Shale gas and climate change: worse than coal?

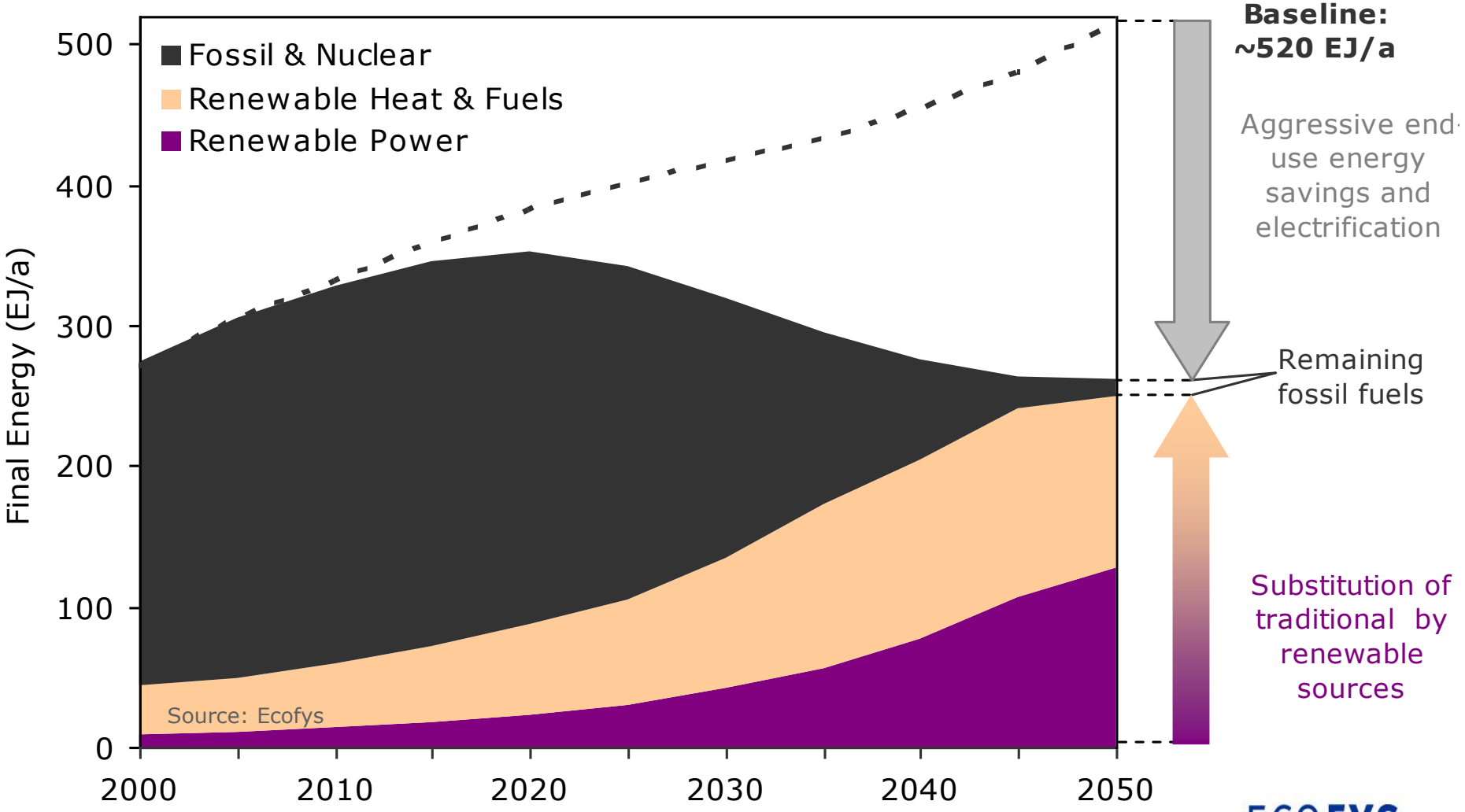
Kees van der Leun

11 April 2011

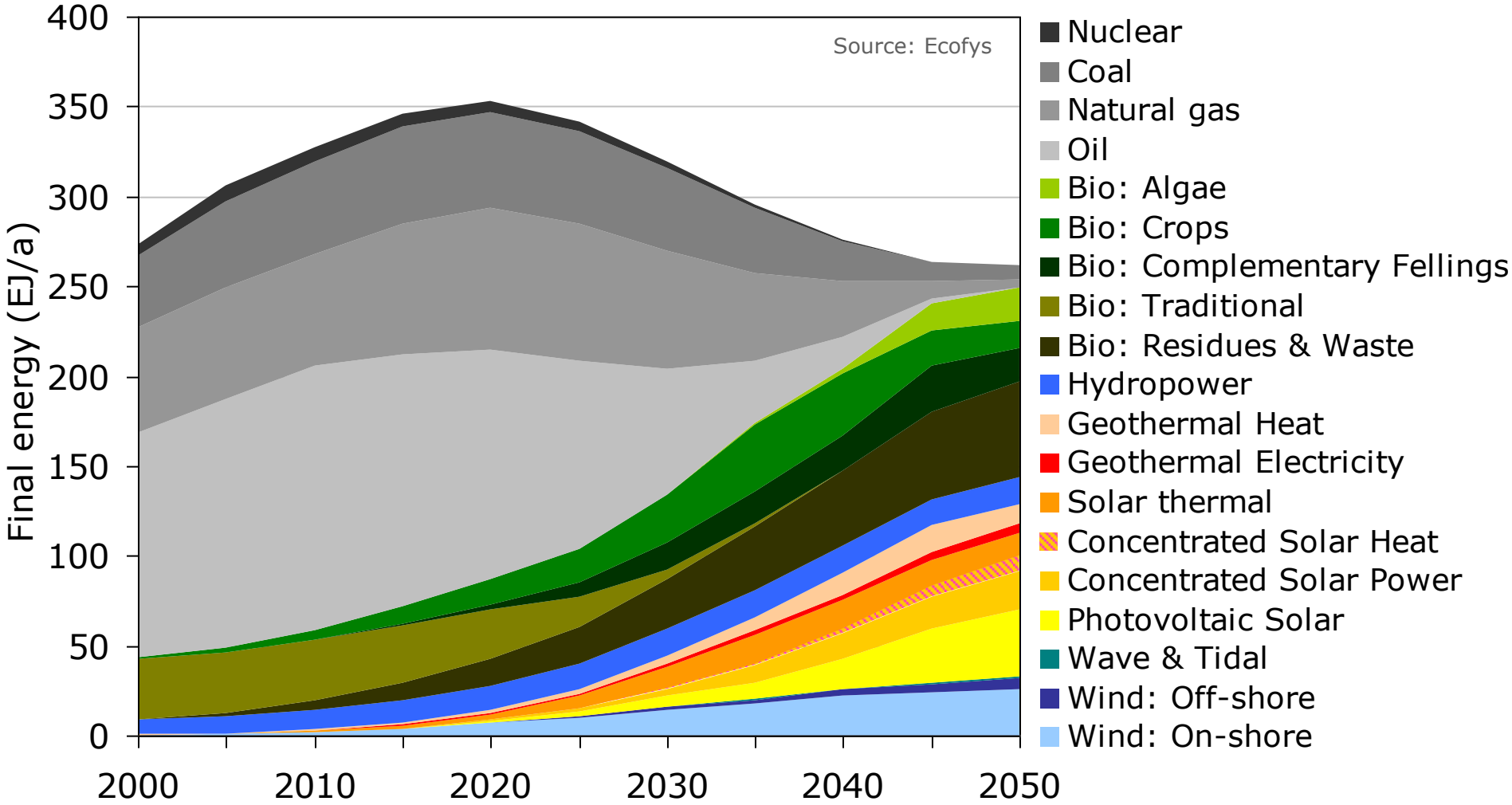
EU long-term goal for GHG emissions

- European Council: -80 … -95% by 2050, compared to 1990
- Consequence: zero-emission energy supply by 2050
- The Energy Report (WWF/Ecofys 2010) shows how this can be done on a global scale

Fossils are phased out over time as renewables take up the challenge



95% renewable energy worldwide by 2050 is possible



Natural gas as transition fuel

- Lower GHG emissions than coal
- Clean-burning
- Allows for flexible power plants, necessary in a system with varying supply (wind, solar) and demand (air conditioning)

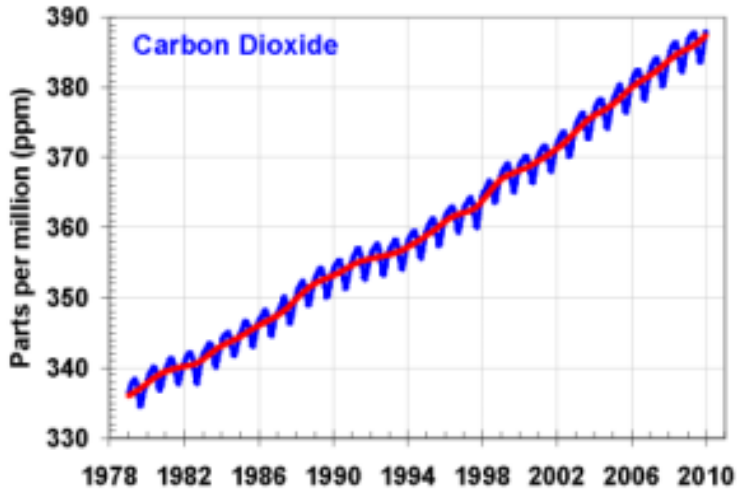
Emissions from 'conventional' natural gas

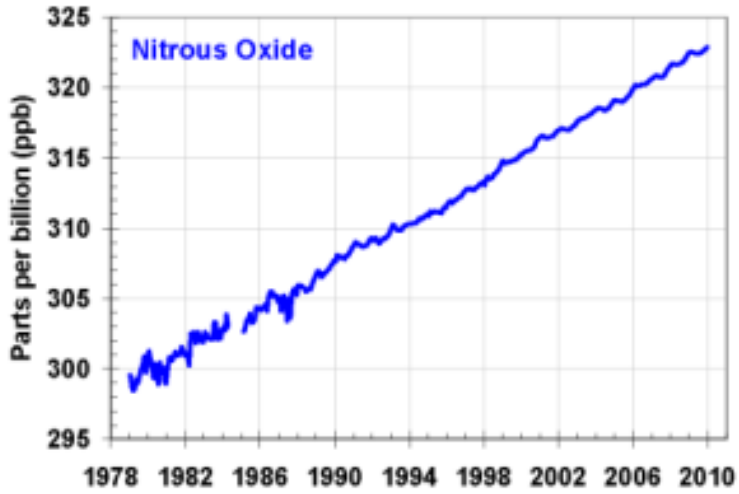
- Direct emissions
  - 56 kg/GJ
    i.e. 40% less than bituminous coal
- Indirect emissions from fossil fuel use in extraction and transport
  - 4 kg/GJ
- Indirect emissions from fugitive methane
  - Strongly dependent on leaking fraction (%) and time horizon
  - Leaking fraction: 1.7 – 6.0%

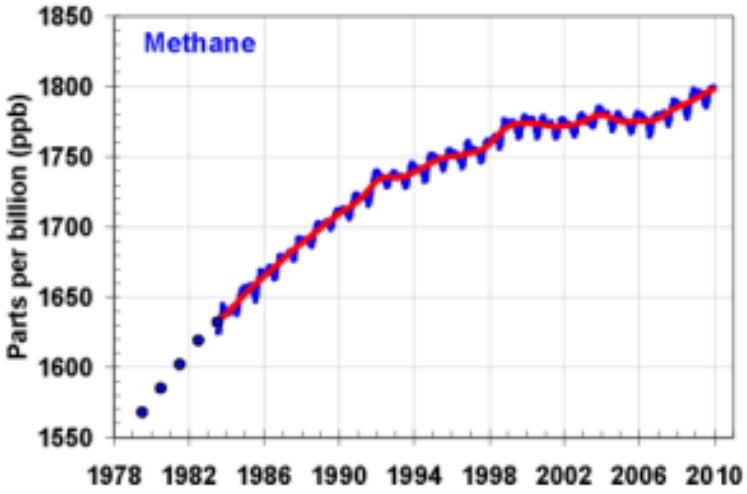
Methane emissions

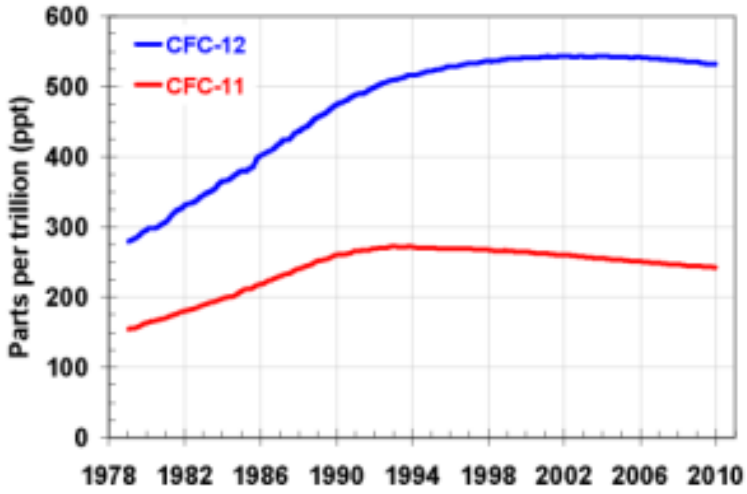
- Methane is more powerful greenhouse gas than CO_2: a molecule leaking has much larger effect than a molecule being burned
- Global Warming Potential (GWP) is effect of 1 kg CH_4 relative to 1 kg CO_2

Methane concentration rising again









Fugitive methane emissions (Howarth e.a.)

Table 2. Fugitive methane emissions associated with development of natural gas from conventional wells and from shale formations (expressed as the percentage of methane produced over the lifecycle of a well)

	Conventional gas	Shale gas
Emissions during well completion	0.01%	1.9%
Routine venting and equipment leaks at well site	0.3 to 1.9%	0.3 to 1.9%
Emissions during liquid unloading	0 to 0.26%	0 to 0.26%
Emissions during gas processing	0 to 0.19%	0 to 0.19%
Emissions during transport, storage, and distribution	1.4 to 3.6%	1.4 to 3.6%
Total emissions	1.7 to 6.0%	3.6 to 7.9%