CCUS Developments in the Netherlands

UKCCSRC Network Conference
Cambridge, 2018.03.26-27

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Number of articles on climate change per month

News articles per month
- Euro barometer
- 12 per. Mov. Avg. (News articles per month)

Persons who indicate environment as one of the most important issue's (fraction)

Source: Utrecht University
Nations Unies
Conférence sur les Changements Climatiques 2015
COP21/CMP11
Paris, France
Holding the increase in the global average temperature to well below \(2^\circ\)C above pre-industrial levels…

... and pursuing efforts to limit the temperature increase to \(1.5^\circ\)C above pre-industrial levels

... to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century ...

- Paris Agreement, UN 2015
CO₂ Budgeting

Budget for 2 ℃ target: 2900 Gt CO₂
CO₂ emissions up until 2016: - 2138 Gt CO₂
Remaining emissions: = 762 Gt CO₂
CO₂ emissions in 2016: / 40 Gt CO₂
Years left (@2016 emissions): = ~19 years

By 2036, the 2 ℃ target will be surpassed
(By 2021, the 1.5 ℃ target will be surpassed)

Source: Carbon Brief 2017
Outline

• Introduction
• Past
• Present
• Future
conclusion

by: Andy Read & Mark Komberink
2013 Energy Agreement
2015 Paris Agreement
2016 Energy Report
2016 Energy Agenda
2017 Coalition Agreement
2018 CCS Roadmap
2018 Climate Agreement?
2021? Start-up projects?
Capture Pilot
Storage Pilot
Start-up
# 2017: Coalition Agreement:

## Table: Indicative allocation of the 49% reduction by 2030

<table>
<thead>
<tr>
<th>Domain</th>
<th>Reduction by 2030 (Mt)</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>1</td>
<td>Recycling</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Process efficiency</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Carbon capture and storage</td>
</tr>
<tr>
<td>Transport</td>
<td>1.5</td>
<td>More fuel-efficient tyres, European standards, electric vehicles</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Biofuels and measures by cities</td>
</tr>
<tr>
<td>Built environment</td>
<td>3</td>
<td>Optimising energy use of office buildings</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Home insulation, district heating and heat pumps</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>New builds that are more energy-efficient</td>
</tr>
<tr>
<td>Electricity</td>
<td>1</td>
<td>Energy-efficient lighting</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Shutting down coal-fired power plants</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Carbon capture and storage at waste incineration plants</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>More offshore wind power</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>More solar power</td>
</tr>
<tr>
<td>Land use and agriculture</td>
<td>1.5</td>
<td>Smarter use of available land</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Lower methane emissions</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Energy-producing greenhouses</td>
</tr>
</tbody>
</table>
2017: Coalition Agreement

- 2018: Climate and Energy Agreement
- Climate law
- Broaden SDE+ / Renewable Energy premium
- Budget of M€ 300/year for policies and demonstration (entire Climate package)
- Minimum price for CO2 emissions in E-sector, increasing to € 43/ton in 2030
- Consultation with Rotterdam harbour, Amsterdam harbour, Westland area
- 2030: end of coal-fired power
2018: CCS Roadmap

• CCS is required
• When is CCS acceptable?
  – CCS for industry; Storage off-shore
  – No lock-in; not at power sector
• Start CCS at:
  – Industry with long-term emission (e.g. Steel)
  – Industry with medium-term emission (e.g. Refineries)
  – Blue hydrogen (transition to green hydrogen)
• Transport and Storage
  – Starts as public responsibility
  – Could be privatised later
• Long-term incentives needed
CCS development plan

**Lab tests**
- ~2010

**Pilots**
- ~2015

**DEMO's**
- ~2020

**Deployment**
- ~2025

2004-2009; 25 M€

2009-2015; 60 M€

2014-now; ~2 M€/year

2019?
CATO in a glance

- Dutch CC(U)S R&D Consortium
- Partners from industry, SME, university, NGO’s
- Dissemination network for international CCS projects
- CATO represents the Netherlands on CCS-R&D

- CSLF
- GCCSI
- IEA-GHGT
- Mission Innovation
- ...

- CATO
- TKI
- CCUS initiatives
- EC-projects
- ...

- ERANET-ACT
- CCU-Phoenix
- CO2-Geonet
- ECCSEL
- EERA-CCS
- H2020 (+FP9)
- SET-plan
- ZEP
- ...

www.co2-cato.nl
Message: There is not one CC(U)S

<table>
<thead>
<tr>
<th>CAPTURE</th>
<th>TRANSPORT</th>
<th>STORAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>Type</td>
<td>Field type</td>
</tr>
<tr>
<td>Oil</td>
<td>Pipe liquid</td>
<td>Gas fields</td>
</tr>
<tr>
<td>Coal</td>
<td>Pipe gas</td>
<td>Oil fields</td>
</tr>
<tr>
<td>Gas</td>
<td>Ship</td>
<td>Coal layer</td>
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<tr>
<td>Biomass</td>
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<td>Aquifers</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td>Land</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Source: Utrecht University</td>
</tr>
</tbody>
</table>

Source: Utrecht University

Re-use
Message: CCU

<table>
<thead>
<tr>
<th></th>
<th>CCU</th>
<th>CCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>Resource</td>
<td>Waste</td>
</tr>
<tr>
<td>Cost driver</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Deployment in NL</td>
<td>Tomorrow</td>
<td>~5 years</td>
</tr>
<tr>
<td>Emission reduction</td>
<td>kton</td>
<td>Mton</td>
</tr>
</tbody>
</table>

Don’t think “OR”, but think “AND”:
• Use as much CO₂ as you can
• And store the final 95% percent
Message: Renewables vs Climate

- CCS needed for climate
- CCS also costs money (like renewables)
- CCS could reduce renewables budget (a bit)
- CCS could delay renewables deployment (a bit)

- As long as we (NGO’s) fuzz about it, industry continues emitting CO2

- So:
  1. Energy savings
  2. Renewables
  3. Remainder: CCS
Final message: Public engagement

- No public engagement
- = no political support
- = no incentive
- = no CCS
- = Climate change (>>2°C)
Final final message:

In the Netherlands, the signs are on green