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The Determinants of Renewables Investment

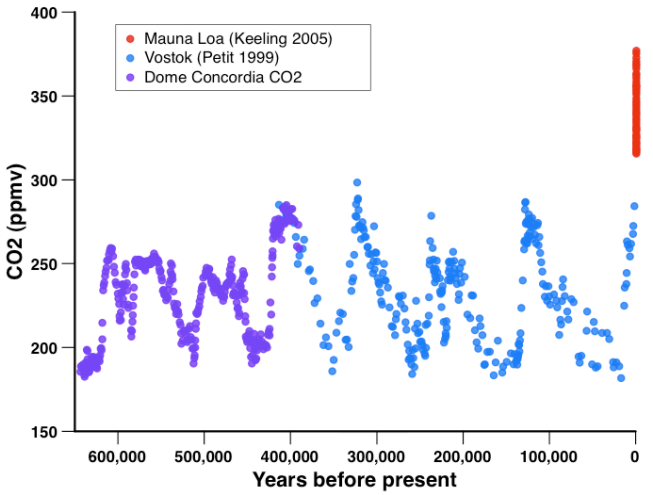
On the 24th of October, SITE held the first of its series of Energy Talks, replacing what for one decade had been known as SITE Energy Day. For this first edition, SITE invited Thomas Sterner, Professor of Environmental Economics at the University of Gothenburg to give a presentation under the headline of "Technological Development, Geopolitical and Environmental Issues in our Energy Future". To comment on the presentation, Leonid Neganov, Minister of Energy of Moscow Region, and Karl Hallding, Senior Research Fellow at the Stockholm Environment Institute (SEI), had been invited. This policy brief reports on the important subjects presented by our guests as well as the discussion that took place during the event.

From climate change concerns to climate change targets

Thomas Sterner began his presentation by addressing the well-known issue of climate change, a constantly current topic.

Different versions of Figure 1 (below) have been used extensively by those discussing climate change over the last decades, most notably by the previous US President Al Gore in his 2006 documentary "An Inconvenient Truth". It shows the concentration of CO2 (carbon-dioxide) in the atmosphere over the past 400,000 years. There is wide agreement within the scientific community that the emissions of greenhouse gases (GHG), such as CO2, methane and nitrous oxides, have led to the shifting weather patterns and increased temperature over the past century (NASA, 2017).

Figure 1. Level of CO2 in the Atmosphere

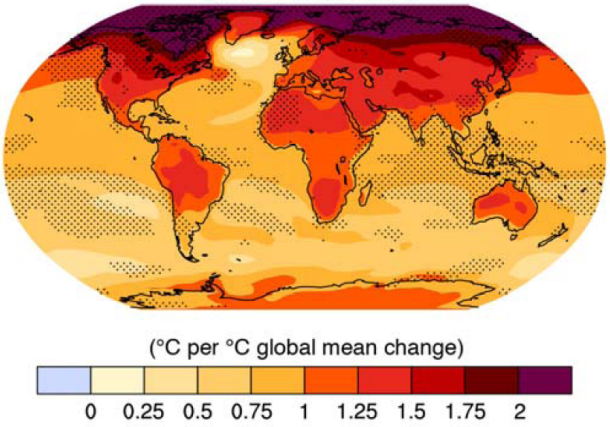


Notes: The vertical red line is the Keeling curve, showing how the concentration has changed since 1958.

Source: Allmendinger, 2007.

Predicting the impact of these emissions is far from an exact science: the temperature increases are likely to be unevenly spread across the world as shown in Figure 2. Some areas are likely to be particularly afflicted, especially coastal lowlands susceptible to flooding and semi-arid areas where droughts can become more likely. Unless current emission levels start to decrease, we are likely to observe severe results of climate change within 20 years, such as displacement and increased migration in the wake of extreme weather (NIC, 2016). For instance, adverse health effects in China, or decreasing productivity in South-East Asia, have already become apparent due to current increased temperatures (Kan, 2011; Kjellstrom, 2016).

Figure 2. Predicted Temperature Increase



Source: IPCC, 2013.

To tackle this issue and its negative economic impacts, many policy makers have agreed to replace fossil fuels with renewables. Renewables is the collective term of energy sources that have a neutral or negative net-effect of GHG emissions and are extracted through resources that are continuously replenished, e.g. solar, wind and hydro power, and biomass energy.

As the issue of climate change is a global one, the transition to renewables needs to be global too. International climate agreements have hence long been the accepted norm to approach climate change issues. The Paris Agreement is currently the guiding principle, in spite of the announcement of the Trump administration to withdraw the United States. Though instrumental in creating a momentum in the transition to lower levels of GHG emissions, it comes with many flaws. Its goal of a maximum average temperature increase of 2°C might be considered radical given current levels. However, the policy instruments that the target depends on – the Intended Nationally Determined Commitments (INDCs) – shift the responsibility to individual nations and

remove the global responsibility. As Thomas Sterner pointed out, the first three words of this acronym remove indeed any binding force, and elementary game theory tells us that it will be hard, not to say unlikely, for all signatories to remain cooperative in achieving the target of 2°C.

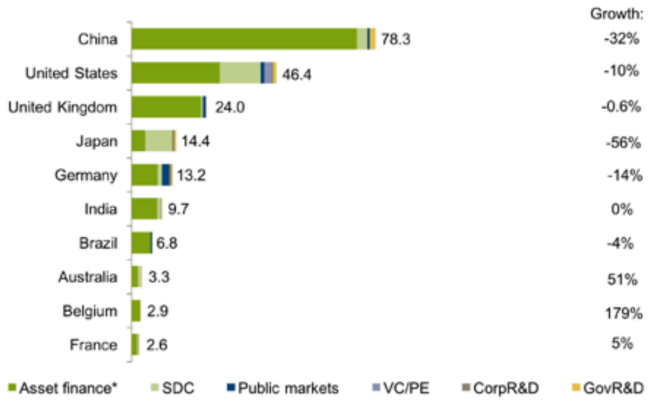
Investing in renewables: from political choice to competitive choice

As stated above, investing in renewables is a necessary condition to achieve climate change targets. Indeed, there are some countries that have pushed the development of renewables with the aim to reduce the fossil fuel dependency to a minimum level in a very near future (see Figure 3). However, most of these investments are currently driven by political will. A natural question is whether renewables technologies can be competitive.

It is a fact that costs of renewables have been severely decreased in the last decade (Timmons et al., 2014). However, as Thomas Sterner mentioned, the cost of renewables and of fossil fuels are still very place and time specific and depends on the scale. Investments in renewables are growing and solar and wind power have both seen production capacities increasing markedly yearly over the last years (GWEC, 2016; IEA, 2017a). However, coming from an initial low level, it will take some time before we will be able to rely on them.

Even with massive investments and decreasing generation costs, the intermittent nature of most renewable energies will still impede the competitiveness of renewables. Solar and wind power are the technologies where most of the development has been centred (Frankfurt School-UNEP Centre/BNEF, 2017). They are highly weather dependent and electricity production from these sources cannot be secured all of the time. This makes countries dependent on backup technologies. In some countries, the obvious answers to these challenges have been hydro and nuclear power. Both technologies have their respective drawbacks though.

Figure 3. World's Top 10 Investors in Renewable Energy in 2016



Notes: New Investments $BN, Growth on 2015.

Source: Frankfurt School-UNEP Centre/BNEF, 2017.

Hydro power requires a geography that allows for dams, which in turn change the nature markedly around them and may not be available during drought periods. Nuclear energy has surrounding safety aspects that most recently came to light with the 2011 Fukushima Daaiichi nuclear disaster, leading Germany to decide to shut down all of its 17 reactors by 2022 (25 % of the country's electricity production). Moreover, it may also be technically difficult to have nuclear as a backup technology given the associated ramping and start-up constraints.

Two further remarks on the intermittency problem can be made. First, this problem is likely to become more severe when policymakers push for large-scale electrification (c.f. EU Energy Roadmap established in 2011). For example, the full electrification of transport or heating sector will drive up the demand for and consumption of electricity. As this happens, the need for something to secure constant energy access will increase.

Second, only the development of technologies that allow electricity storage could solve this issue permanently. However, the current technological

progress regarding batteries' capacity cannot yet offer the solution (J. Dizard, 2017).

Oil price, a reference price

Another important aspect stressed by Thomas Sterner was to take into account the significant role of fossil fuel prices. Although identifying an optimal oil price for a fossil-free future is not a straightforward procedure, as discussed during the event.

The high price of oil during the late 00s and early 10s stimulated the development of alternative technologies. As awareness of climate change and its effects increased among policy makers and the general public, there was a momentum to push for the development of renewables.

As investments in renewables went up, so did investments in another less green technology: hydraulic fracturing, or fracking. In the 10 years between 2005 and 2015, the United States alone saw the extraction of shale gas and oil to increase six-fold. (EIA, 2016) In part to maintain a market share, OPEC countries exceeded their own set production limits and oil prices tumbled from around $100 per barrel to around $50 (Economist, 2014).

With roughly three years behind us of somewhat stable and low oil prices, the question is what the implications of this are. It makes it more difficult to phase out fossil fuels as demand for them goes up, depressing efforts put into the research and deployment of renewables. Energy efficiency also becomes less important, driving up waste and stopping investments in energy conservation.

On the other hand, with low oil prices, investments in the fossil-fuels industry are also less likely to take place. Keeping resources in the ground becomes more palatable as profit margins are pushed down. This, in turn, is likely to have a positive effect on environment by decreasing the level of GHG emissions.

The invited guests, Leonid Neganov and Karl Hallding spoke more in depth about two central countries that contribute in shaping global environmental policy.

The local conditions, Russia and China examples

As the world's fourth largest supplier of primary energy and the largest supplier of natural gas to the EU (IEA, 2017b), Russia presents an interesting case to observe as a country supplying fossil fuels. Leonid Neganov, Minister of Energy of Moscow Region, commented on the current policy direction of the country. He explained that non-renewable, GHG emitting energy sources make up a majority, roughly 60% of the Russian energy balance. The rest is provided by more or less equal shares of nuclear and hydro power. New renewable technologies make up a miniscule share of an estimate 0.2% of the current total.

According to Neganov, in the coming 20 years, we should not expect to see too much of a change. Though total output is expected to increase, the share of GHG-neutral energy will remain more or less constant, though the share of renewables are set to increase to 3% according to the current drafts of Russian energy policy. A more pronounced transition to other energy sources are more likely in a longer perspective towards 2050, even though circumstances may naturally change over the coming decades.

Other available information also points to that Russia has decided to tackle the shift in consumption of its major market in Europe by widening its geographic reach. Massive infrastructure investments, such as the Altai and TurkStream gas pipelines, will enable Russia to more easily reach markets that are currently beyond any practical reach.

With the Altai pipeline, Russia will be able to provide China with natural gas at a much greater level than before. China being by far the largest producer of coal sees an opportunity to shift away

from the consumption of a resource that during winters causes its major cities to periodically become enveloped in clouds of smog and at the same time also decrease its GHG emissions. The environmental benefits of natural gas as opposed to coal should not be exaggerated though. Thomas Sterner pointed out that methane, the main compound of natural gas, is a considerably more potent GHG than CO2. A total leakage of an estimated 1% negates the environmental benefits, he said.

Karl Hallding, Senior Research Fellow at SEI, particularly stressed the need to look at China. It is the supplier of half of the world's coal, extraction levels remain high. (BP, 2017) Domestic consumption is decreasing but consumption of Chinese coal is, however, more likely to shift geographic location rather than to be left in the ground, said Hallding. Through massive infrastructure investments, such as the New Silk Road, and in energy production in Sub-Saharan Africa, China spreads its influence (IEA, 2016). By exporting emissions, the impact at the global level will not change.

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