

Hydrocarbons for a decarbonized economy. How is our industry supporting the energy transition?

Federico Games

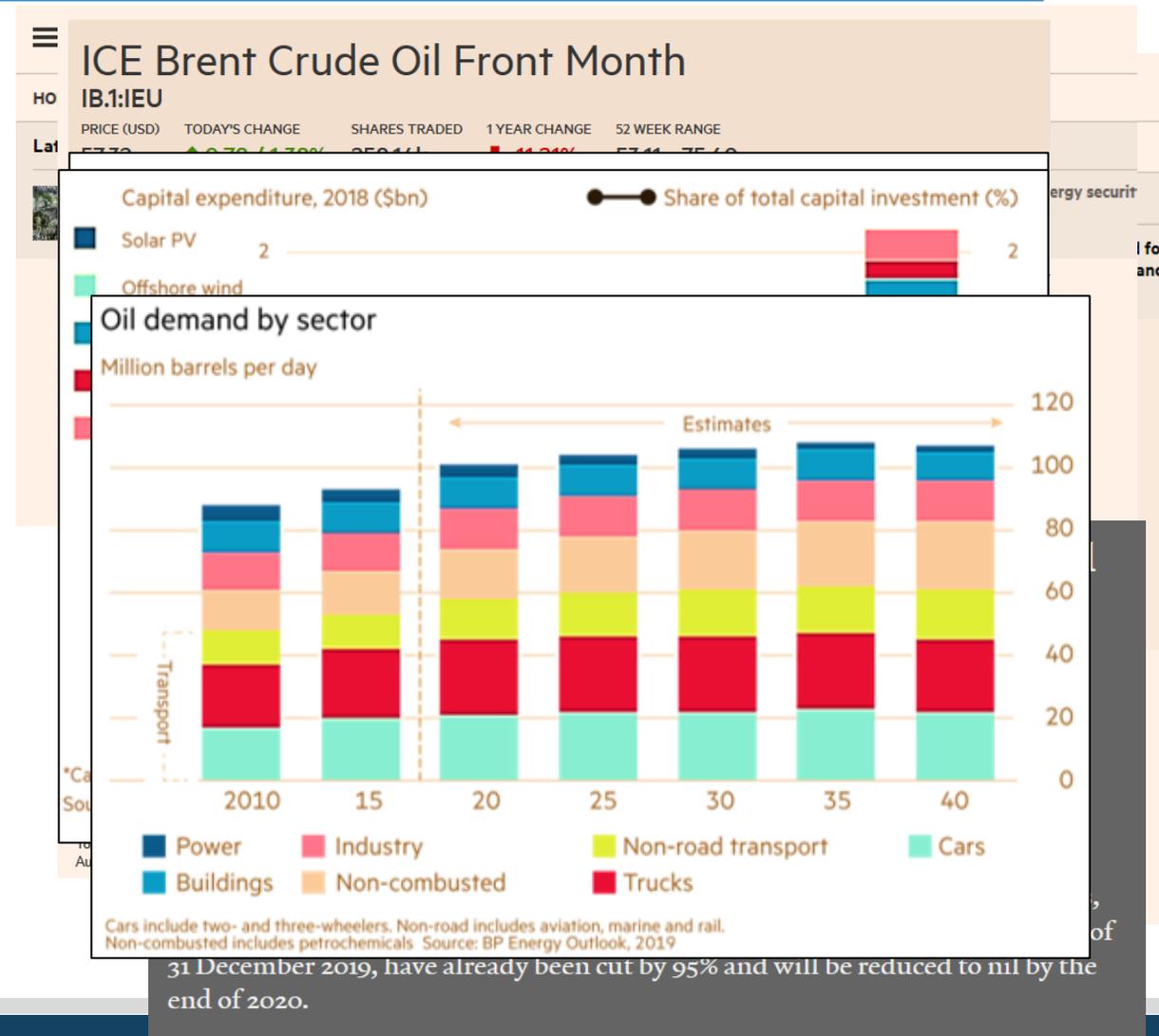
Geneva, 21 February 2020



A very complex environment ...

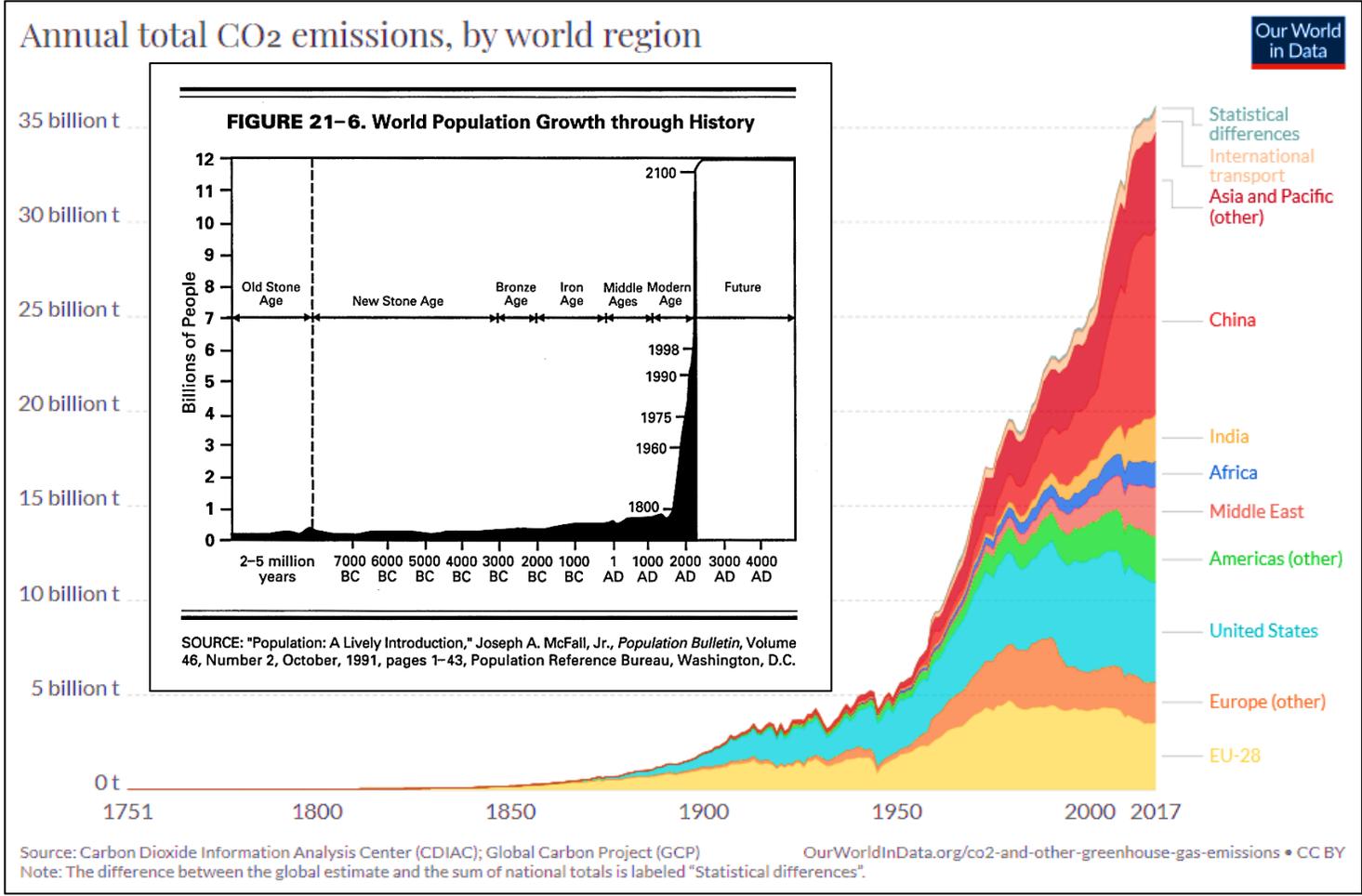
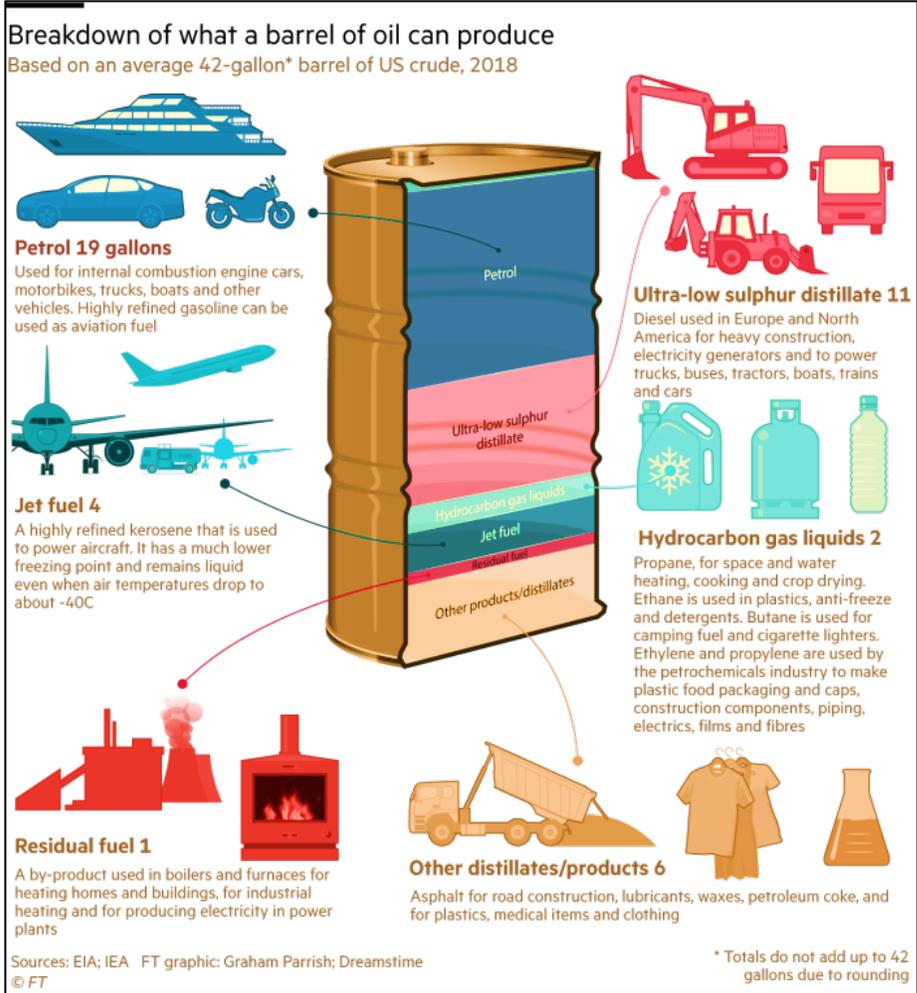
Trade-offs between climate change and economic development

- Enterprise Value
- Newspapers and Media Pressure
- Shareholders demands and economic environment (cost of capital)
- Volatile oil price (e.g. Coronavirus)
- Low Investment in complex and conventional Oil&Gas projects
- Low Investment in Renewables
- 900 Billions USD at risk (stranded assets)
- Future energy requirements



Benefits of a Carbonized Economy...

During the 20th century, humanity benefited from the highest rise in living standards in human history (Richard A. Easterlin, 2000), supported by the energy provided from fossil fuels sources.

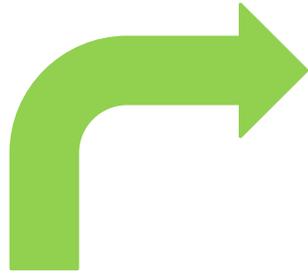


Carbon Budget Determination...

“All models are wrong, but some are useful” (George Box)

Main Inputs

External factors that change the amount of the sun’s energy that is absorbed by the Earth.



Schematic for Global Atmospheric Model

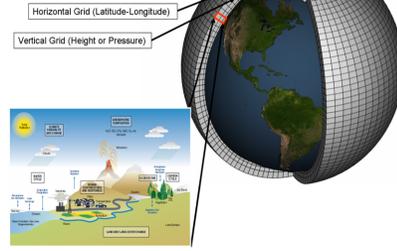


Illustration of grid cells used by climate models and the climatic processes that the model will calculate for each cell (bottom corner). Source: NOAA GFDL

Climate Model

$$\rho \left[\frac{\partial u}{\partial t} + \frac{\partial u}{\partial x} u + \frac{\partial u}{\partial y} v + \frac{\partial u}{\partial z} w \right] = -\frac{\partial p}{\partial x} + \mu \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) + \rho g_x$$

$$\rho \left[\frac{\partial v}{\partial t} + \frac{\partial v}{\partial x} u + \frac{\partial v}{\partial y} v + \frac{\partial v}{\partial z} w \right] = -\frac{\partial p}{\partial y} + \mu \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} \right) + \rho g_y$$

$$\rho \left[\frac{\partial w}{\partial t} + \frac{\partial w}{\partial x} u + \frac{\partial w}{\partial y} v + \frac{\partial w}{\partial z} w \right] = -\frac{\partial p}{\partial z} + \mu \left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2} \right) + \rho g_z$$

Navier-Stokes equations



Main Outputs

Thousands of different variables...

2100 WARMING PROJECTIONS

Emissions and expected warming based on pledges and current policies



Dec 2019 update

Warming projected by 2100

Baseline
4.1 – 4.8°C

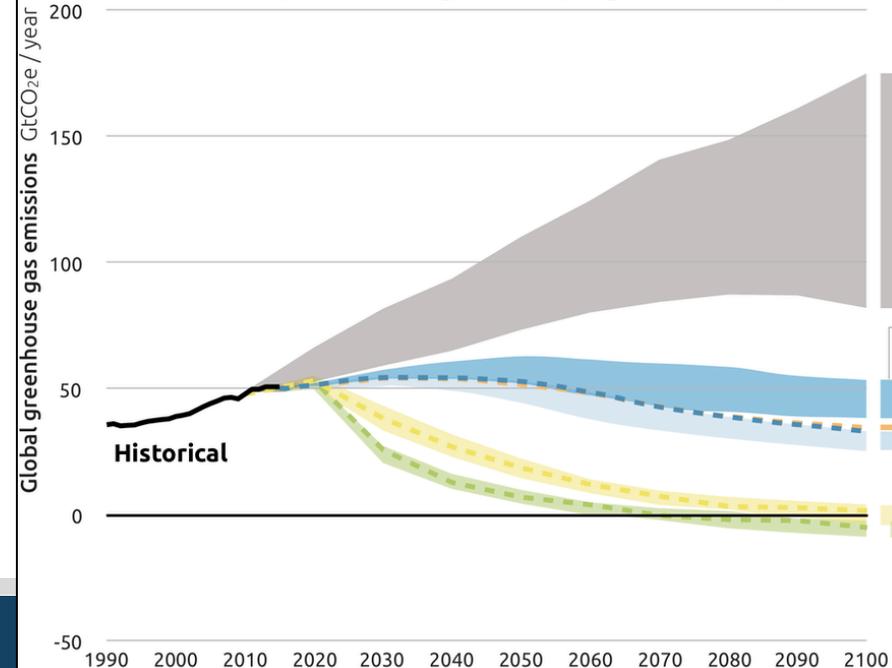
Current policies
2.8 – 3.2°C

Optimistic policies
2.8°C

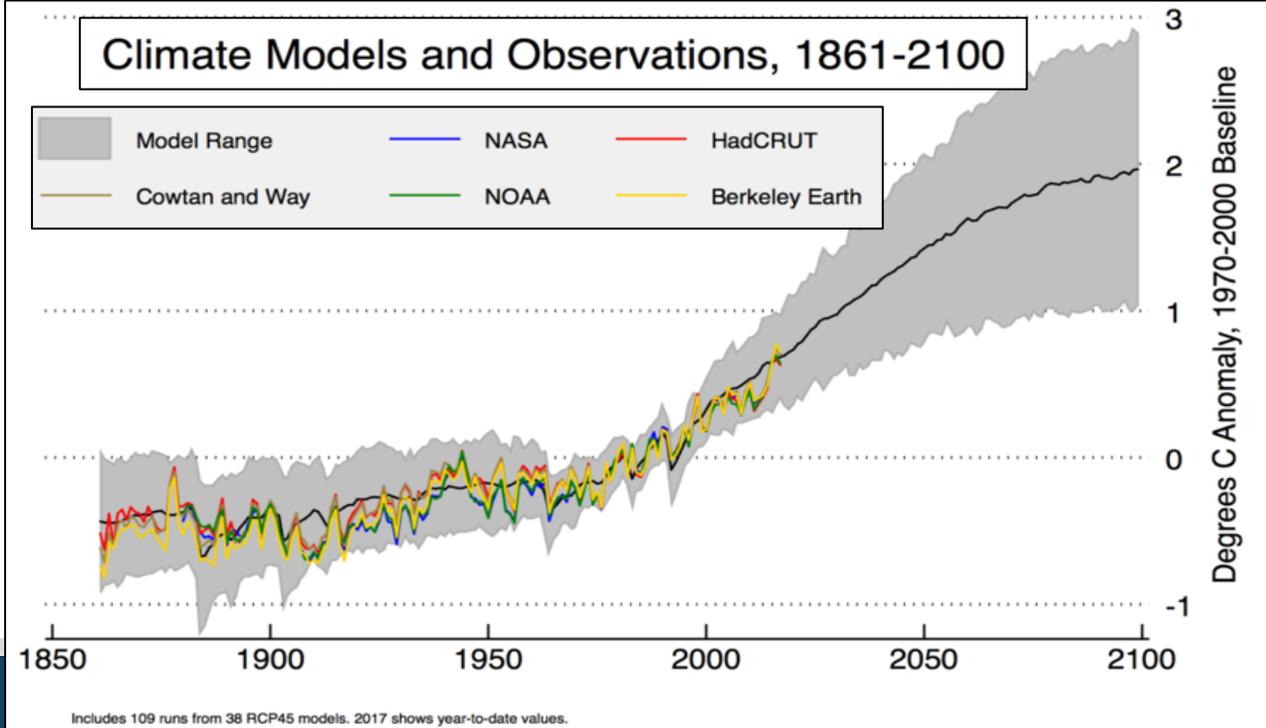
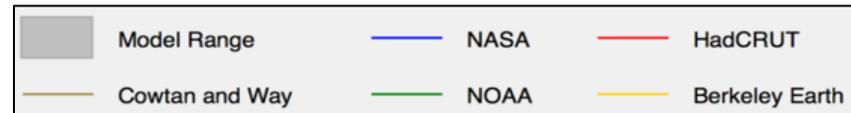
Pledges & Targets
2.5 – 2.8°C

2°C consistent
1.6 – 1.7°C

1.5°C consistent
1.3°C



Climate Models and Observations, 1861-2100

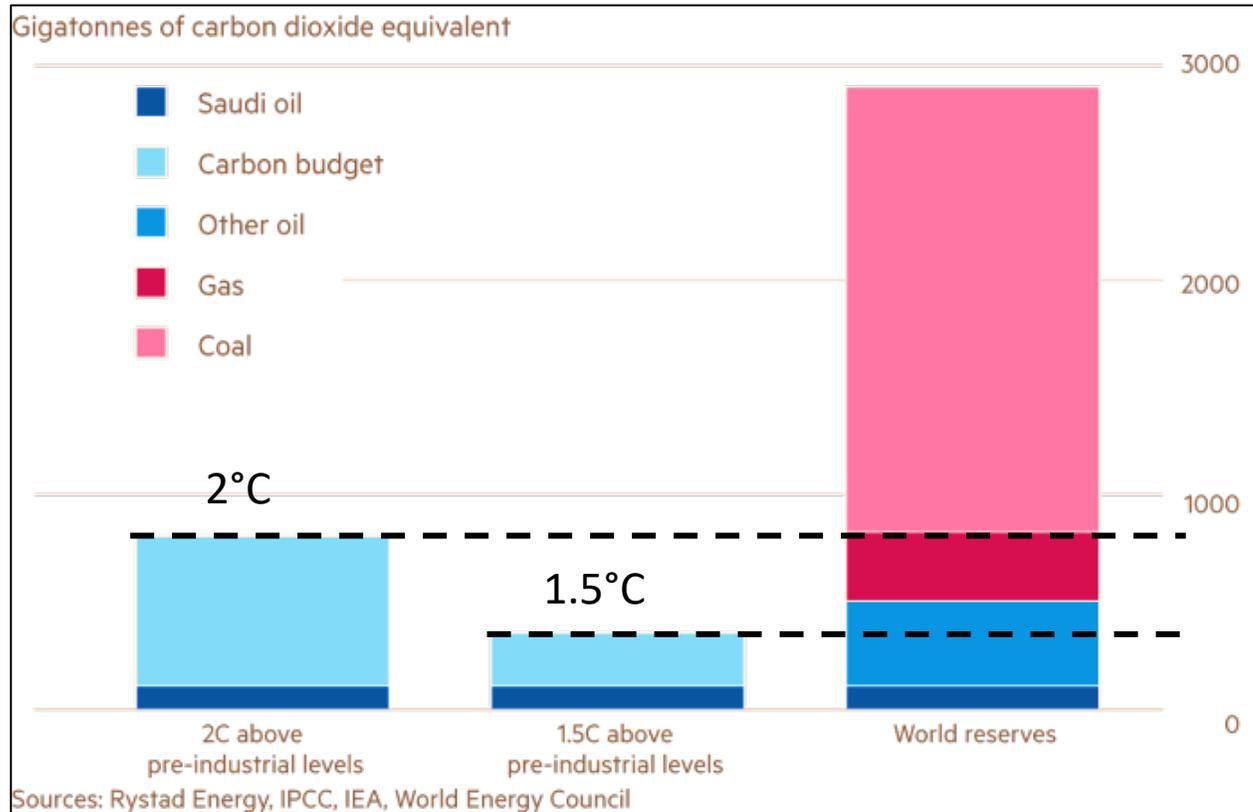


Includes 109 runs from 38 RCP45 models. 2017 shows year-to-date values.

A Decarbonized Economy ...

Oil and natural gas are the next stranded asset?

Global fossil fuel reserves outweigh carbon reduction targets



- **1.5C** global warming target : **84%** of the remaining fossil fuels would need to remain in the ground
- **2C** global warming target : **59%** of fossil fuel reserves would have to be left untouched to meet
- **3C** global warming target : **4%** of the remaining carbon stock would be left untouched

Open Discussion...

One of the 17 UN sustainable goals is “**Affordable and clean energy**”, the 2030 targets in terms of energy can be resumed as:

- a) the world energy industry needs to further increase the efficiency of current fossil fuels,
- b) reduce GHGs emissions,
- c) and increase the share of renewable energy in the energy mix in order to provide universal access to energy.

1. **How Oil&Gas companies can contribute to achieve these objectives?**
2. **Not yet industrialised countries (e.g. Guyana), should not enjoy the same fossil-fuelled development ?**
3. **How much of the burden of reducing our oil habit should these markets be expected to assume?**



Swiss Section

SPE Swiss Section 2020

Merci

Merci vilmal

Grazie

Grazcha

Thank you!