PBL Netherlands Environmental Assessment Agency

Climate adaptation in the energy sector: the lighthearted approach of the Netherlands

IEA EGRD Workshop RD&D Needs for Energy System Preparedness and Resilience

13 November 2013 | Pieter Boot

Content

- Policy context
- Observed and future climate change in the Netherlands
- Possible effects on energy demand
- Effects on energy supply
- Adaptation approach in the Netherlands
- Expected costs
- Conclusions

Policy context (1)

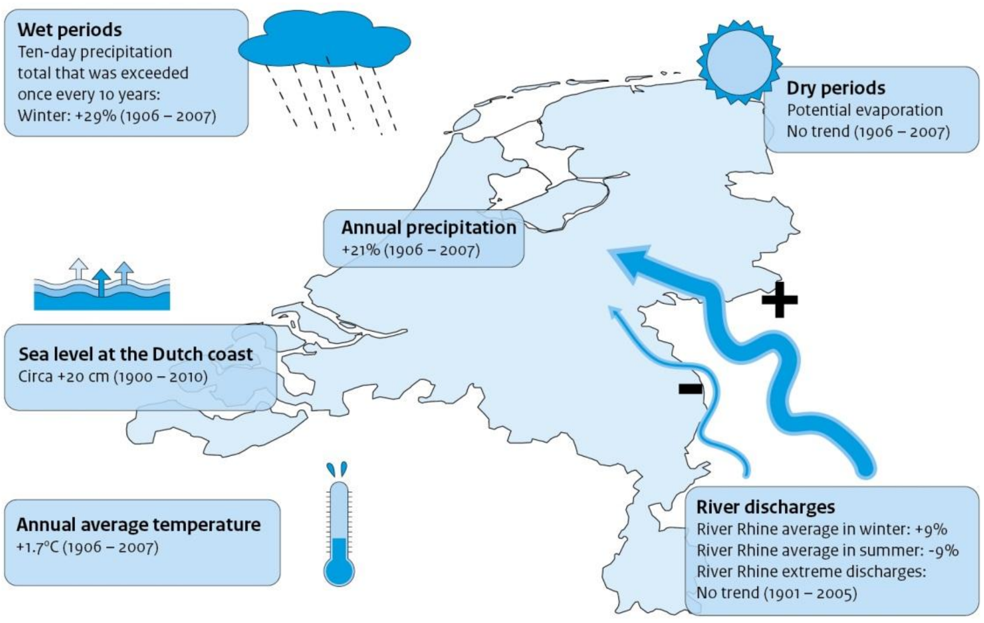
- 2007 National adaptation strategy, without follow up or specific policy instruments, except:
- 2010 Delta programme on water (flooding from sea and rivers; water management; spatial planning) with large budget and high ranking Delta Commissioner, adopted without opposition in Parliament (2011)
- 2012 Court of Audit: broader adaptation agenda is lacking
- 2013 (April) Communication of European Commission on Climate Adaptation: Commission will prepare Adaptation preparedness Scoreboard with key indicators (2014); Member States will report; Commission will assess whether action being taken by MS is sufficient (coverage and quality of national strategies). If not, it will propose legally binding instrument

Policy context (2)

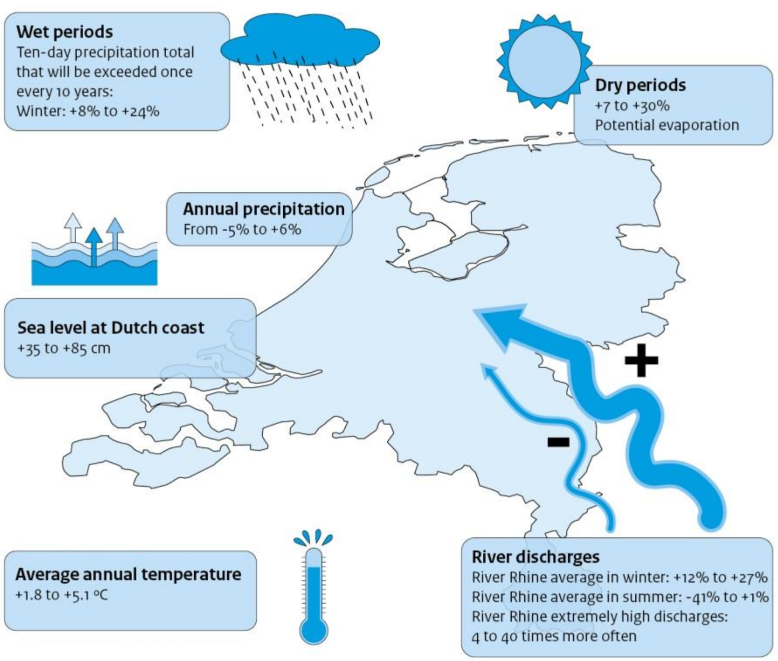
- 2013 (October) Government Climate Report (Klimaatagenda):
  - joint approach of mitigation and adaptation;
  - risk analyses of transport energy, ICT, agriculture and fisheries, health needed;
  - adaptation strategy, dovetailed with Deltaprogramme (water), will be presented before 2017.
- PBL/KNMI will look at climate adaptation risks in these sectors and interactions in 2014/15

Observed & projected changes

Observed climatic changes, 1900 – 2010



Possible climate changes for the 1990 – 2100 period, according to KNMI'06 scenarios



Possible effects on energy demand in Central Europe North/NL

- European Project PESETA 2 (Joint Research Centre): bottom up modelling approach of energy demand for 2071-2100 time horizon, without taking possible tipping points into account: only gradual changes
- Possible impact Central Europe North (Benelux, Germany, Poland) energy demand in 2050
  - Reference Scenario – 19/21% (mean, reference)
  - Two degrees Scenario – 11/16% in main variants (central run, mean)
  - Consists of one quarter additional cooling and five quarters less heating
- Degree days in Netherlands –9/14% in 2030 and -15/20% compared with 1995-2009 (medium scenario) leads to energy demand -8% in 2050 in the buildings sector (PBL 2012, 2013)

Possible effects on energy supply in Europe

Qualitative link between technologies and climate change effect

Technology	Δ air temp.	Δ water temp.	Δ precip.	Δ wind speeds	Δ sea level	Flood	Heat waves	Storms
Nuclear	1	2		-	-	3	1	-
Hydro	-	-	2	-		3	-	1
Wind (onshore)	-	-	-	1	-	-	-	1
Wind (offshore)	-	-	-	1	3	-	-	1
Biomass	1	2	-	-	-	3	1	-
PV	-	-	-	-	-		1	1
CSP	-	-	-	-	-	1	-	1
Geothermal	-	-	-	-	-	1	-	-
Natural gas	1	2	-	-	-	3	1	-
Coal	1	2	-	-	-	3	1	-
Oil	1	2	-	-	-	3	1	-
Grids	3	-	-	-		1	1	3

Note: 3 = Severe Impact, 2 = Medium Impact, 1 = Small Impact, - = No Significant Impact;

Ecorys, Investment needs for future adaptation measures in EU, 2011

Energy vulnerability matrix

Highest UK risks in:

- Renewable energy (precipitation, wind, storm – but less understood yet)
- Transmission lines and pylons (storms, wind, precipitation, temperature)
- Substations (precipitation, temperature)
- Cooling water (IEA: in 2040s a '2003 summer' could occur every two years)
- Computer systems (temperature)

Broad agreement on most risky parts of electricity system

Be aware of long lag periods: +2° C in 2050 is +3°C in 2100

Source: URS, Adapting Energy, Transport and Water Infrastructure to the Long-Term Impacts of Climate Change, 2010

Adaptation approach in the Netherlands (1)

- Offshore wind:
  - No large experience yet
  - Sea level rise responsibility of investors
  - 1 out of 7 'Topconsortia Knowledge and Innovation in Energy R&D ' looks at extreme waves, more detailed measurement, foundations, grid resilience, but Adaptation no formal R&D issue
- Network:
  - High voltage grid (150 kV) already partly underground due to local opposition of new grids; operator Tennet made comprehensive analysis of potential impacts of climate change after July 2010 storm; no large black outs in October 2013 storm
  - Distribution grid underground; 2.5% annual maintenance; smart grids/decentralized generation main challenge
  - Grid resilience has to be enforced whatsoever
- Netherlands has 11.7% of high voltage cables underground, against 8.2% in UK, 4% in Germany and 1.9% in France (2007) (IEA-RETD, RES-E-Next, 2013)

Power generation in the Netherlands goes to sea except CHP

Elektriciteitscentrales

Adaptation approach in the Netherlands (2)

- Cooling. Temperature in Rhine river +3°C in past 100 years, of which 1/3 by increased air temperature
- Last serious problems in
  - July 2006 (several days ‘code red/ fase 2’ because of higher Rhine temparature causing insufficient balancing capacity which enables ministry of Water Management to allow generators to use cooling water with higher temperature) and
  - August 2003 (same situation with somewhat lower generation, slightly higher demand, one plant allowed to drain higher temperature water), but additionally less import from France which lead to record spot market prices)
- Flooding by rivers no serious problem yet
- Flooding by increased sea level. New investments (e.g. Rotterdam harbour area) withstands 1 in 10,000 year storms, and takes next 50 years of expected sea level increase into account

Institutional structure of the Netherlands

- 1 high voltage grid company (also in Germany), Tennet, state owned
- 3 large and 5 smaller distribution grid companies, fully unbundled (implementation of legal situation not finalized) , well organized and forward looking
- 5 large scale power generators (3 foreign owned, 2 smaller Dutch); large share of industrial CHP
- Share of local generation still very small
- 1 ministry responsible for energy

Expected costs in Central Europe North up to 2080

- Equal to 1.5 – 1.7% GDP, mainly due to flooding in coastal areas; costs lower if timely measures are taken
- Highest possible costs occur from 2040: in wind offshore (sea level) and grids (storms, temparature); medium in nuclear, natural gas and coal fired power (mainly floods)
- Net costs in 2^{o}C scenario only slightly lower
- Negative welfare effects appear to be small or even positive, as decrease of energy costs could equal costs; in case of timely adaptation measures welfare effect possibly positive
- Energy ranks relatively high in sectors that have to look at adaptation measures, but mitigation regarded as much greater challenge.

Source: European Commission, Impact Assessment Climate Adaptation, part 2, 2013

Conclusions

- Adaptation policy in the Netherlands focusses on water (sea, rivers, spatial planning); no big issue in energy yet
- Observed sea level rise 20 cm, temperature increase 1.7°C, no trend in Rhine extreme discharge. Possible change sea level + 35-85 cm up to 2100, temperature + 1.8°-5.1°C, more extreme Rhine discharges
- Problems in power system (2003, 2006) could be tackled up to now
- Energy demand -8% in buildings sector in 2050 (without looking at extremes)
- Energy vulnerability mainly in grids, offshore wind and floods
- Hypothesis: we have to look at adaptation challenges more carefully because of long-term impact, but the mitigation challenge is greater in next 40 years.