Alternative: Supersonic Separator

- Contaminated gas, 100 bar, 20 °C
- Vanes
- Laval nozzle annulus
- Cyclone separator, 30 bar, -40 °C
- Conditioned gas, 75 bar, 10 °C
- Liquid CO₂ and slip gas
Carbon capture and storage
Our last line of defence

Sleipner project

- Started in 1996
- Separating and injecting 1 million tons CO₂ annually
- Storing in saline aquifer at 800 m depth

Source: Statoil
CO$_2$ emission rates [kg/ MWh (3.6 GJ)]

PC = Pulvized Coal
IGCC = Integrated Gas Combined Cycle
NGCC = Natural Gas Combined Cycle
Pulse-cooling device (van Dongen tube)
Rapid condensation of high-pressure gases

Conclusions

- We are not running out on oil and gas (no decline in RP ratios over the last century)
- Are we willing to pay the price?
  - CO2 emissions and global warming
  - Environment (Deepwater Horizon, Nigeria oil spills)
- Recall that all renewables together are at 2.1% of global energy use
- Sunset of the oil and dawn of the gas era?
Ramp met de Deepwater Horizon
Primair energievraag (-bunkers) circa 3400 PJ

- Glastuinbouw: 10%
- Utiliteit: 17%
- Huishoudens: 25%
- Industrie: 48%
Zonnecellen: 175 kWh/jaar/m²

Jaarlijks elektriciteitsverbruik per huishouden NL: 4500 kWh ≈ 25 m²

Ongeveer 4% van ons NL energieverbruik.....
Windturbines: $18-26$ kWh/jaar/m²

Energieverbruik NL 2010:
$940$ miljard kWh $\approx 45,000$ km²

Elektriciteitsverbruik NL 2010:
$117$ miljard kWh $\approx 6,000$ km²

Offshore inmiddels geïnstalleerd:
$41$ km² (OWEZ, Amalia)