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Impact of the Netherlands Coal Tax on:

- the use of power stations
- costs to end-users and government revenues
- support for energy transition

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Introduction

- The aim of this study is to chart the impact of the coal taxation instrument on the Dutch electricity market.
- The study is based on an analysis of the highly integrated electricity markets of the Netherlands, Belgium and Germany.
- The situation now and in the years to come: low margins for coal-fired power plants, largely negative margins for gas-fired power plants and low CO_2 price. The result is a lower demand for gas and a higher demand for coal than anticipated electricity production.
- The introduction of a coal tax in the Netherlands will lead to an increase in the marginal costs for coal-fired power plants.
- This presentation summarises the key findings with regard to the consequences of the introduction of a coal tax for the various stakeholders in the energy value chain:
    - The use of power stations
    - Government revenues and costs to end users
    - Support for energy transition

Summary

Current situation: Share of coal is rising strongly

- CO_2 emissions from gas-fired power plants are substantially lower than from old and new coal-fired power plants (45 to 70% lower). However, the available capacity of coal-fired power plants in the Netherlands is increasing substantially.
- This expansion means the production of electricity from coal will rise to 46 per cent of the total amount of electricity produced in the Netherlands in 2015.

Switch from coal to gas at a CO_2 price from EUR 40

- At current prices for gas and coal, the switch from coal to gas will only take place from a CO_2 price of EUR 40 per tonne (current CO_2 price is EUR 7 per tonne).
- Additional measures are needed to bring about the energy transition until the CO_2 price significantly increases again.

Coal tax: Greater use of gas-fired power plants

- The introduction of a coal tax of EUR 13.73 per tonne will lead to a greater use of combined heat and power plants; the coal tax would have to be at least EUR 35 for the greater use of stand-alone gas-fired power plants.

Higher e-production from gas and limited imports

- A coal tax of EUR 13.73 per tonne will result in higher electricity production from gas (17 per cent in 2015) and a limited rise in electricity imports.

Coal tax: lower CO_2 emissions

- A coal tax of EUR 13.73 will reduce CO_2 emissions by 3 per cent in the Netherlands, including a slight import effect. A higher coal tax will have a higher CO_2 effect.

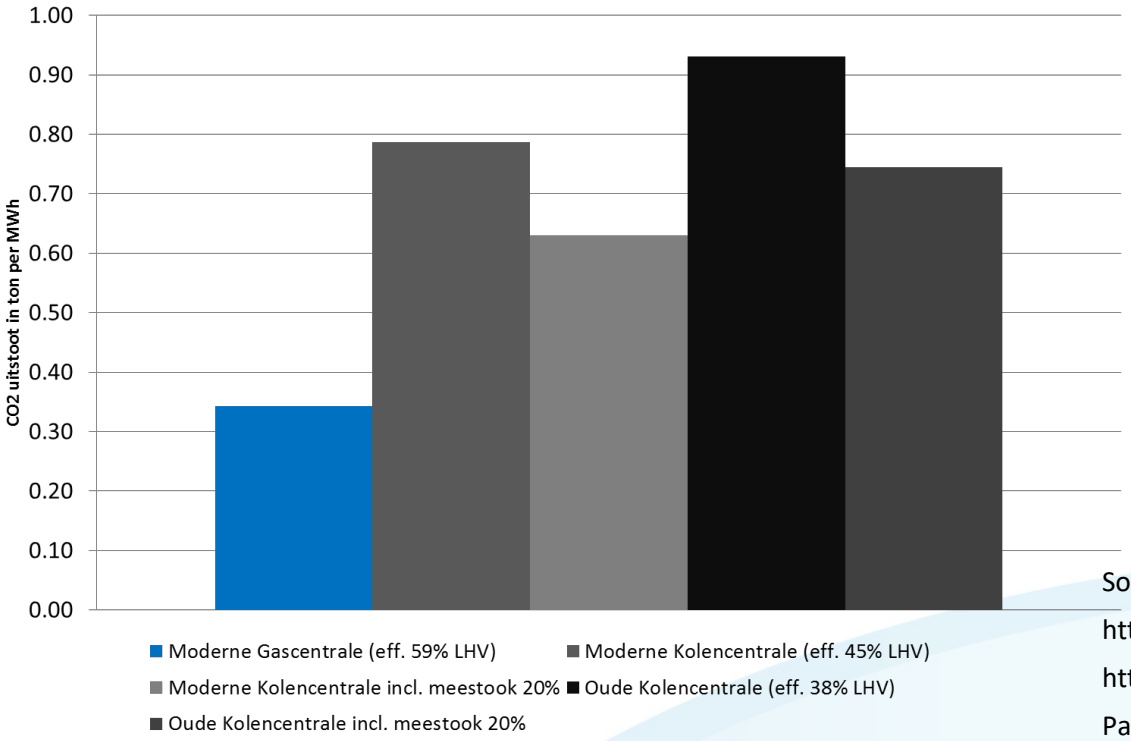
Slight impact on prices

- The effect of a coal tax on wholesale prices is slight (2 per cent) and consequently also on end-user prices.
- A coal tax will have less of an effect on prices than a high CO_2 price.

Higher Government revenues

- A coal tax will result in higher government revenues from the coal tax itself and a slight saving on the sustainable energy subsidy (SDE+).

Gas-fired power plants: lower CO_2 emissions than coal-fired power plants

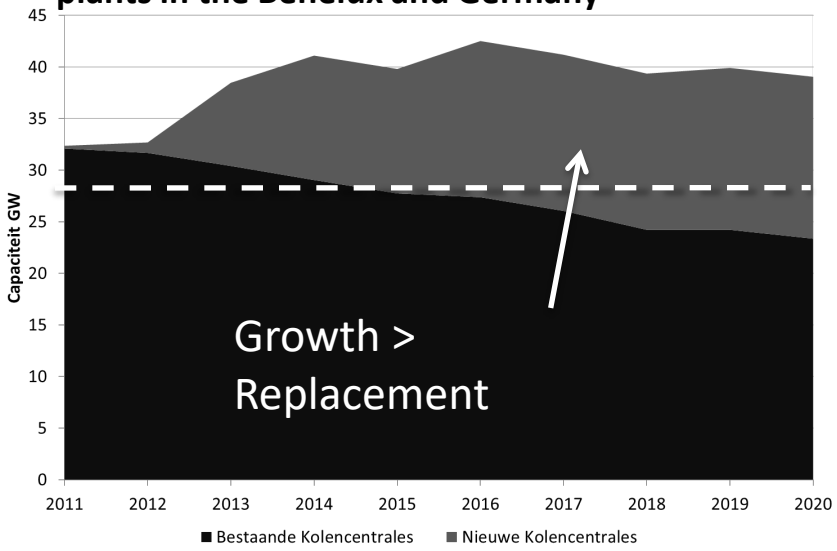


Sources: team analyses, http://www.enecogen.com/Pages/Default.aspx, http://acm.eionet.europa.eu/docs/ETCACC_TechnPaper_2003_10_CO2_EF_fuels.pdf

- CO_2 emissions from gas-fired power plants are substantially lower than from old and new coal-fired power plants (45 to 70 per cent lower).
- Adding and including the combustion of biomass reduces CO_2 emissions from coal-fired power plants, but not at the same level as from gas-fired plants.

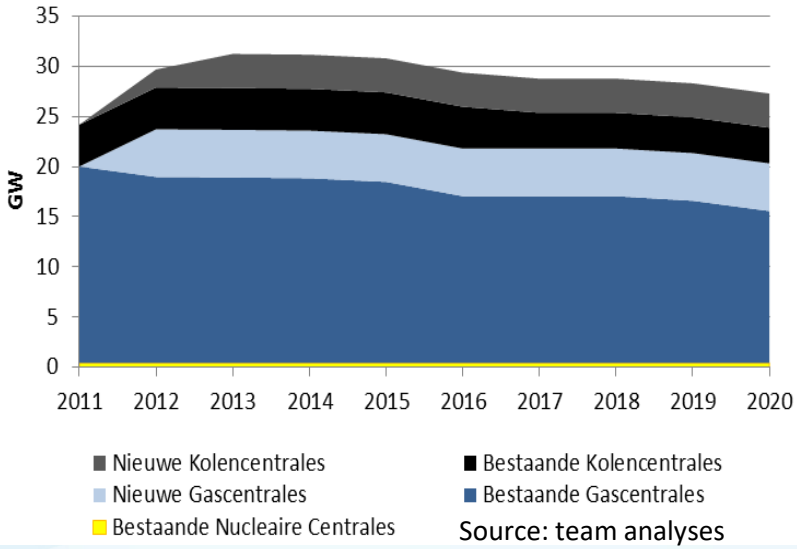
If policy does not change, available capacity of coal-fired power plants in NL will double

Development of capacity of coal-fired power plants in the Benelux and Germany



Source: team analyses

Development of available capacity in the Netherlands



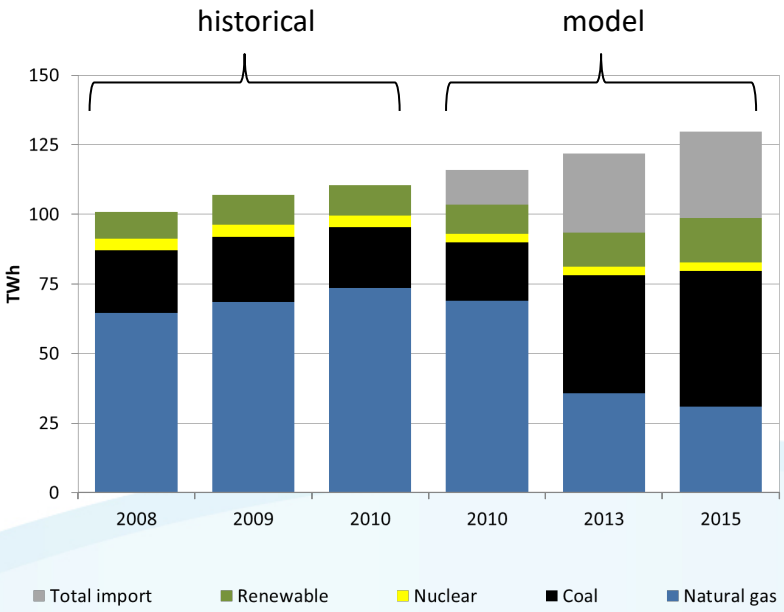
Source: team analyses

- Total coal capacity in the Benelux and Germany will increase until 2016, by 15,388 MW over the entire period from 2010 to 2020 (exclusive of lignite capacity). This mainly refers to power plants already under construction. Plans for construction of new power plants in the period from 2017 to 2020 are very advanced.
- Subsidies for addition and inclusion of biomass ensure it remains viable to use older coal-fired power plants. Our analysis reveals that the business case in which biomass is added and included in the combustion process is viable in particular for old coal-fired power plants from a compensation level of EUR 45 per MWh.

Electricity production is impacted by trend changes

- Total electricity production has slightly increased and this growth is likely to continue.
- While the gas share did increase until 2010, market conditions have changed dramatically since then.
- The price of CO_2 has decreased by more than 50 per cent compared to 2010, the price of natural gas has increased by 20 per cent, while the price of coal has decreased by 5 per cent. This means the gap between the marginal costs of coal vis-à-vis gas has further increased.
- More coal-fired power plants will come on-line and the Netherlands will import more inexpensive power) from Germany (surplus of solar PV and wind energy).
- So if no policy changes are implemented, the production of coal-fired power plants will rise further while that of natural gas-fired power plants will decrease.

Historical and forecast electricity production in the Netherlands



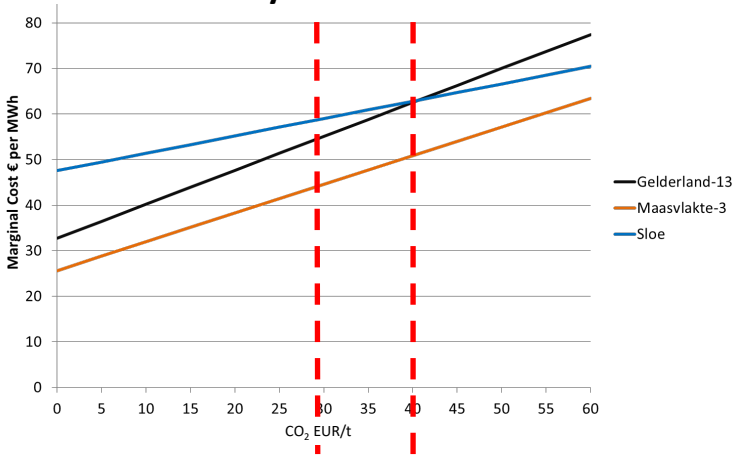
Source: CBS, team analyses

Switch from "old" coal to gas from a CO_2 price of EUR 40

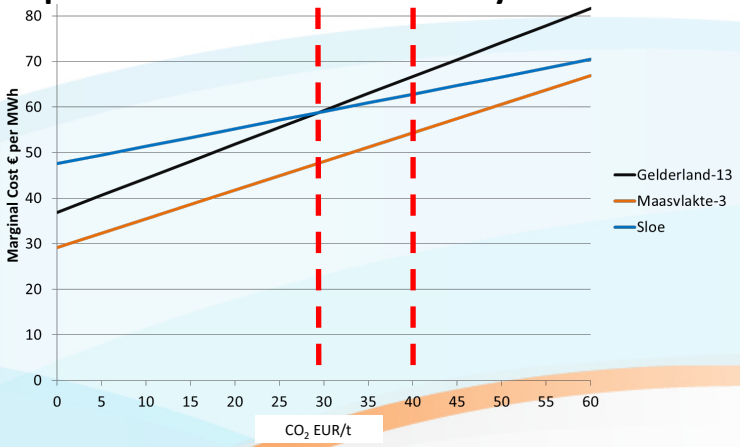
- The moment when it is viable to switch from an old coal-fired power plant such as Gelderland-13 to a modern stand-alone gas-fired power plant such as Sloe is when the CO_2 price is EUR 40 per tonne. This is somewhat lower for combined heat and power plants.
- **A coal tax rate of EUR 13.73 per tonne reduces the moment when it is viable to switch to a CO_2 price of EUR 29 per tonne.** The Parliamentary Spring Agreement included a resolution to terminate exemption for coal-fired power plants in respect of this tax.
- For a new coal-fired power plants such as Maasvlakte-3, the switch moment is still above EUR 60 per tonne.

N.B. Calculation includes addition and inclusion of biomass by Gelderland-13 and Maasvlakte-3, for which it is assumed that compensation for co-firing is EUR 45 per MWh.

Without coal tax a CO_2 price of EUR 40 per tonne is necessary for the switch



At a coal tax rate of EUR 13.73, a CO_2 price of EUR 29 per tonne would be necessary for the switch

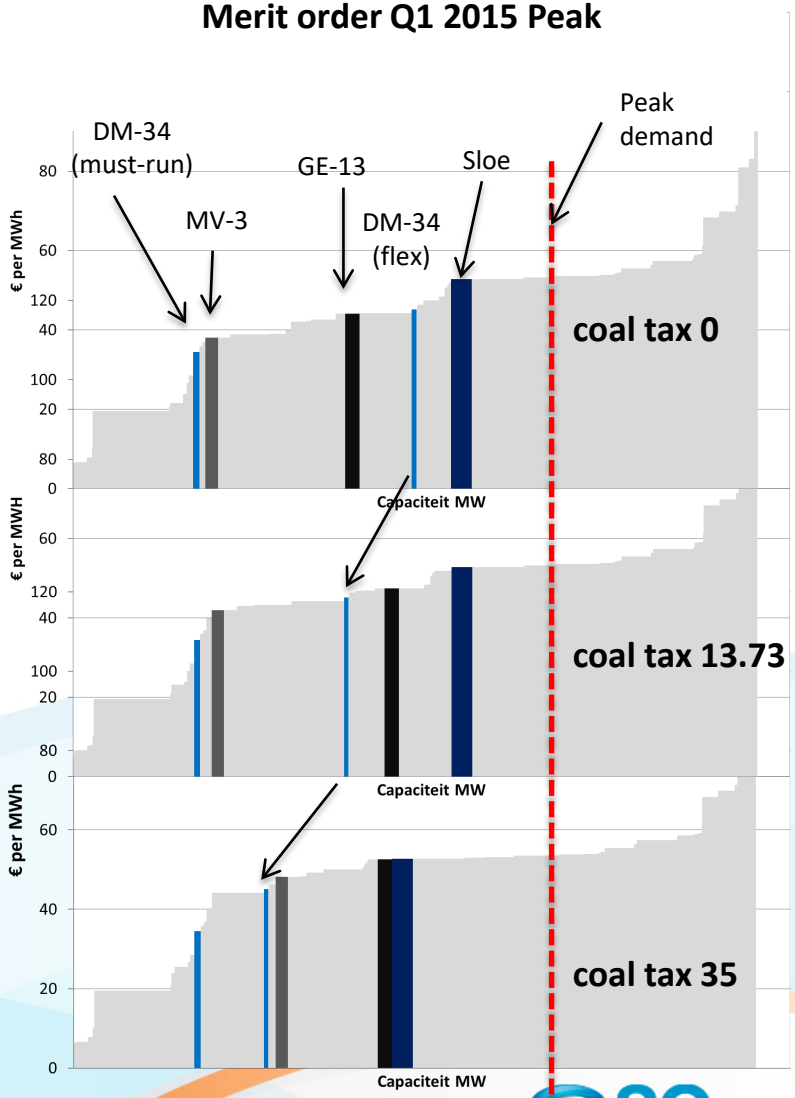


Source: team analyses

Coal tax increases the use of gas-fired power plants

- A coal tax of EUR 13.73 per tonne results in increased competition of the flexible part of combined heat and power plants.
  The moment it is viable to switch between new gas-fired power plants and old coal-fired power plants in the merit order is ever approaching.
- At a level of EUR 35 per tonne, gas-fired power plants are (in the example of the new Sloe power plant) break-even with old coal-fired power plants. In practice, gas-fired power plants are then preferable owing to their lower start/stop costs , for example.

Merit order Q1 2015 Peak



DM-34: gas-fired combined heat and power plant in Diemen;
MV-3: new coal-fired power plant Maasvlakte-3;
GE-13 : old coal-fired power plant Gelderland-13;
Sloe: new gas-fired power plants in the Province of Zeeland

N.B. The adjacent graphs do not take renewable energy production and import capacity into account.

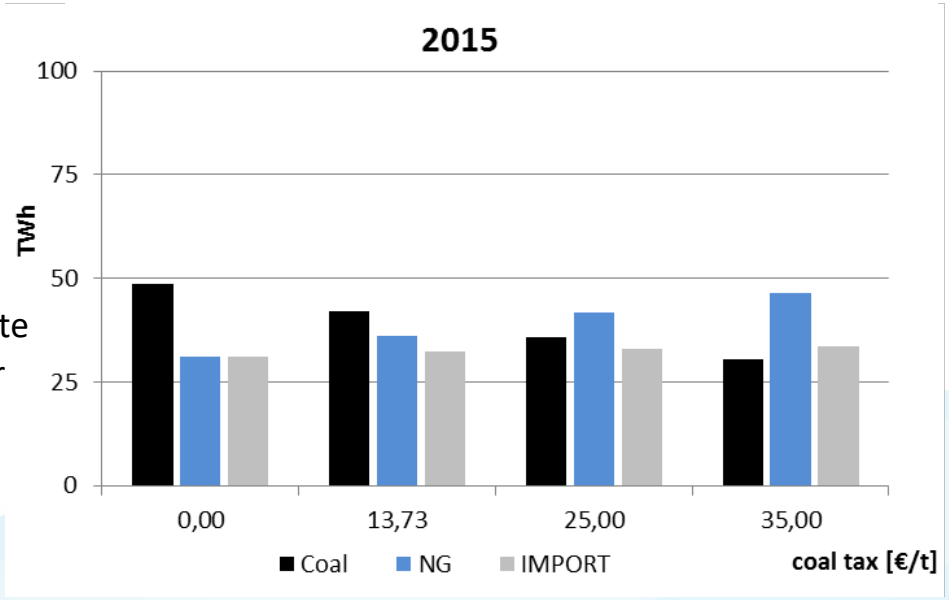
Source: team analyses (model output)

Coal tax: higher e-production from gas and limited import growth

Higher electricity production from gas-fired power plants

- At a coal tax rate of EUR 13.73 per tonne, coal-fired power plants will partly be replaced by gas-fired power plants (combined heat and power plants in particular).
- Electricity production from gas is increasing, particularly owing to the increased use of combined heat and power plants. At a coal tax rate of EUR 35 per tonne, stand-alone gas-fired power plants such as Sloe are just competitive.
- The import of electricity increases to a limited degree in all scenarios. This is attributable to the already extensive use of cross-border capacity.

Annual production of Dutch gas and coal-fired power plants and the change in imports at different levels for coal tax

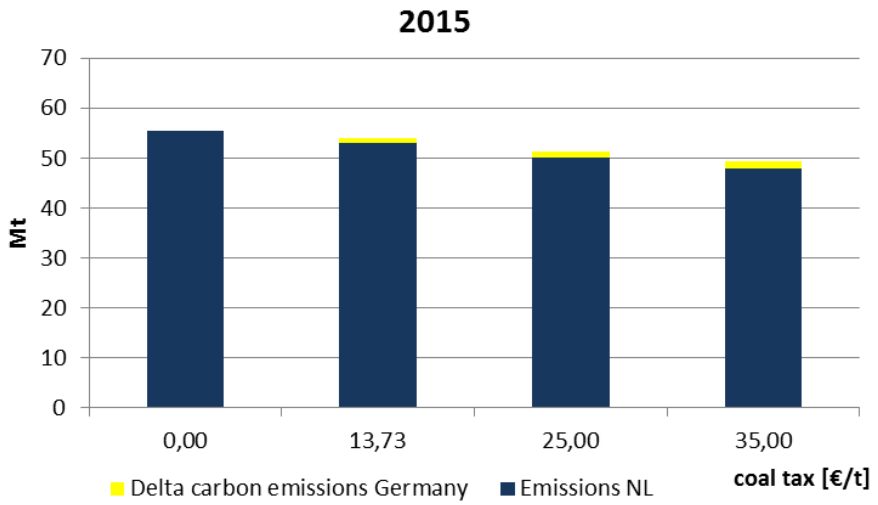


Source: team analyses

Coal tax; lower CO_2 emissions including the effect of imports

- There will be 3 per cent less CO_2 emissions in 2015 as a consequence of the coal tax (EUR 13.73 per tonne).
- The "imported" CO_2 emissions are limited, as the coal tax has a limited effect on imports.
- In the case of high CO_2 prices, the CO_2 reducing effect would be much more pronounced on account of the significant increase in the operational level of gas-fired units.
- The impact on NO_x emissions has not been investigated, but it is not expected to be a negative one.

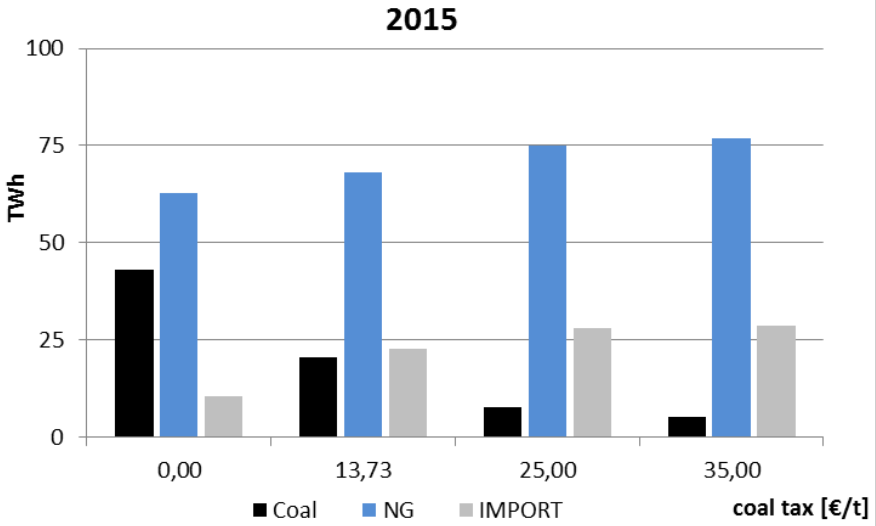
CO_2 emissions from Dutch electricity production under various scenarios for coal tax and the change in emissions of imports



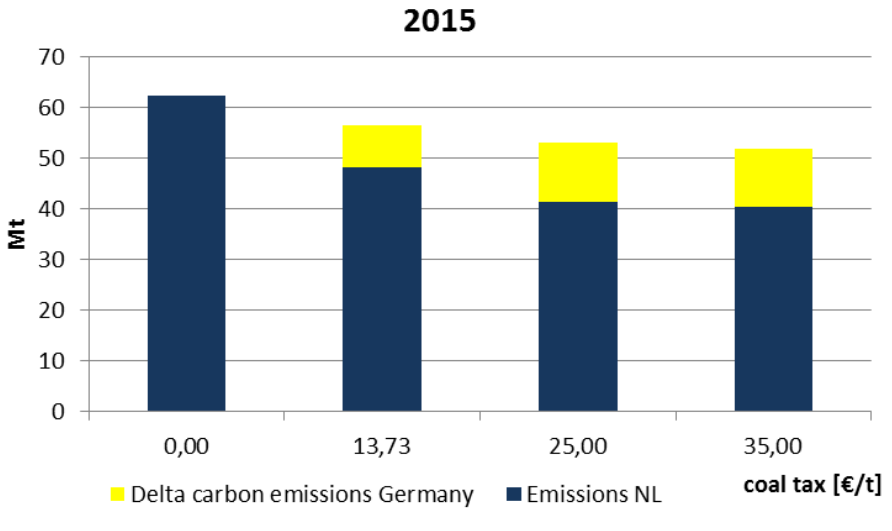
Source: team analyses

The impact of coal tax when CO_2 prices are high (EUR 32 per tonne)

Annual production of Dutch gas and coal-fired power plants and the change in imports at different levels for coal tax



CO_2 emissions from Dutch electricity production under various scenarios for coal tax and the change in emissions of imports

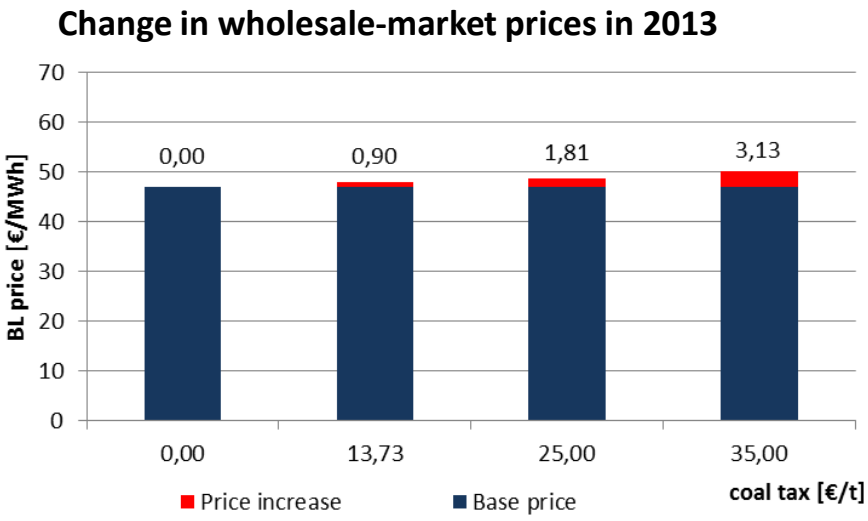


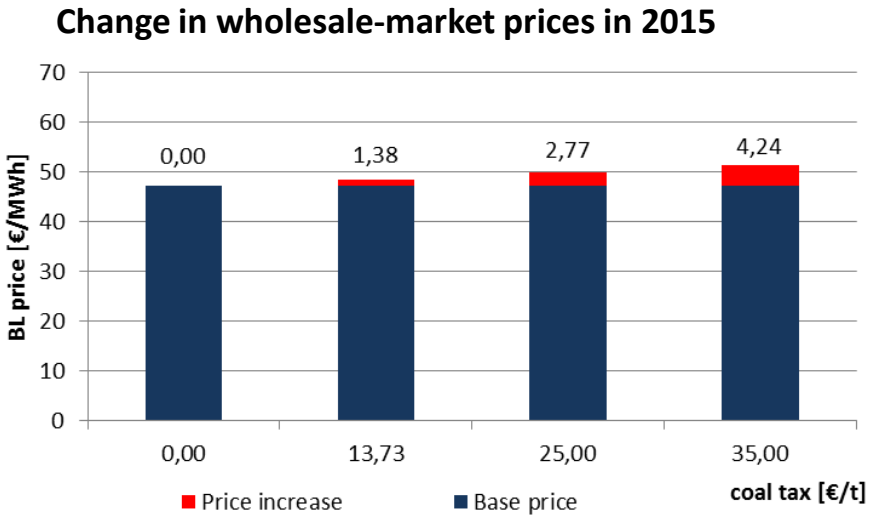
- A combination of high CO_2 prices and a high coal tax results in a significant production increase by gas-fired power plants.
- In this scenario, the Netherlands would import less and export more compared to a scenario with low CO_2 prices (CO_2 emissions in NL would also increase, but would decrease in other countries).

- Compared to a scenario with low CO_2 prices, the CO_2 intensity of additional imports would increase on account of the high prices in the Netherlands.
- But this increase will be amply offset by the greater use of gas-fired power plants in the Netherlands (more than 75 per cent rise).

source: team analyses

Effect on wholesale prices is slight





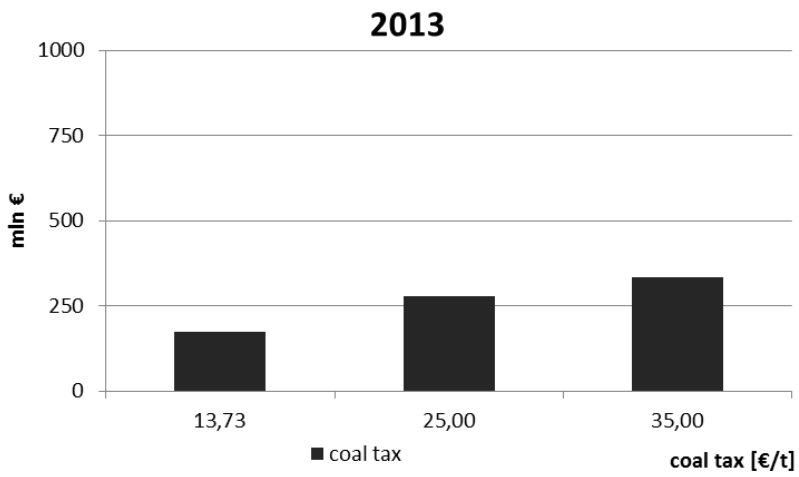
Source: team analyses

Conclusions

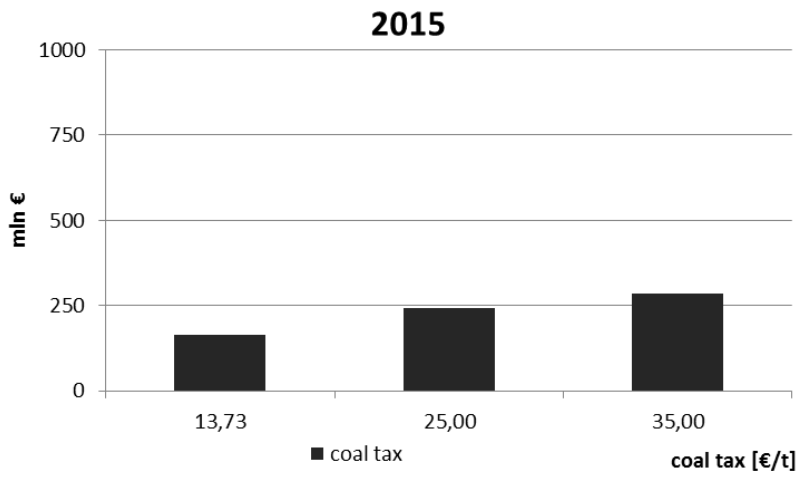
- A coal tax rate of EUR 13.73 per tonne will have a minimal effect on the wholesale prices of approx. 2 per cent; for consumers this means a rise of approx. 0.5 per cent (a factor of 4 lower).
- A rise in the coal tax rate to EUR 25 per tonne and EUR 35 per tonne is likely to result in an increase in wholesale prices of 6 per cent and 9 per cent respectively in 2015. The increase in 2013 will be 4 per cent and 7 per cent.
- A higher CO_2 price would have a higher impact on prices than a coal tax. A rise in the CO_2 price from today's EUR 7 to EUR 32 per tonne results in an increase in the wholesale price of almost 30 per cent.

Higher revenues for Government

Government revenues in 2013



Government revenues in 2015



Source: team analyses

Conclusions

- The extra revenues directly from the coal tax rate of EUR 13.73 per tonne will be EUR 174 mln in 2013. The Parliamentary Spring Agreement mentioned EUR 115 mln, while our analyses reveal a higher figure.
- If additional volumes to be used by gas-fired power plants come from Dutch resources, they will result in additional benefits.
- In addition, and on account of the slight increase in wholesale prices, there will be an SDE “windfall” of between EUR 5 mln (coal tax rate of 13.73 in 2013) and EUR 26 mln (coal tax rate of 35 in 2015).

Annex

- Key assumptions
- Quantifying the impacts of a Dutch Coal Tax

Key assumptions

- The analysis takes typical power plants as its basis, representing a group of power plants for which more or less the same conclusions may be drawn.
  - Old coal-fired power plant: Gelderland-13 or G-13, efficiency: 38% (LHV)
  - New coal-fired power plant: Maasvlakte-3 or MV-3, efficiency: 45% (LHV)
  - New gas-fired power plants: Sloe, efficiency: 59% (LHV)
  - Combined heat and power plant: Diemen 34, efficiency: 59% (LHV)
- The prices for the key commodities are:
  - Coal $ 95 per tonne
  - Gas $ 25.25 per MWh
  - Currency 1.25 $/€
  - CO_2 € 7.5 per tonne
- Start/stop costs are not included in the analysis
- 2015 is taken as the basis for all analyses, unless otherwise indicated
- The standard assumption is that coal-fired power plants include biomass in their combustion mix insofar as this is economically feasible at a level of compensation for an unremunerative maximum EUR 45 per MWh
- CO_2 content: for coal this is assumed to be 9.83 kg per GJ, and for gas 5.62 kg per GJ (source: IEA)