Co-impacts of climate measures on air pollutants in the Netherlands

Opportunities and risks within the NEC revision

Pieter Hammingh, Koen Smekens, Arjan Plomp, et al.,
Content

- The revisions: Gothenburg & NECD
- NEC & climate policies
- BOLK: a second opinion
- Co-impacts on Dutch air pollutants
- Optimizing opportunities & preventing risks
What are the targets of the NEC revision?

TSAP targets: contribution CLE & additional measures 2005

- Years of Life lost PM2.5
- Premature deaths ozone
- Forest area unprotected acidification
- Ecosystem area unprotected eutrophication

Percentage improvement in 2020 compared to 2000
What are the targets of the NEC revision?

TSAP targets: contribution CLE & additional measures 2010

- Years of Life lost PM2.5
- Premature deaths ozone
- Forest area unprotected acidification
- Ecosystem area unprotected eutrophication

Percentage improvement in 2020 compared to 2000

Reduction CLE AP + C&E
Additional C&E / AP?
Why combine CC&AP policies?

Air pollution and greenhouse gas emissions mitigation costs, 2020

- To meet climate and energy targets (indicative)
- Further air pollution measures to achieve the targets of the Thematic Strategy on Air Pollution
- Implementing current air pollution legislation

Bar chart showing:
- National energy projections (+3% CO₂ in 2020)
- illustrative projections meeting the EU climate target (-20% CO₂ in 2020)

Co-impacts on Dutch air pollutants from climate policies
GAINS: the central model of the NEC revision

http://gains.iiasa.ac.at

Co-impacts on Dutch air pollutants from climate policies
Baselines in the NEC revision & climate policies

- Climate& energy policies assumed in baselines for GHG&NEC

- 2005 Thematic Strategy on Air Pollution → CAFE baseline  
  (GDP 2.3%, CO₂ 20€/ton)

- 2008 EC NEC ‘proposal’ → Primes ’07 baseline  
  (GDP 2.1%, CO₂: 22 €/ton, RES:8%, biofuels 8%)

- 2009 Gothenburg Revision → Primes ’09 baseline  
  (GDP 1.4%, CO₂ 19 €/ton, RES 11%, biofuels 9%)

Co-impacts on Dutch air pollutants from climate policies
Importance of co-impacts for Dutch NEC 2020

<table>
<thead>
<tr>
<th>Pollutant (Kiloton)</th>
<th>NEC 2010</th>
<th>Dutch baseline 2020 from ’09</th>
<th>GAINS-Primes baselines 2020: ’07/’09</th>
<th>Indications for ceilings for 2020 (?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>50</td>
<td>48</td>
<td>45 / 33</td>
<td>44 / 33</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>260</td>
<td>199</td>
<td>178 / 166</td>
<td>177 / 166</td>
</tr>
<tr>
<td>NH$_3$</td>
<td>128</td>
<td>129</td>
<td>129 / 130</td>
<td>≤ 126</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>-</td>
<td>15</td>
<td>18 / 16</td>
<td>≤ 16</td>
</tr>
<tr>
<td>VOC</td>
<td>185</td>
<td>165</td>
<td>161 / 156</td>
<td>≤ 161</td>
</tr>
</tbody>
</table>

| GHG | Kyoto 200 | 254 | 205/175 | EU/NL targets 173/150 |

Co-impacts on Dutch air pollutants from climate policies
BOLK: a second opinion for co-impacts

- Dutch Research Programme on Air and Climate (BOLK)
- Focus on co-impacts Dutch climate programme & in-depth studies on co-impacts biomass, biofuels, LCA, CCS
- Input for the Dutch Government in the NEC revisions
- Input to climate and air pollution policy makers
- Results available via the BOLK website in English
Methodology: Options Document & Analysis Tool

- Baseline 2009
- 170 Options Effects & Costs
- Basic assumptions
- GHG & AP Targets
- Analysis tool
- Options package Effects on GHG, AP, Costs
### Update of the Options Document

- **BOLK updated 10 CCS, 7 biomass, 3 biofuel options!**

<table>
<thead>
<tr>
<th>Option</th>
<th>CO$_2$ reduction (Mt)</th>
<th>Costs (€/ton)</th>
<th>Co-impacts AP (Kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCS new coal power plant</td>
<td>12</td>
<td>35</td>
<td>-4.5 SO$_2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+2.9 NH$_3$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+1.7 NO$_x$</td>
</tr>
<tr>
<td>Biogas from manure digestion</td>
<td>3.2</td>
<td>189</td>
<td>-7.4Mt CH$_4$ (CO$_2$-eq)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+4.4 NO$_x$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+2.0 NMVOC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0.3 SO$_2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0.1 PM$_{10}$</td>
</tr>
<tr>
<td>2$^{nd}$ generation biofuel mix</td>
<td>0.5</td>
<td>481</td>
<td>-0.2 kton NO$_x$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0.1 kton SO$_2$</td>
</tr>
</tbody>
</table>

Co-impacts on Dutch air pollutants from climate policies.
Translate Dutch climate programme into options

- GHG reductions of the Dutch Climate programme ‘Clean and Efficient’ in 2020;

<table>
<thead>
<tr>
<th>Sectors</th>
<th>GHG reduction (Mt) uncertainty range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Energy</td>
<td>1.0</td>
</tr>
<tr>
<td>Industry and Refineries</td>
<td>0.0</td>
</tr>
<tr>
<td>Transport</td>
<td>6.5</td>
</tr>
<tr>
<td>Residential</td>
<td>3.5</td>
</tr>
<tr>
<td>Commercial, Trade, Services</td>
<td>1.2</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.1</td>
</tr>
<tr>
<td>Non CO2 GHG</td>
<td>0.8</td>
</tr>
<tr>
<td>Export of electricity</td>
<td>-1.0</td>
</tr>
<tr>
<td>Total</td>
<td>13.1</td>
</tr>
</tbody>
</table>
Co-impacts on Dutch air pollutants from climate policies

Co-impacts on air pollutants by Dutch climate package, 2020

NO\textsubscript{x}:
- Change compared to Dutch baseline without climate package (BL2009) (kton)
- Co-benefit
- Disbenefit
- High estimate
- Low estimate

SO\textsubscript{2}:
- Change compared to Dutch baseline without climate package (BL2009) (kton)
- Co-benefit
- Disbenefit
- High estimate
- Low estimate

Netherlands Environmental Assessment Agency

Co-impacts on Dutch air pollutants from climate policies
Co-impacts: Dutch vs European estimates

Co-impact ratios on air pollutants by European and Dutch estimates, 2020

Netherlands Environmental Assessment Agency

Co-impacts on Dutch air pollutants from climate policies
GHG Target packages: EU and NL

Reduction of greenhouse gas emissions to achieve targets, 2020

Change compared to Dutch baseline without climate package (BL2009) (Mton CO₂ eq.)

- NOₓ options
- NMVOC options
- Renewables
- Extra export electricity
- Non CO₂ greenhouse gas options
- Energy saving
- Volume and structural effects
- Nuclear
- Fuel switch
- Combined heat and power
- CCS industry
- CCS energy

- Dutch target
- EU-target

Co-impacts on Dutch air pollutants from climate policies
Co-impacts from Target packages

Co-impacts on air pollutants by Dutch climate package, 2020

CO2 emissions

- EU target package
- Dutch target package

PM options
NO2 options
NMVOC options
Renewables
Non CO2 greenhouse gas options
Energy saving
Volume and structural effects
Nuclear
Fuel switch
Combined heat and power
CCS industry
CCS energy

Netherlands Environmental Assessment Agency
## Dutch baselines including co-impacts

<table>
<thead>
<tr>
<th>Pollutant (Kiloton)</th>
<th>Dutch baselines 2020</th>
<th>Indications for ceilings for 2020 (?)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No C&amp;E</td>
<td>NL C&amp;E</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>48</td>
<td>42-47</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>199</td>
<td>192-195</td>
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<td>129</td>
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<td>VOC</td>
<td>165</td>
<td>165</td>
</tr>
</tbody>
</table>
Conclusions

- Net co-benefits $\text{SO}_2$ and $\text{NO}_x$ can be substantial, but have their uncertainties;
- Uncertainties: no final national climate programs yet, ETS/CDM, CCS, export electricity, economic growth, methodologies;
- If climate policies do not deliver, larger risk for non-attainability of a low $\text{SO}_2$ ceiling;
- Disbenefits: $\text{NO}_x$ (CCS/biomass/CHP), $\text{NH}_3$ (CCS/biomass), NMVOC (biomass/CHP);
Recommendations

- Climate policy makers: take into account co-impacts on air pollutants from: small-medium scale bio energy, wood stoves, CHP, CCS, biofuels, LCA;
- An update of the BOLK analysis with a post-crisis baseline and options document;
- Workshop recommendation: since climate policies do not guarantee less air polluting emissions, setting more stringent national emission ceilings remain a key tool on the way to a better air quality.
More opportunities, less risks?

BOLK reports on LCA, biofuels, biomass and CO₂ capture and storage available at:

http://www.pbl.nl/en/

search for BOLK

or contact pieter.hammingh@pbl.nl