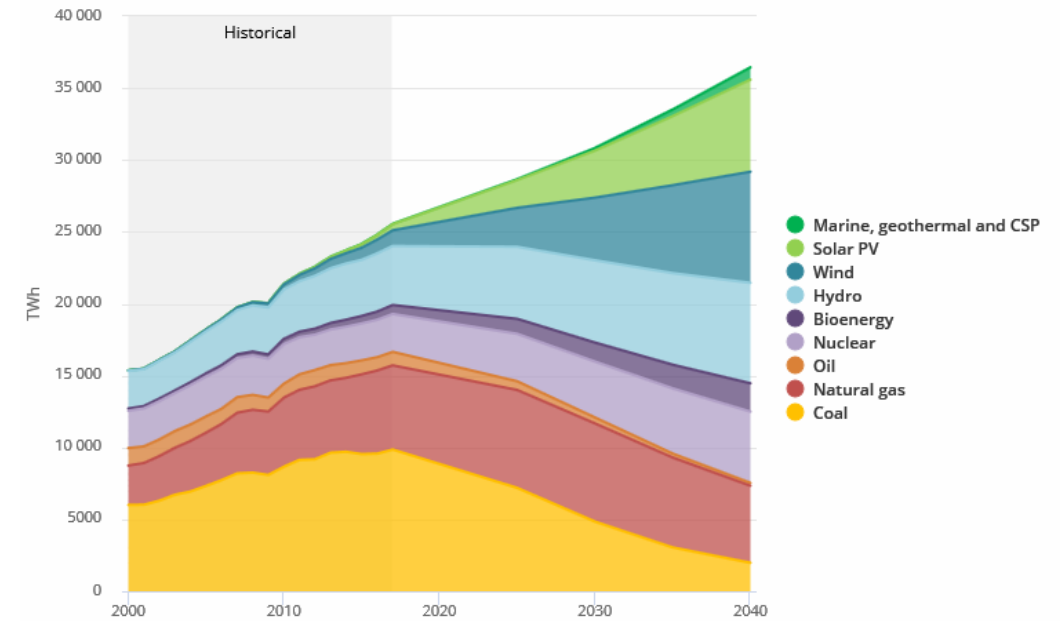


World electricity production by technology under differing policy scenarios

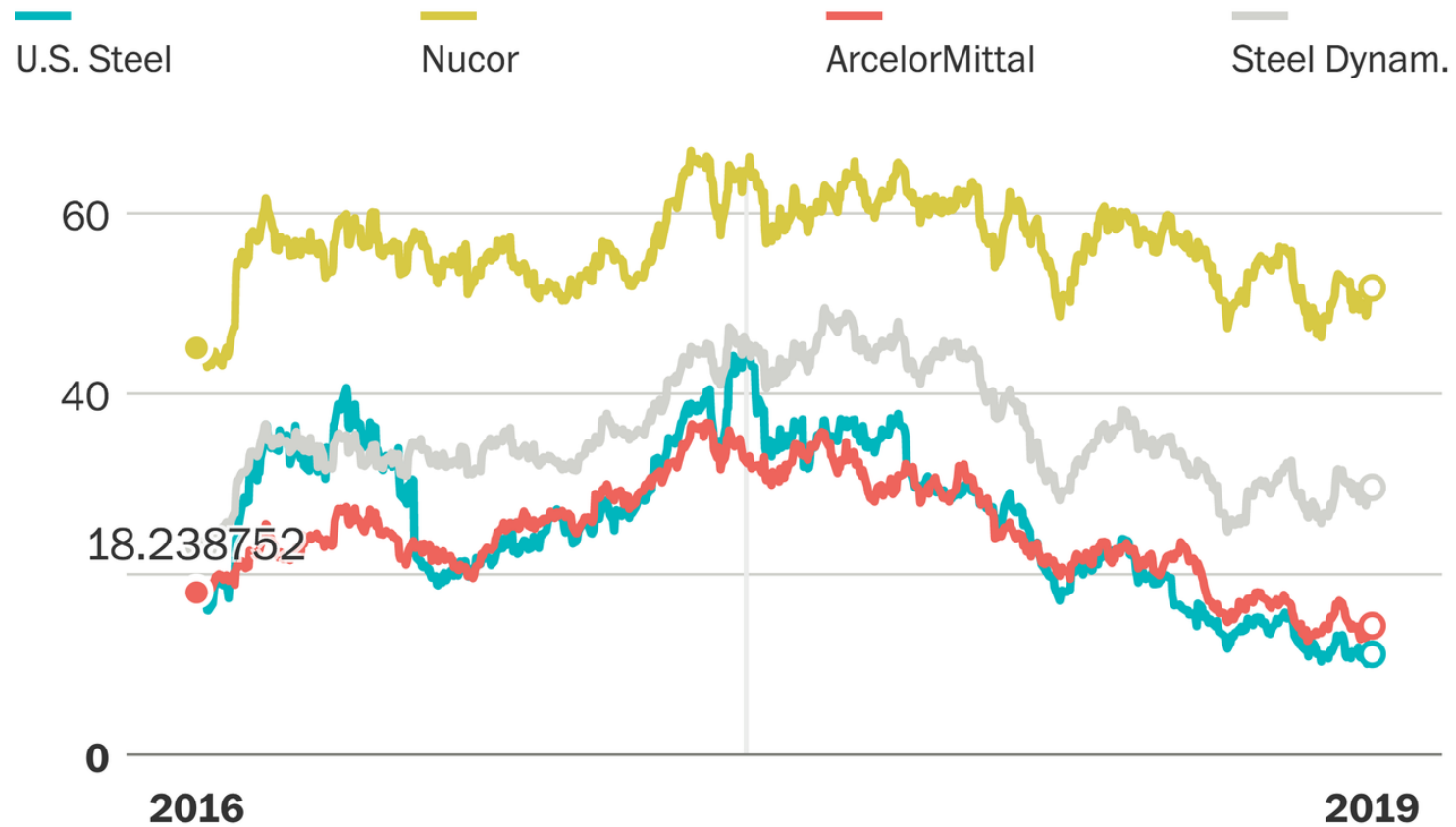
New policies scenario



Sustainable development scenario



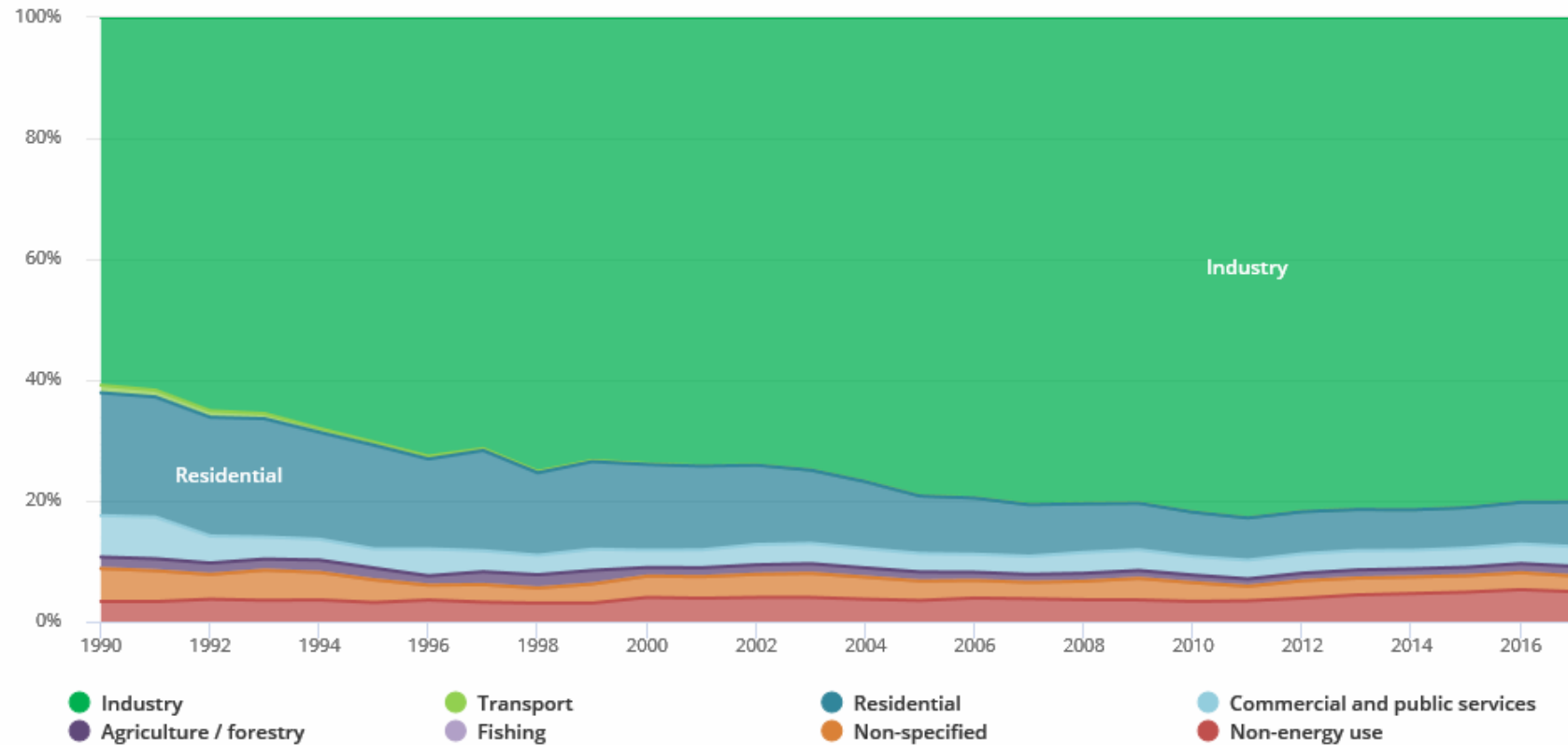
Share price of major steel producers



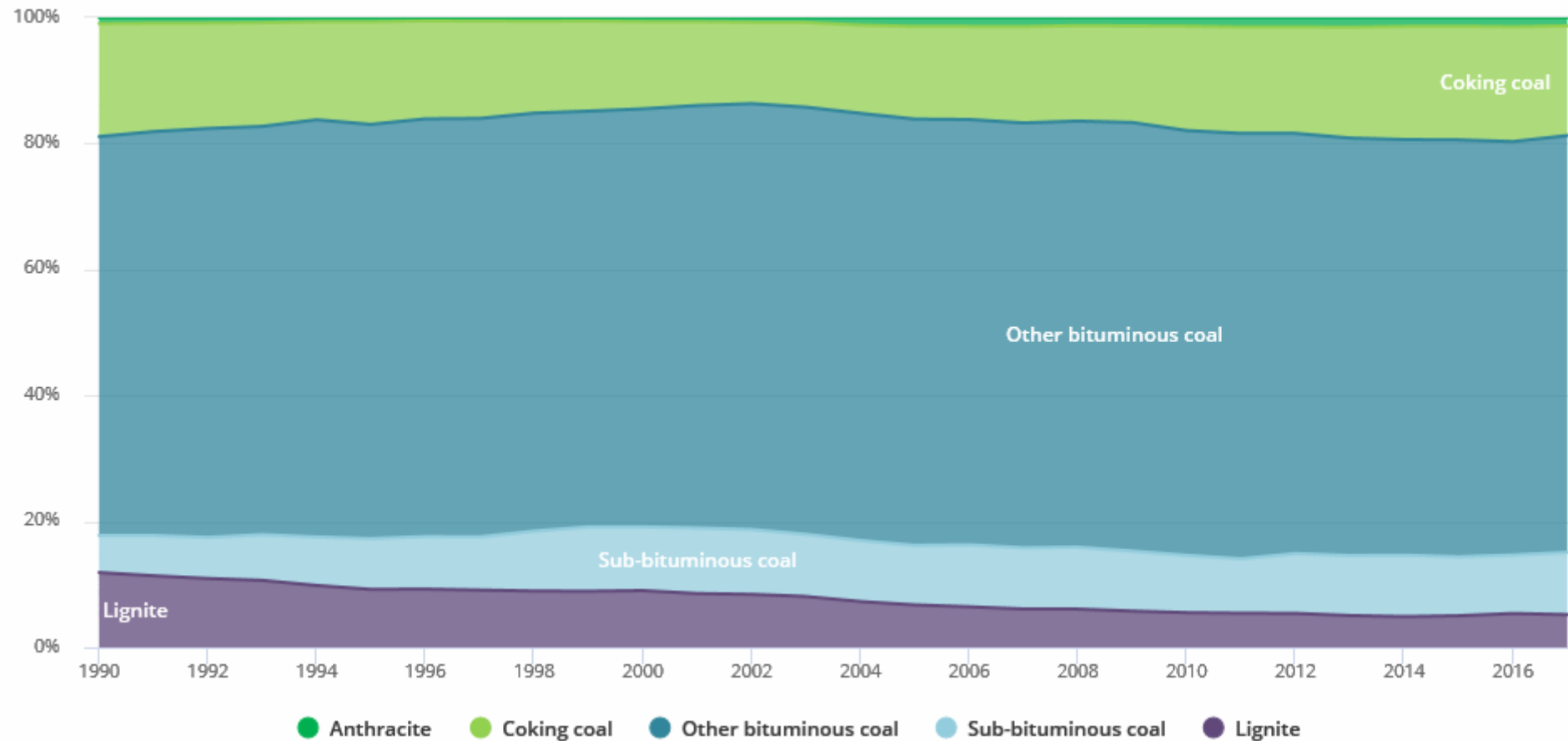
Source: Yahoo! Finance

JEFFREY STEIN/THE WASHINGTON POST

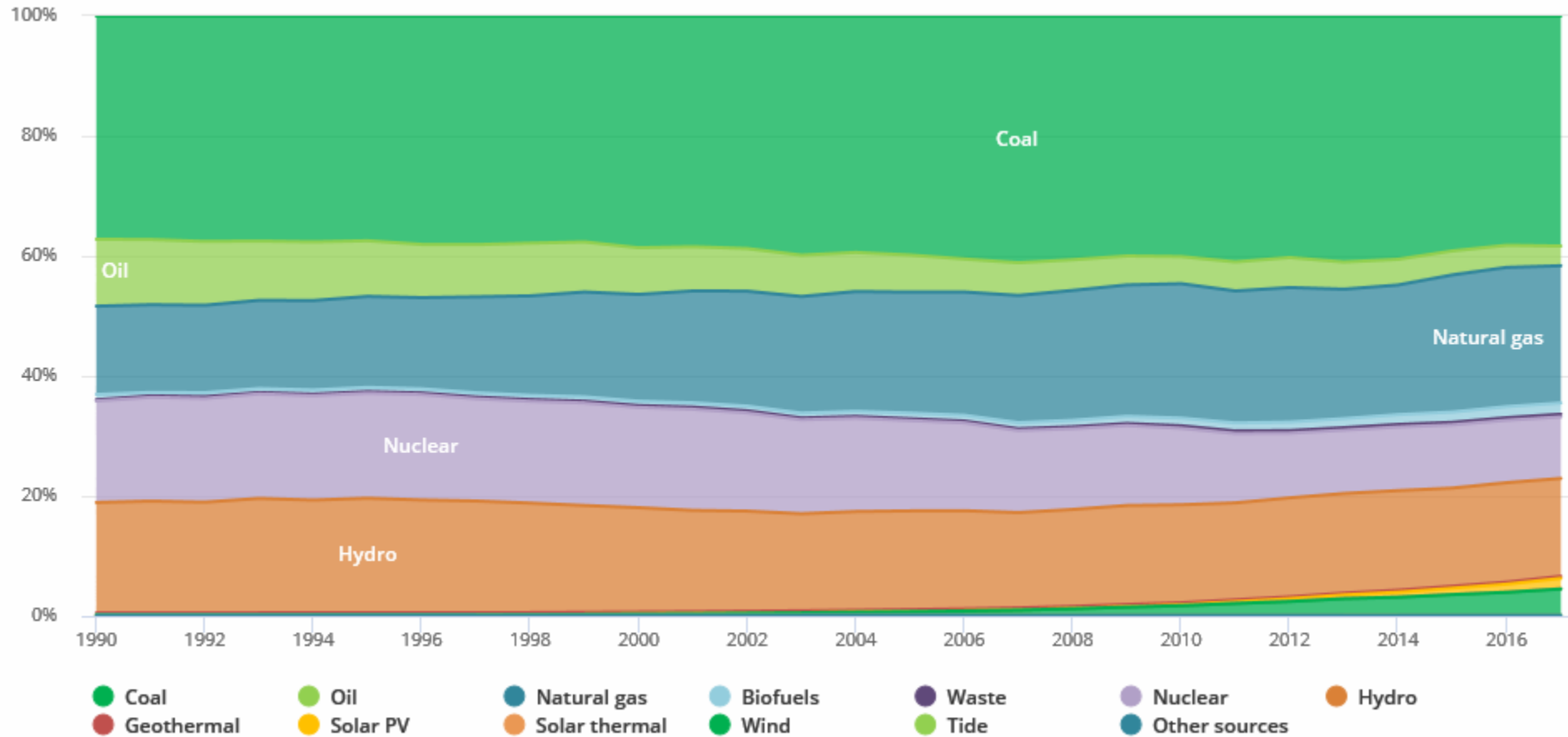
Coal final consumption by sector: World 1990-2017



Coal production by type: World 1990-2017

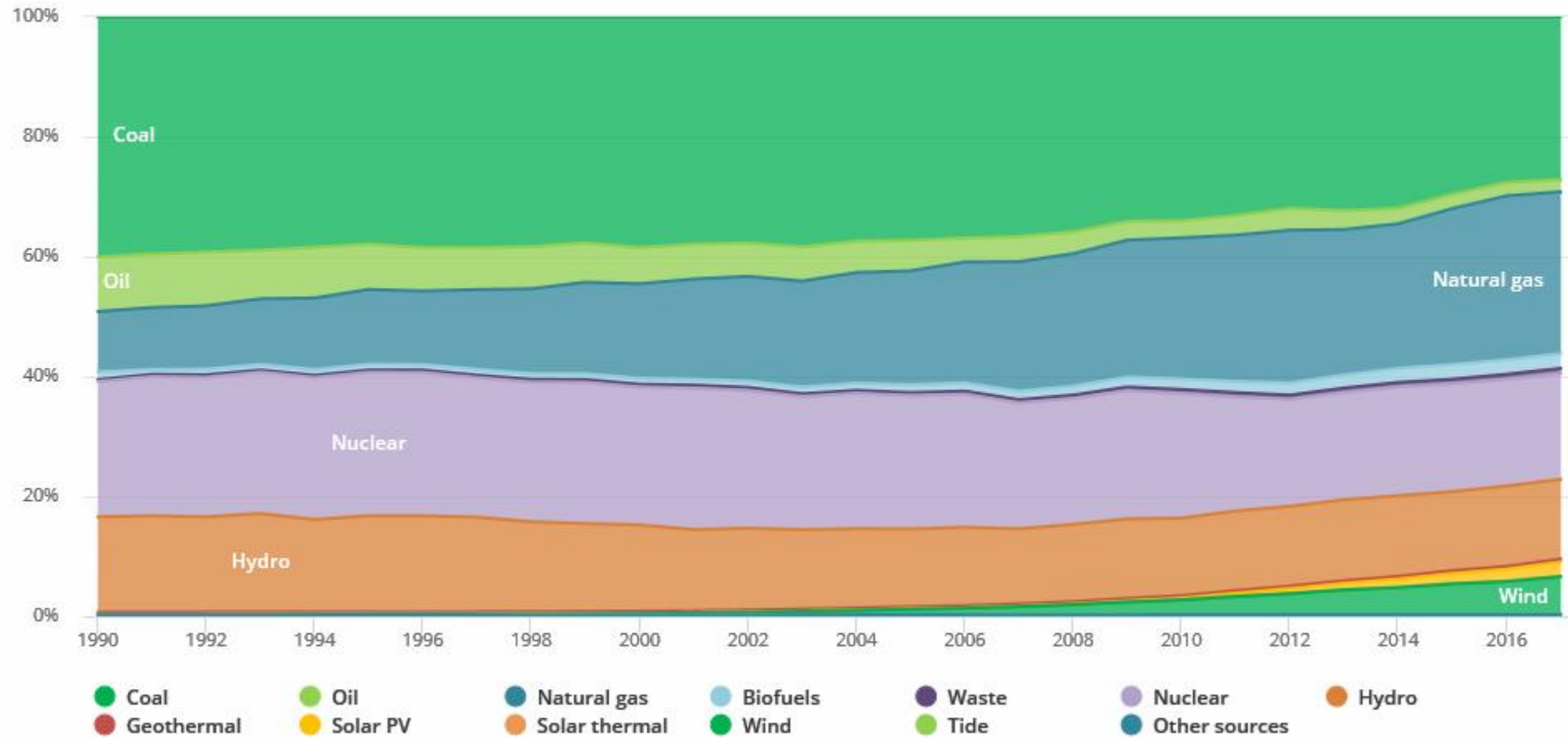


Electricity generation by source: World 1990-2017



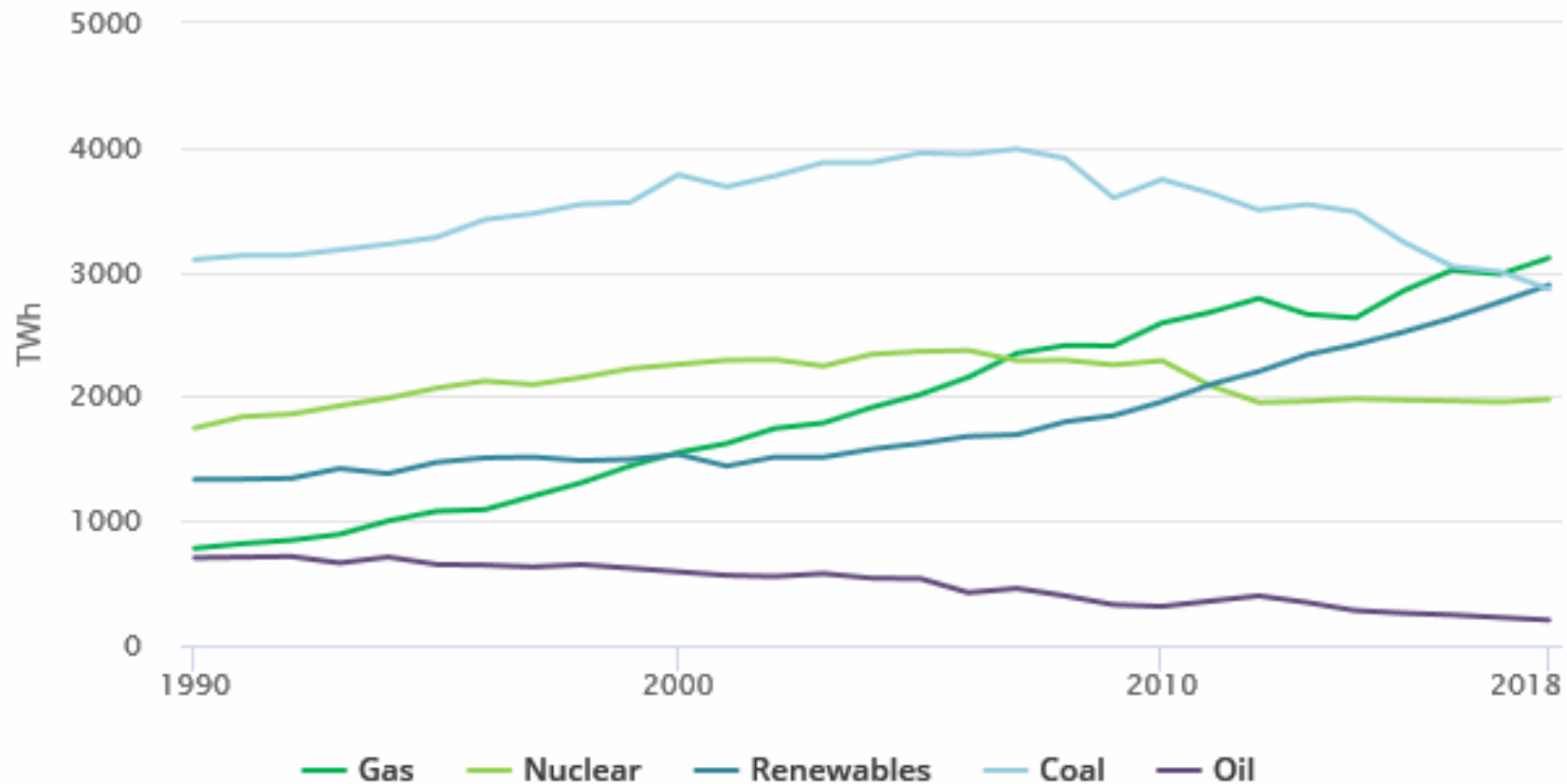
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Electricity generation by source: OECD Total 1990-2017



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Electricity generation by source: OECD 1990-2017



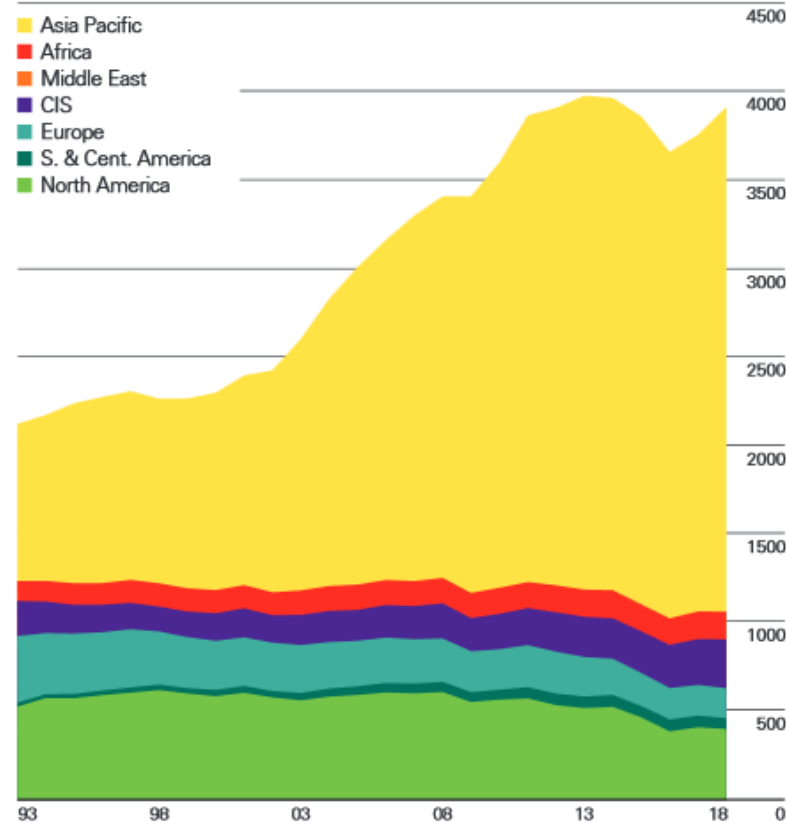
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Global coal prices: December 2009–October 2019

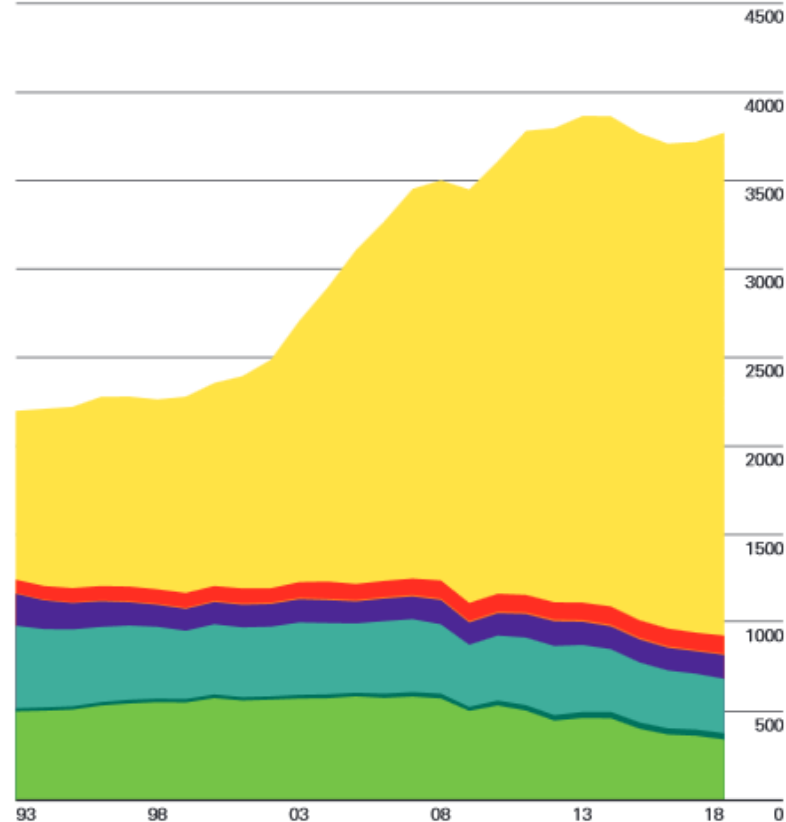


Coal production and consumption by region 1993-2018

Coal: Production by region
Million tonnes oil equivalent



Coal: Consumption by region
Million tonnes oil equivalent



Opportunities for methane emission mitigation and lowering coal-fired power generation carbon footprint

Coal Mining Life Cycle

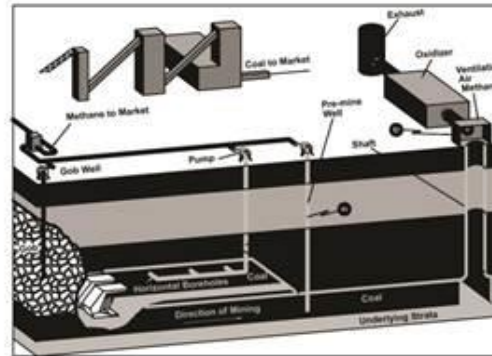
Mine Planning
Undeveloped Coal Reserves



**Gas Resources Evaluated and
Production Plan Adopted**

Exploration

Active Mining
Developed Coal Reserves



**Gas Produced and Sold During
Mining**

Pre-mine and Gob Drainage

Mine Closed
Depleted Coal Reserves

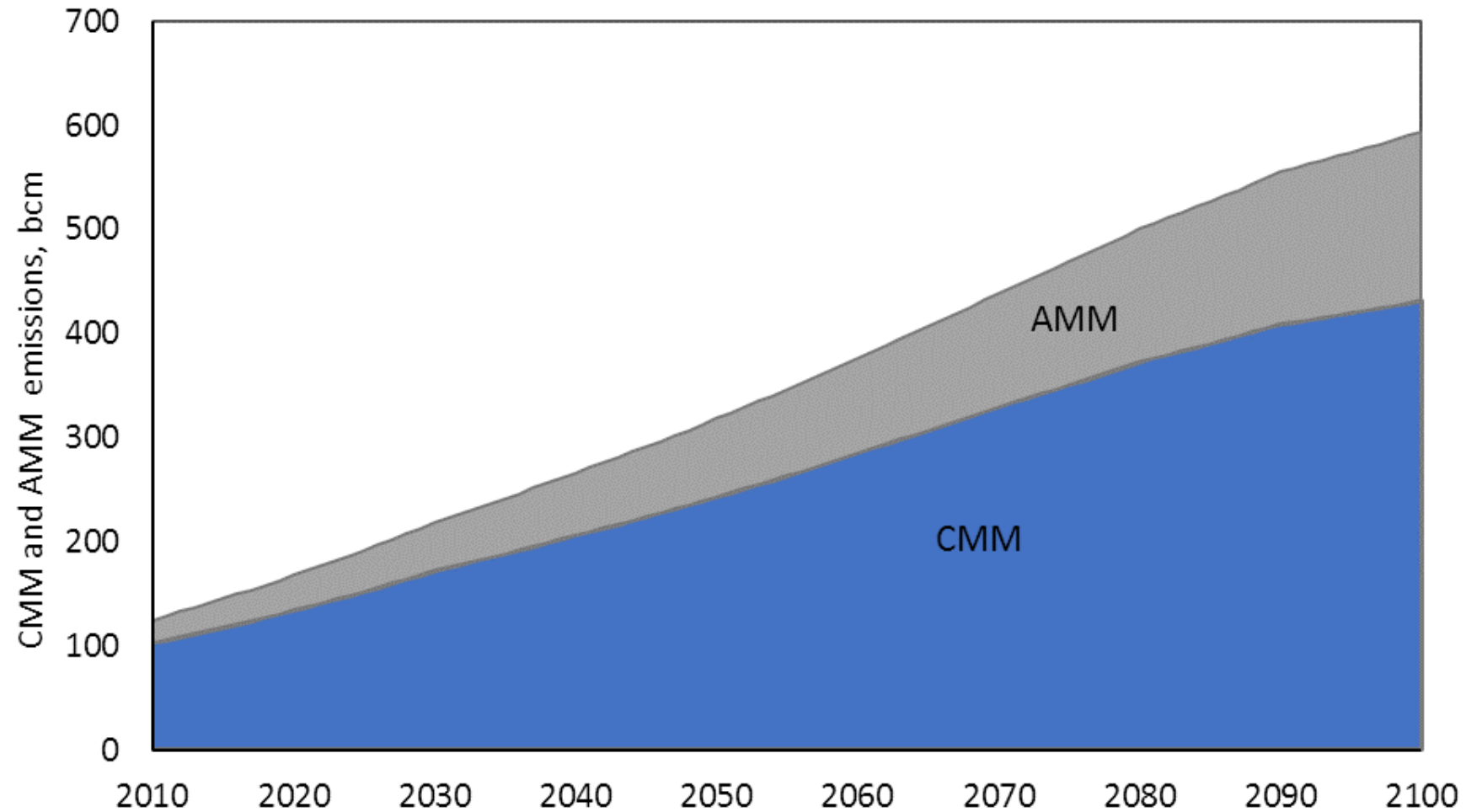


**Enhanced CH₄ Recovery and CO₂
Sequestration**

Post-mining Gas Production

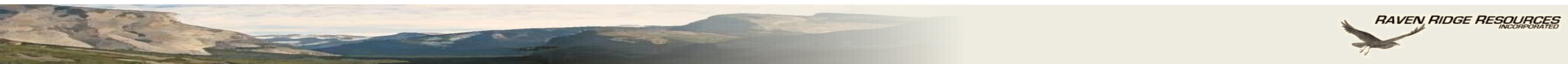
Gas Production Life Cycle

AMM and CMM emissions projections



Discussion points

- Coal production will persist as a source of fuel for power production into the foreseeable future
- Supply is price sensitive and other sources of supply will come online to replace diminished reserves– waning Indonesian supply will be supplanted by Russia and Australia
- Asian consumption will grow, even as OECD countries will reduce coal consumption
- Emissions of methane from the coal mining life cycle will persist and offer opportunities for power sector investment lowering upstream carbon footprint
- CMM emission reductions are sizable and competitive with CCS



Thank you!

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