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Considerations of climate related policies and vulnerability of Estonian electricity and heat system development

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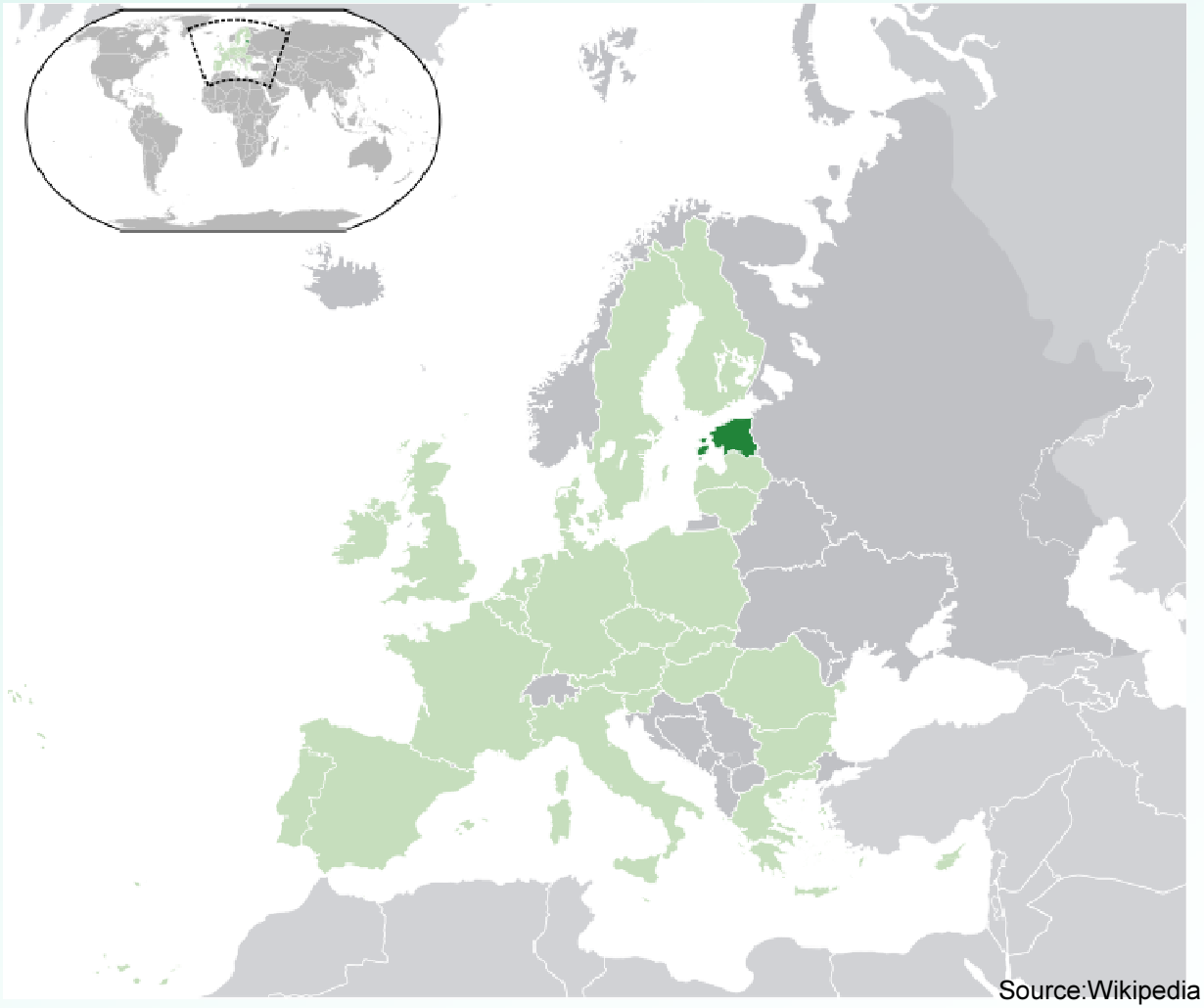
Agenda

- Overview of Estonia's electricty and heat market
- Current policies and considerations of climate change related events
- Examples of possible climate related events
- Future options

Estonia

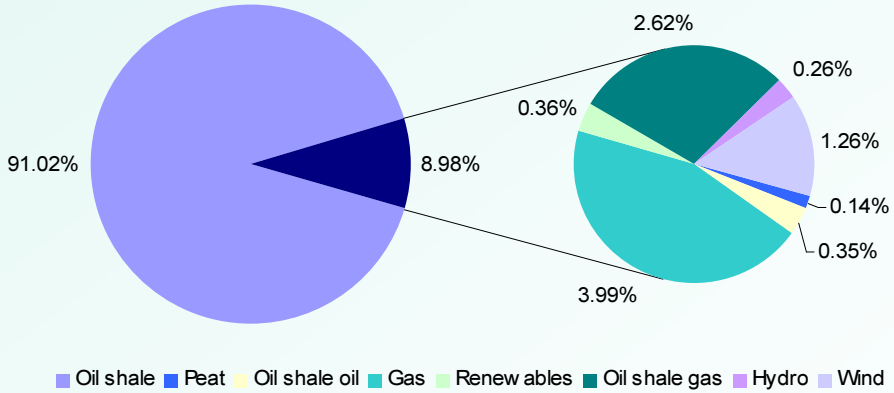
- Small Nordic country: population 1.34 million, area 45 227 km^2
- The average population intensity: 30 persons per km^2
- The average temperature in the summer months is typically 15 – 18ºC; in winter, –4 – –5ºC
- Domestic energy resources: oil shale and its products, peat, wood or other biomass, wind, hydro
- Imported resources: oil products, gas, coal



Source:Wikipedia

Electricity market

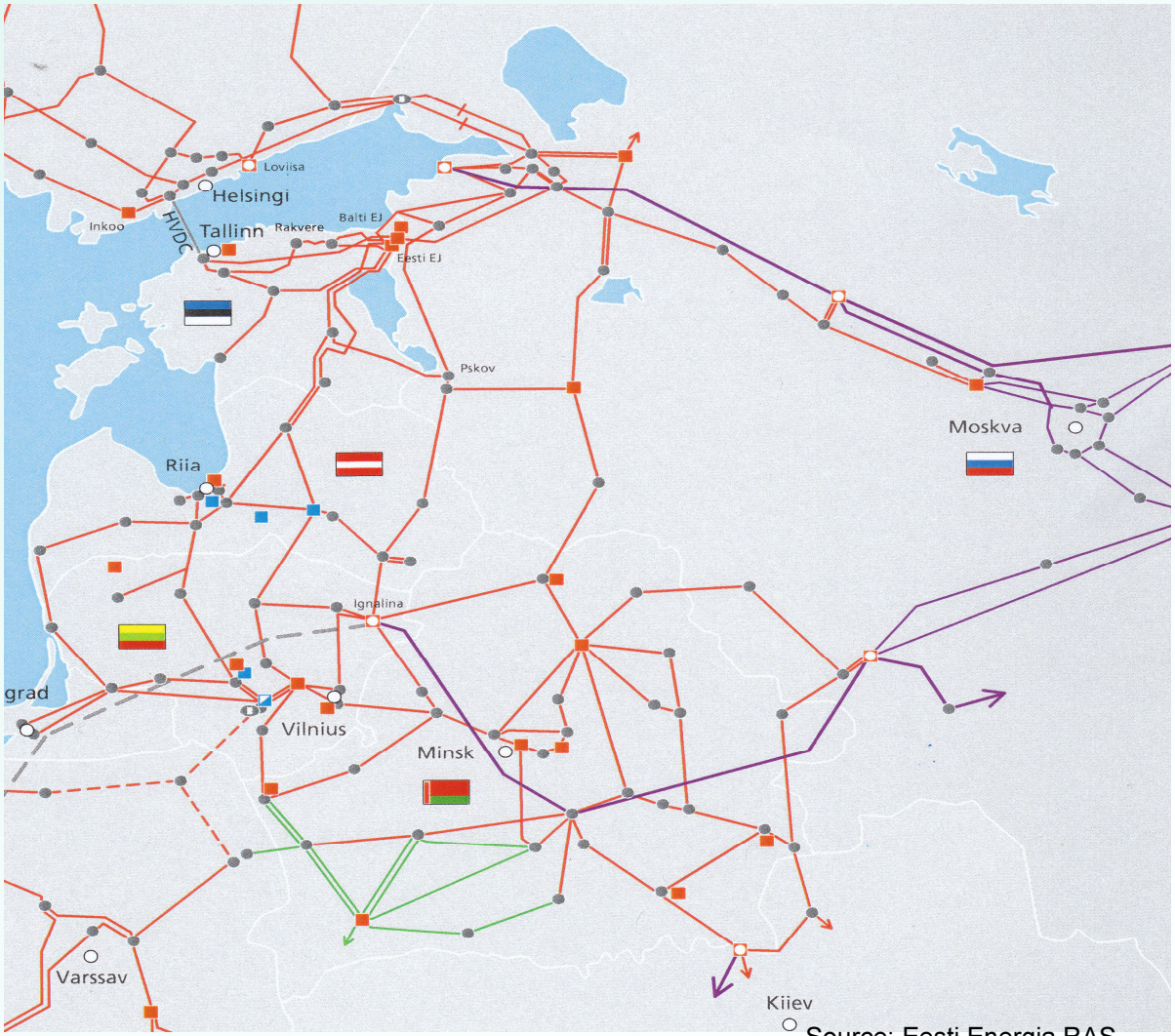
- Net installed capacity in 2008: 2362 MW
- Production in 2008: 9498 GWh
- Consumption in 2008: 7427 GWh
- Losses in 2008: 10.7%
- The difference was exported to Latvia and Finland
- Most of the electricity is produced by two oil shale fuelled power plants located in Northeast Estonia



Electricity production in 2008 according fuel (GWh)
Source: Statistics Estonia

Electricity grid

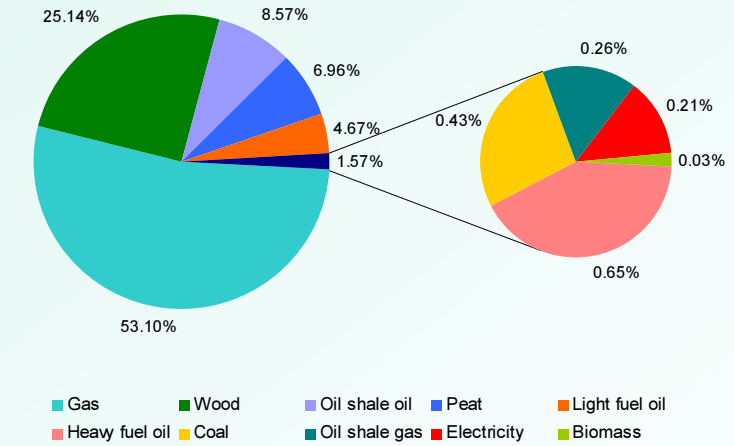
- Estonia's grid is well connected to and also synchronized with the networks of Latvia, Lithuania, Belarus and Russia
- Sea cable Estlink between Estonia and Finland since 2006 – 350MW
- Another sea cable planned – 635MW



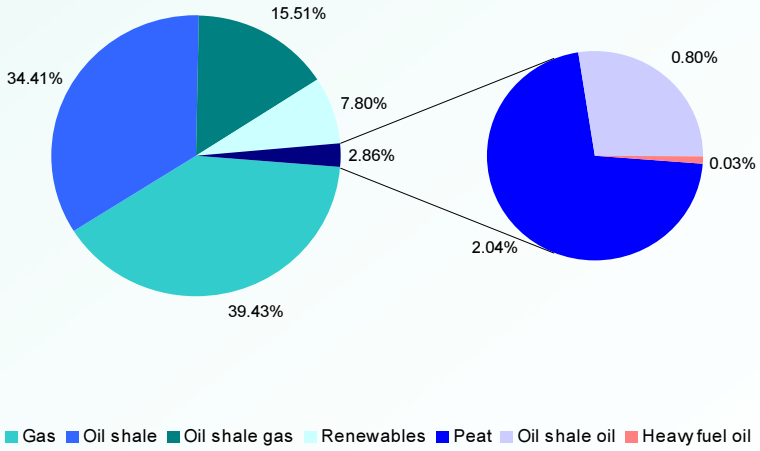
Source: Eesti Energia RAS

Heat market

- Production in 2008: 9240 GWh
- Consumption in 2008: 8284 GWh
- Losses in 2008: 10.3%
- Five CHPs with capacities varying from 23.5 to 100 MW
- Large number of small boilers – 81% <1 MW in capacity
- Most common fuels are gas and wood in boilers and oil shale and gas in CHPs
- Currently there is more capacity installed for heat production than real need



Heat production in boilers by fuel in 2008 (GWh)



Heat production in CHPs by fuel in 2008(GWh)

Source: Statistics Estonia

The energy policy up to this point

- Based on energy independence:
  - No strict CO_2 taxes (Kyoto protocol has no effect on Estonia)
  - Economic and social security
  - Existing capacities
  - Assumes little fluctuation in peak demand growth
  - Trying to decrease the share of gas due to security risks involving Russia as the sole supplier

Current state of analyses about possible effects of climate change related extreme events

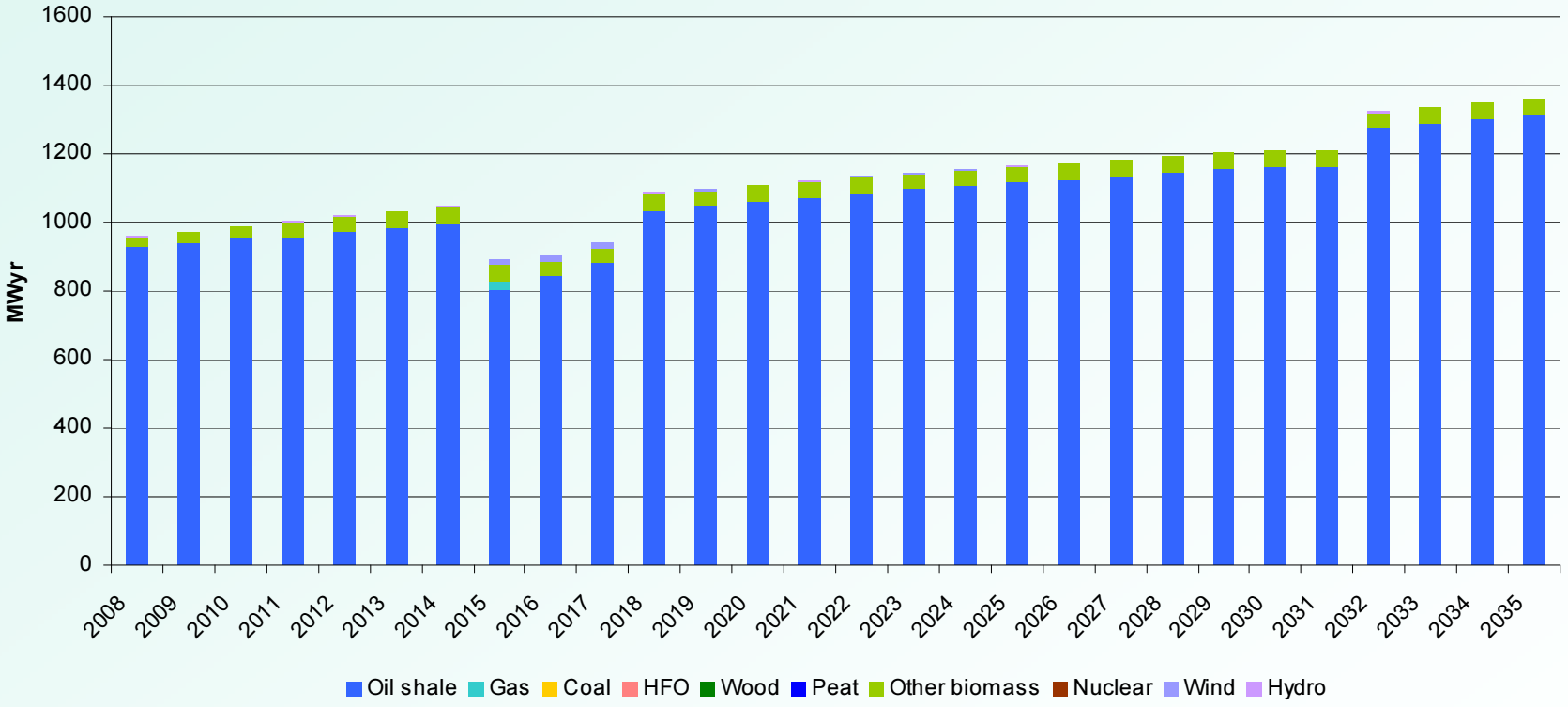
- No impact expected in short term
- Hydro and wind plants are regarded as most vulnerable, but their share is insignificant
- Climate change caused extreme events are not considered in energy development plan nor any other long term plan
- Only possible climate change related threat considered is CO_2 tax

Source: www.flickr.com
user respres

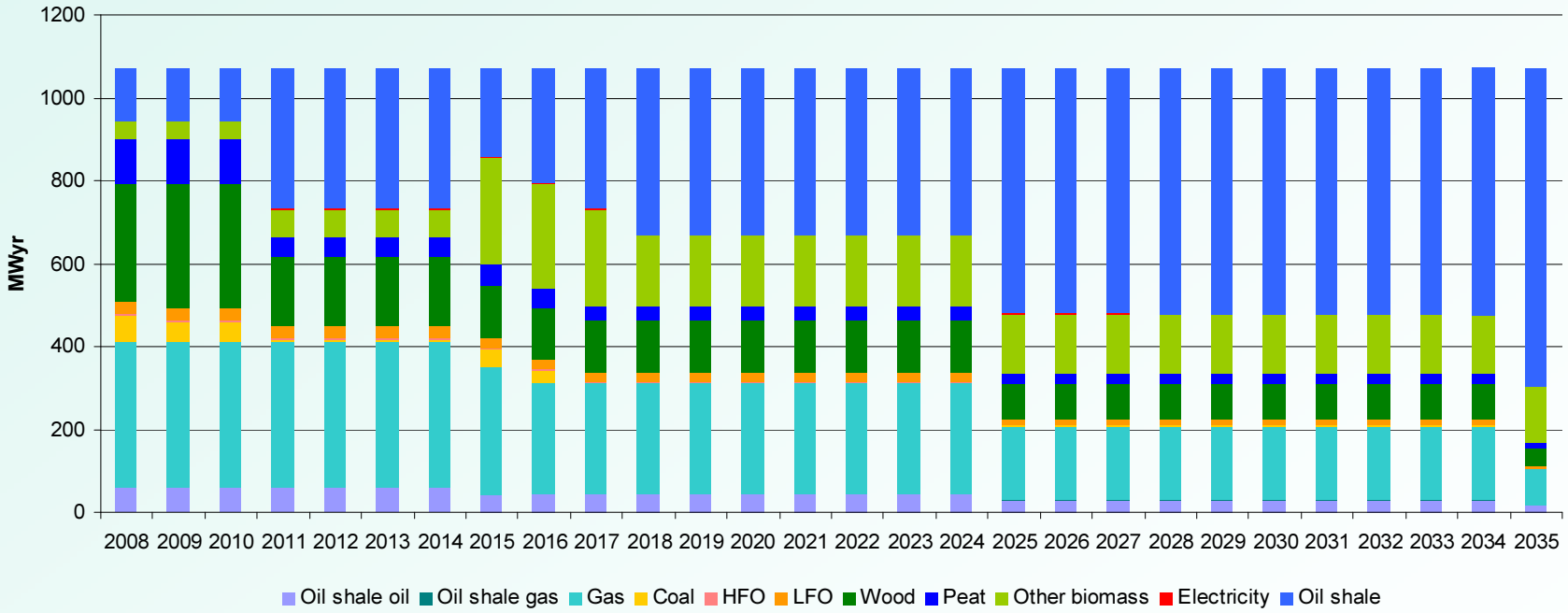
The model for Estonia's heat and electricity supply

- Estonian heat and electricity supply model was created with MESSAGE
- Modelling period 2007-2040, with results reported till 2035
- Entire country is modelled as a single homogeneous region
- Demand of electricity is expected to increase 1.5% annually, demand of heat is expected to stay same.
- Discount rate 5%, all costs in 2008 prices
- Imported fuels prices based on Energy Outlook 2009, investment and operation costs on IEA's *Projected costs of Generating Electricity*, 2010 edition
- CHPs and PPs modelled separately, boilers aggregated by fuel
- CO_2 tax of 20 Euros per tonne starting from 2013 was assumed for base cases

Business-as-usual
Electricity production by fuel



Heat production by fuel



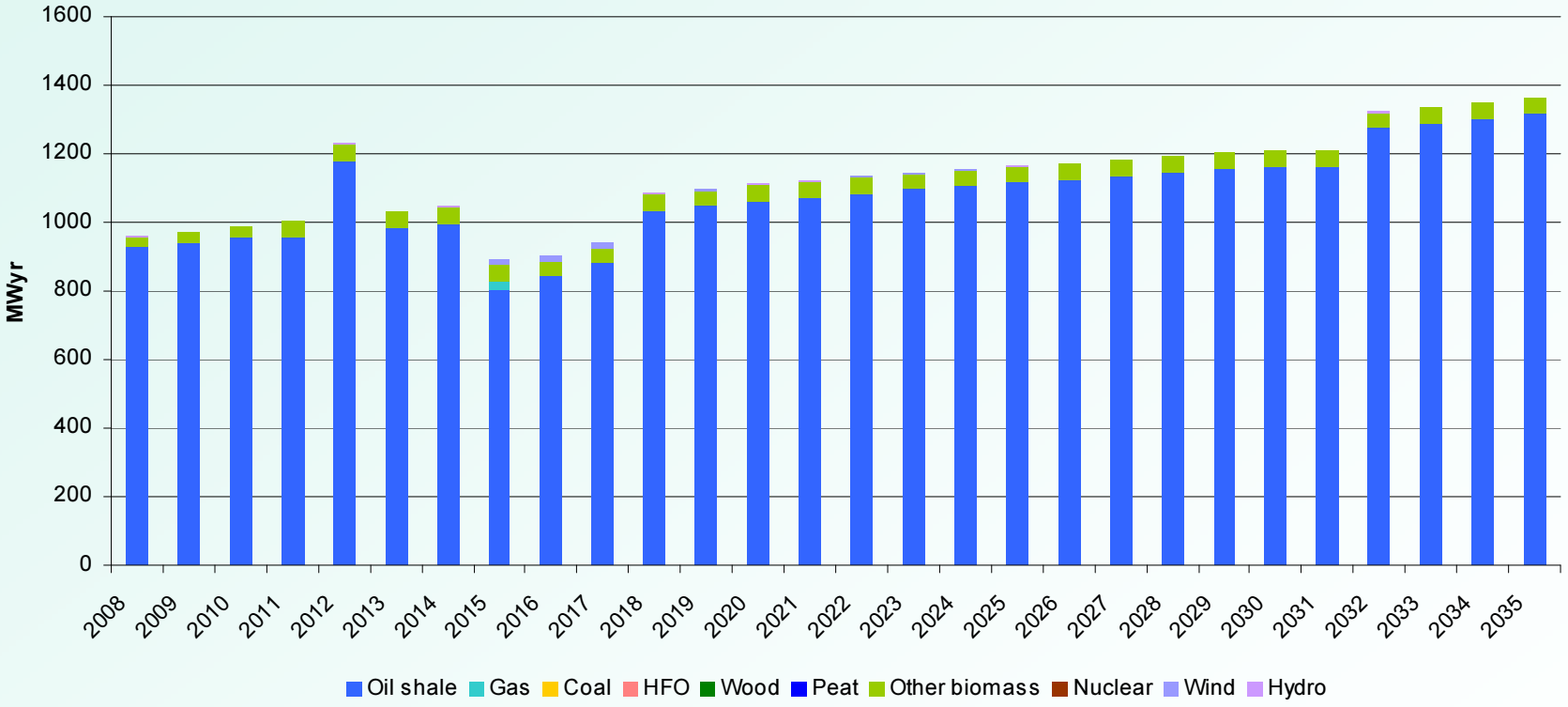
Estimated costs

- Estimated discounted cost of CO_2 emissions from 2008-2035 with tax 20 Euros per tonne starting from 2013 – 2.59 billion Euros
- Estimated with tax 45 Euros per tonne– 5.82 billion Euros

Demand shocks

- Current system can accommodate winter demand increases up to 50 %
- Uncertain economic profitability makes building excess capacity in future questionable
- Imports during demand shocks caused by weather are unlikely, because whole region will experience the same shock

Demand shock at 2012



Conclusions

- Continuing current policy can incur considerable costs
- Only economic indicators are not enough to guarantee the supply of electricity and heat in future

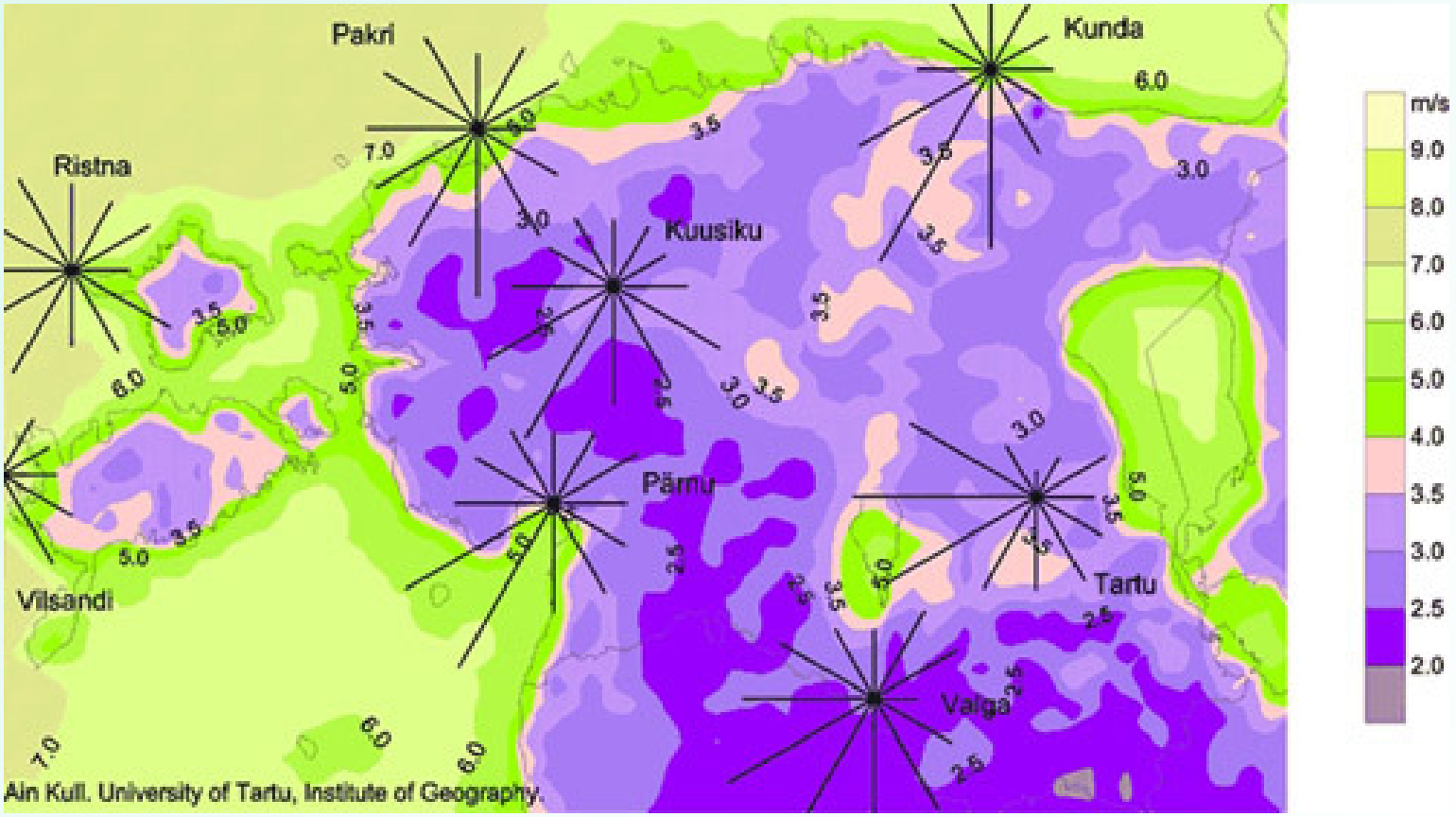
Other technology options for the future

- Increase the share of renewable energy

+ Low CO_2 emissions

- Increasing vulnerability to weather related extreme events as main available renewable resource is wind
- Need to build extra capacity for stabilising windmills

Wind distribution in Estonia



Other technology options for the future

- Nuclear power

+ Low CO_2 emissions, better capability to deal with demand shocks

- High investment cost

- No legislative framework yet


Thank you for your attention!