





Towards a geopolitics of energy system transformation International Network for Low Carbon Societies 9th Meeting, University of Warwick, 2017

Mike Bradshaw

Professor of Global Energy Michael.Bradshaw@wbs.ac.uk

Structure

- Constraints
- Consequences
- Challenges



'Lower forever?'



"We have to have projects that are resilient in a world where oil has peaked," Mr. van Beurden told reporters on a conference call discussing the company's secondquarter financial results. "When it will happen we don't know, but that it will happen we are certain."

27 July 2017



Constraints: starting proposition:

"Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;..."

The Paris Agreement, 2015



Climate constraints curtail fossil fuel use

"The 'carbon budget' measures the total amount of carbon in fossil fuels that will ever be extracted."

Socolow 2015, p. 25



Robert Socolow (2015) "Climate Change and Destiny Studies: Creating our near and far futures," *Bulletin of the Atomic Scientists*, 71 (6), 18-28.



WEO 2016: Global primary energy demand and related CO₂ emissions by scenario

Source: IEA 2016



Figure 1: The recommended fifth carbon budget would continue emissions reduction on the path to the UK's 2050 target





Estimates of remaining fossil fuel reserves and resources and how these relate to 2 °C climate change budgets





401 10.3858/hature140

The geographical distribution of fossil fuels unused when limiting global warming to 2 °C

Christophe McGade¹ & Paul Ekind

Policy makers have generally agreed that the average global tempor-ature rise cannol by growthouse gas emissions should not encode effectivelinit average global varying to 2 °C. Our result show that When the clauded by problem is presented as industrial times", policy maker' indices to exploit explicit, and completely their ter-thas been estimated that to have at kent a 50 per cent chance of criterial food fields are, in aggregate, inconsistent with their comkeeping warming below 2 "C three about the twenty divit contexy, mainteents to this temperature limit. Implementation of this poly steping senting betwee 2 is completen to reverent on a non-y, in numerics to its integration into a spectra of the senting of the senting senting between the length of a neural L100 (gaptions of article distille dis (CO)², sequentizers is well dister disting and the senter are neural distributions of a sentid between the However, the gravitous gap invisions contained in proceed of However, the gravitous gap invisions contained in proceed of the senter of distribution and have neural direct times higher mass of dish that had neurons are sented direct times the mass of dish that had neurons are sented direct times the senter of the senter than this¹⁴ and as the multipled associal concent to self and associates at a closely related to consulative consistences. is incompatible with a warming limit of 2 C. Here we use a single gases emitted over a given timeframe¹⁴⁷. This has resulte integrated assessment model that contains estimates of the quarks or per of the remaining global current budget associated with the prob-feedboording and nature of the work? soil, gas and on a reserve and whether the probability herping the global emperature relevance and which is shown to be considered with a discriminate of the "The herping commendial" the Comparison of Linax Change (IRCC). of residiling approaches with different assumptions", to replace the recently suggested that to have a better than even character of avoiding implications of this emissions limit for four if and production is a fill more than a 27 C surpresence rise, the action holger between 2011 front regions. Our readin suggest that light dot a strike directory, and 2020 a around 2012-1240 GE CO.

half of partners and over 10 per cent of carrier out reserves should . Such a carbon budge will have protocal implements for the face remain unused from 2000 to 2000 in order to most the target of utilization of oil, gas and coal However, to indextand the quantities 2 °C. We show that development of resources in the Arctic and any that are required, and are not required, under different scenarios, write





Source: Christophe McGlade & Paul Ekins (2015), "The geographical distribution of fossil fuels unused when limiting global warming to 2°C," Nature, 517, pp. 187-190

Oil and coal consumption significantly different between 2°C and 5°C scenarios, but gas acts as a 'transition' fuel



Source: McGlade and Ekins 2015



Consequences

- "..., globally, a third of oil reserves, half of gas reserves and over 80 per cent of current coal reserves should remain unused from 2010 to 2050 in order to meet the target of 2 °C.
- We show that development of resources in the Arctic and any increase in unconventional oil production are incommensurate with efforts to limit average global warming to 2 °C.
- Our results show that policy makers' instincts to exploit rapidly and completely their territorial fossil fuels are, in aggregate, inconsistent with their commitments to this temperature limit.
- Implementation of this policy commitment would also render unnecessary continued substantial expenditure on fossil fuel exploration, because any new discoveries could not lead to increased aggregate production."

McGlade and Ekins 2015



The Global Energy System 2035-50 and beyond?















The Role of Fossil Fuels in the Future

SCENARIOS	In Shell's Mountains Scenario in 2050 hydrocarbons account for 67.6% of total primary energy and in the Oceans Scenario they account for 71.3%, neither scenario meets the 2°C requirement.
ExconMobil	In Exxon's 2040 energy outlook, oil and gas are projected to account for 57% of primary energy supply and when coal is added hydrocarbons account for 77% of total supply. They predict that energy-related CO ₂ will peak in 2030 and then gradually decline, no comment is made as to the climate change consequences.
BP Energy Outlook 2035	By 2035 all the fossil fuel shares are clustering around 27% and fossil fuels are still the dominant form of energy in 2035 with a share of 81%, compared to 86% in 2013. Global emissions in 2035 are nearly double the 1990 level and well above the 2°C path.
2016	In the IEA's New Policies Scenario the share of fossil fuels in 2040 is 78%, compared to 81% in 2014. In the 450 Scenario the share is 58%, with 13.4% of global primary energy demand being met by: coal (2014: 28:7%), oil 22.4 (2014: 31.2) and natural gas 22.2 (2014: 21.1).



WEO 2016: World primary energy demand by fuel and scenario



Source: IEA (2016) World Energy Outlook.







Coal is hit hardest in a 2 °C scenario & oil demand peaks before 2020: only consumption of natural gas ends up higher than today

Source: IEA 2017







The next 'disruption': Carbon budgets, divestment and fossil fuel abundance

- The traditional paradigm in relation to energy geopolitics is built around the notion of 'fossil fuel scarcity', continuing demand growth and competition between states to secure supply at affordable prices (energy security).
- This conventional framing is now challenged by the conflicting demands of climate change policy (decarbonisation) and the consequences of the unconventional oil and gas revolution.
- The basic contradictions between decarbonisation and fossil fuel abundance are reflected in the concept of 'unburnable carbon' and the divestment campaign, but the fossil fuel age is not over (yet).
- The challenge of decarbonisation is made all the more difficult in the context of abundant and relatively inexpensive fossil fuels.
- One solution is to increase the cost of carbon (emissions).



Challenges: Towards a 'Geopolitics of the Low Carbon Energy Transition'





The future of fossil fuels?



"Oil and gas producers face three threats: prolonged low oil and gas prices, tightening of climate policy and a tough budget on cumulative carbon emissions, and technological innovation producing cheap substitutes for oil and gas. These threats pose real risks of putting oil and gas producers out of business."

Van der Ploeg



"The end of fossil fuels is not about to arrive, and will not be caused by running out of any of them. The quantities are sufficient to fry the planet several times over, and technological progress in the extraction of fossil fuels has recently been as fast as for renewables. We live in an age of fossil fuel abundance."

Dieter Helm



International Security in the Age of Renewables

Theme issue November 2016

"An extraordinary global energy transformation will be required for the world to successfully slow and then halt climate change. It is a transformation that will likely also change power dynamics among nations and the security arrangements that will be needed to keep the peace among the powers that vie for advantage in the coming age renewables era."

John Mecklin

"Today, the balance of power in energy geopolitics is shifting away from the owners of fossil-fuel resources to countries that are developing low-carbon energy sources.... The geopolitics of renewable energy,..., is a much more complicated affair with numerous decentralized players."

Sergey Paltsev



Bulletin

of the Atomic Scientists

A geopolitics of renewables?

Five characteristics of renewable energy:

- 1. Renewable energy resources are not scarce or as geographically constrained as fossil fuels;
- 2. Many sources, including the most potent (solar and wind) are intermittent;
- 3. The nature of renewable energy generation technologies whose units are often much smaller than that of conventional energy technology hint at a more distributed energy system; every land- or even roof owner is a potential energy producer;
- 4. Renewable energy generation [and storage] require new rare earth [mineral] resources; and
- 5. Electricity can be expected to become the dominant energy carrier in a world dominated by renewable energy.

Source: Scholten, D. and Bosman, R. (2016) The geopolitics of renewables: exploring the political implications of renewable energy systems. *Technological Forecasting & Social Change* 103: 273-283. <u>http://dx.doi.org/10.1016/j.techfore.2015.10.014</u>





The Geopolitics of Renewable Energy

- **Critical materials supply chains**. As the transition to renewable energy accelerates, cartels could develop around materials critical to renewable energy technologies.
- Technology and finance. In a world in which renewables are the dominant source of energy, capital for investment and technology may increasingly become sources of international cooperation or rivalry.
- **New resource curse.** The prevalence of the resource curse could be affected by a rise of renewable energy
- **Electric grids**. Renewable energy technologies may lead to greater electric interconnections between nations, more widespread distributed energy generation or both.
- **Reduced oil and gas demand**. To the extent that renewable energy reduces demand for oil and gas, there could be significant geopolitical consequences.
- Avoided climate change. Reduced greenhouse gas emissions as a result of expanded use of renewable energy should logically reduce the risk of conflict and instability that climate change would otherwise generate.
- **Sustainable energy access**. Access to modern forms of energy is one of the preconditions for achieving sustainable development.

https://www.belfercenter.org/sites/default/files/files/publication/Geopolitics%20Renewables%20-%20final%20report%206.26.17.pdf



Conclusions: Geopolitics in an age of Fossil Fuel Abundance and Carbon Constraints

- "Key powers that were traditionally able to manage global supply and demand are now under pressure as new powers emerge. Amid low oil prices and financial impacts on oil producers, renewed strategic competition has unfolded between states (WEF 2016)."
- However, there is a need pressing need to manage the continued supply of oil and gas to global markets during the coming transition between now and the 2040s (or maybe sooner).
- Major oil and gas producing states and companies need to plan now for a future of slowing demand growth and eventual decline.
- With investment horizons spanning 30 years or more, some assets may get stranded in the 2030s and 40s.
- The emergent renewable (low carbon) energy system will generate a new geopolitics.
- The 'resource curse' will take on new meanings in a world of fossil fuel abundance, security of demand, no supply, will be paramount.



Challenges: Towards a 'Geopolitics of the Low Carbon Energy Transition'





Conclusions



