



# **PAMs Assessment in Finland**

**The evaluation of PAMs related to renewable energy development**

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# Content

1. **Overview** of content and methods
2. Details on individual analysis
3. Summary of results from 2015 update

# Overview of Finnish PAMs in EEA database

- 55 PAMs in total (in the latest 22nd March 2016 dataset)
  - 4 presented in detail here
  
- 1. Promoting **wood chips**
- 2. Promoting the use of **biofuels in the transport** sector
- 3. Promoting **wind power**
- 4. Promoting **biogas in electricity and heat** production
- 5. Promoting biogas in road transportation
- 6. Promoting liquid biofuels in heating

# Overview of socio economic evaluation

- 'Impact' research program from 2010 to 2012
  - Estimates with complex tools: energy system model TIMES VTT and macroeconomic model VATTAGE
  - Development of simplified methods for lighter annual updates
- A simplified tool and annual updates 2013 onwards

## Overview of methods

- GHG emission reductions cannot be measured
  - Reductions are compared to reference scenario / baseline,
  - Estimates limited to emissions in Finnish ETS + ESD
  
- Costs as actual costs in Finnish state budget
  
- Employment effect estimated as a net change of employment in Finland

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## Measure 1: Details on promoting wood chips

- Very important policy measure for Finland
  - **Target** to increase the consumption of wood chips to 13,5 Mm<sup>3</sup> by 2020
  - Consumption ~1 Mm<sup>3</sup> at 2000 and 6,2 Mm<sup>3</sup> at 2010
  
- Wood chips (forest residues)
  - **Replace mainly peat** in co-generation of heat and power (CHP), but
  - also other fuels both directly and through market effects
  
  - Are supported by several instruments targeting both harvesting and utilization
  
  - Positive employment effect includes harvesting and machinery industry
  - Negative employment effect includes peat harvesting and machinery

## Measure 2: Details on biofuels in transportation

- **Target** to increase the share to 20% of road transport fuels by 2020 (including double counting)
  
- Transport biofuels
  - **Replaces other transport fuels** reducing emissions, but
  - feedstocks and manufacturing produce emissions
  
  - Is supported mainly by lower tax (€snt / litre) and mandatory blending target
  
  - Employment effect includes
    - Collecting/harvesting the raw material (if domestic raw material)
    - construction of new production capacity, and
    - annual operation



## Measure 3: Details on promoting wind power

- **Target** to increase the capacity to 2500 MVA by 2020
  
- Wind power
  - **Replaces other electricity generation** on Nord pool electricity market
  
  - is supported mainly by feed in tariff
  
  - Employment effect includes
    - construction of new capacity,
    - operation of all capacity, and
    - Manufacturing depending on % of domestic wind power

## Measure 4: Details on biogas in power&heat

- **Target** to increase electricity production from biogas by 140 GWh by 2020
  - Biogas reactors produce almost 3x more heat
  - Target excludes landfill gas recovery
  
- Power and heat production from biogas
  - **Replaces local heat production** in cities, villages and farms
  - Replaces other electricity generation on Nord pool electricity market
  
  - is supported mainly by feed in tariff and investment subsidies
  
  - Employment effect not estimated. Often additional work supporting existing jobs at rural areas.

## Central assumptions as numbers

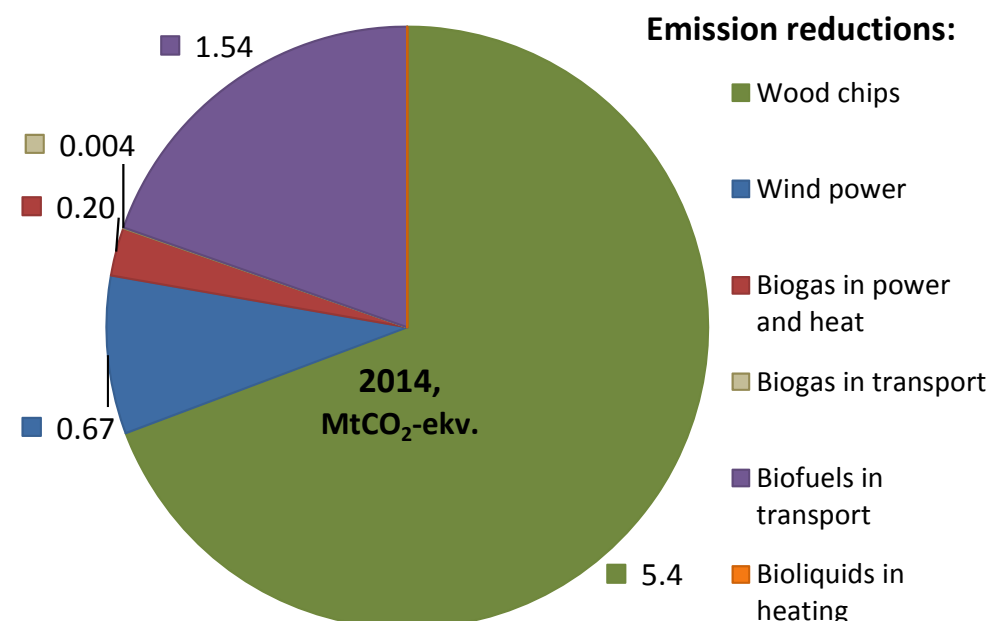
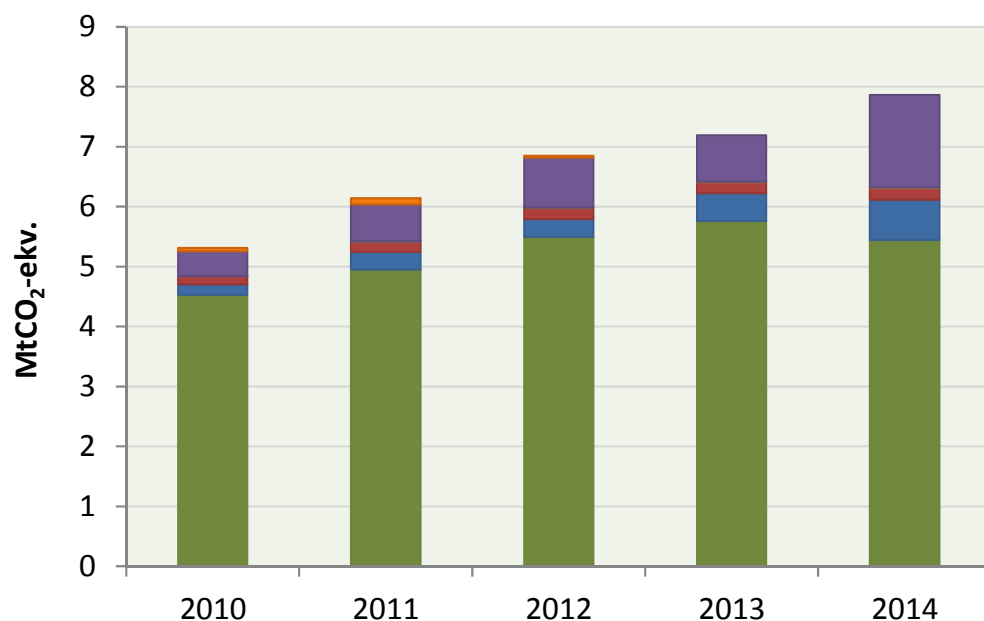
- **GHG replacement** (increasing amount of renewables will lower these)
  - 350 gCO<sub>2</sub>/kWh<sub>fuel</sub> (wood chips in power and heat)
    - 97% of this in ETS
  - 600 gCO<sub>2</sub>/kWh<sub>electricity</sub> (wind power, biogas)
  - 240 gCO<sub>2</sub>/kWh<sub>fuel</sub> (biogas)
- **Net employment effect** (increasing efficiency may lower these)
  - Wood chips – peat: net employment 0.05 work year / GWh<sub>fuel</sub>
  - Wind power (manufacturing depends on domestic share, other fully domestic)
    - Infrastructure: 0.7 work year / new MW
    - Project management, design, consultancy etc: 0.1 work year / new MW
    - Wind mill manufacture: 3 work year / new MW
    - Operation and maintenance: 0.4 work year / existing MW
  - Not enough public data on bioliquid feedstocks

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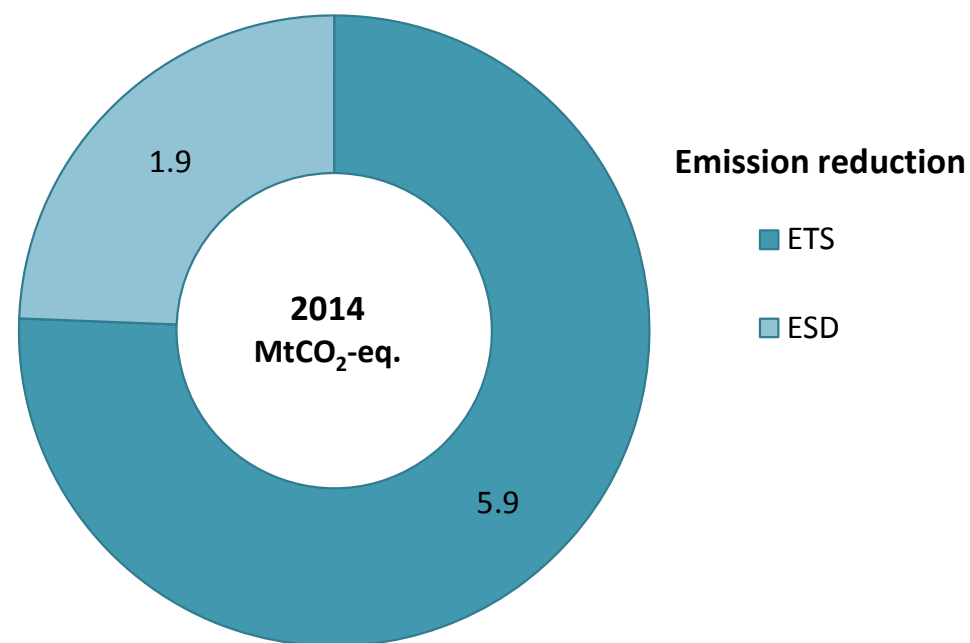
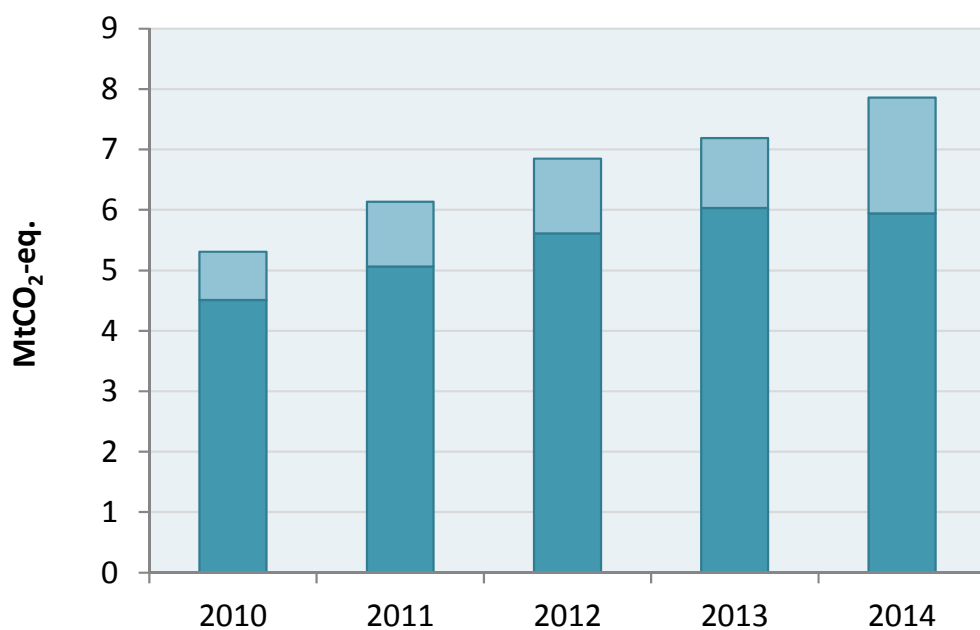
## Summary of results: emission reductions 1/2

- Wood chips contribute the 70 % of the GHG reductions from these measures in the ETS and ESD sectors
  - Change is compared to 2010 when there was relatively small amount of wood chips and wind power.



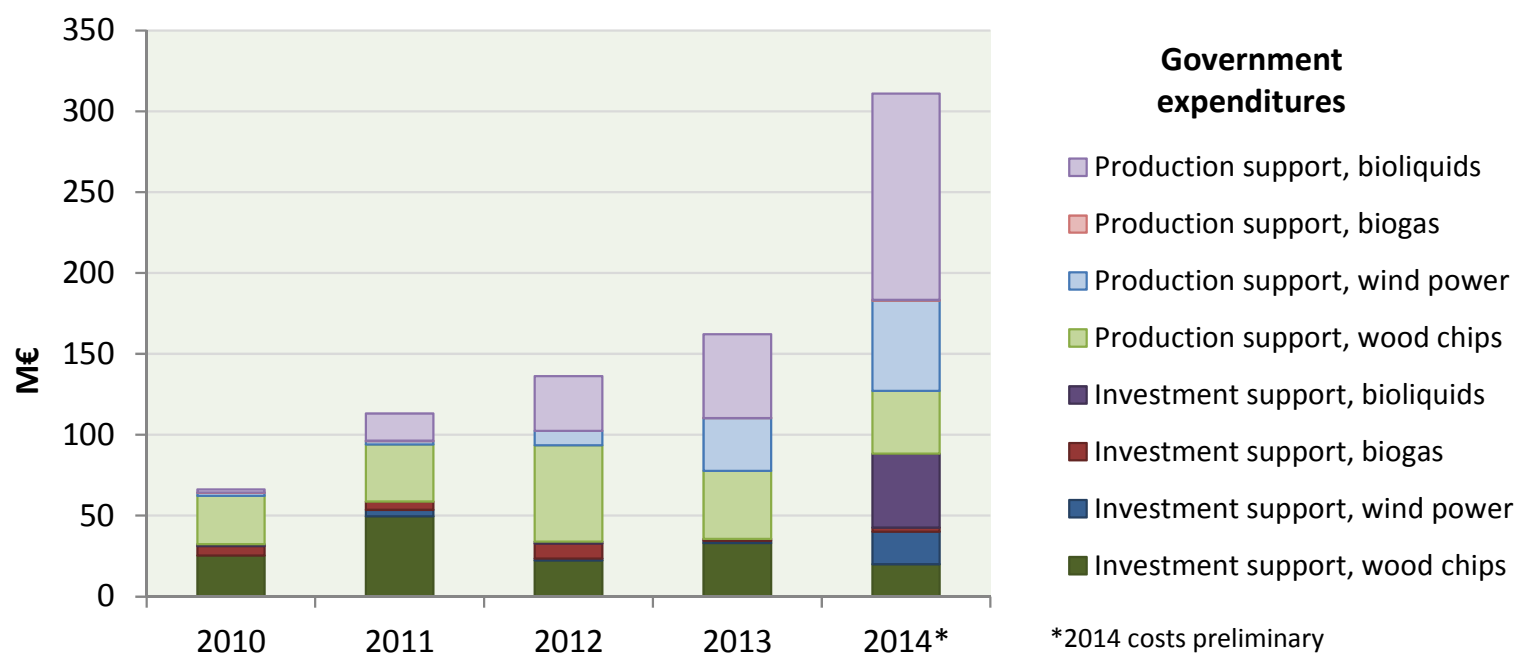
## Summary of results: emission reductions 2/2

- 3/4 of the estimated emission reductions in the ETS



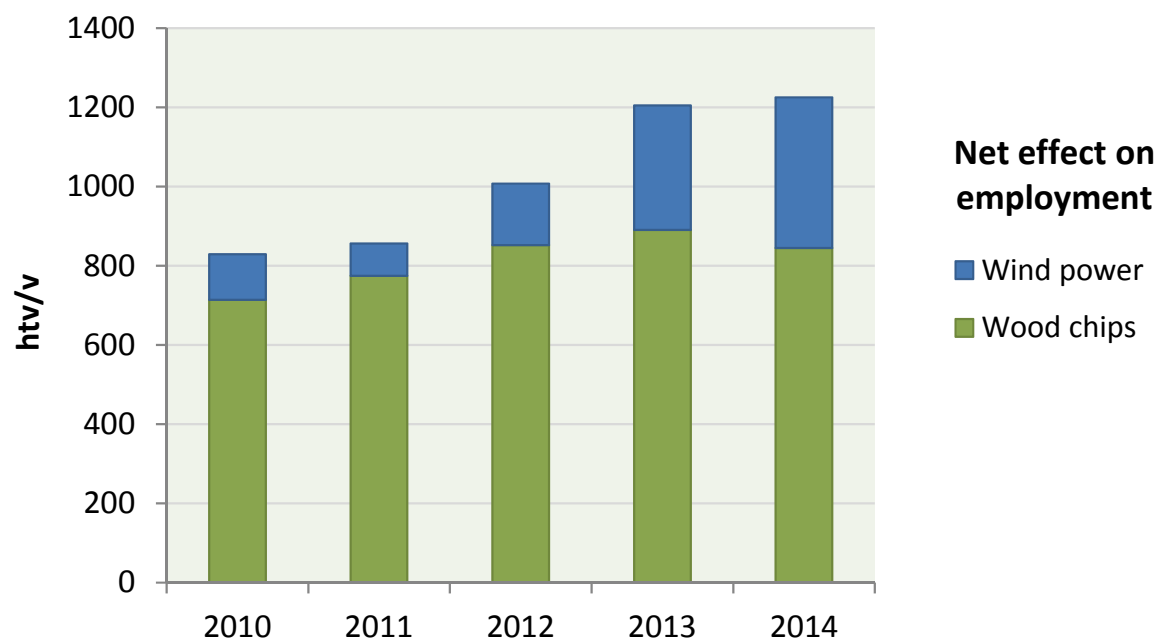
## Summary of results: costs

- 70% of the support depends on the amount of production (feed-in tariff, lower tax level, ...)



## Summary of results: net employment

- Wind power has relatively higher share in net employment effect





The logo for VTT, consisting of a stylized white 'V' followed by the letters 'VTT' in a bold, sans-serif font.A white line-art illustration on a blue background. It features a man in a suit on the left holding a tablet, a woman in a business suit in the center holding a tablet, and two construction workers in hard hats on the right. The background includes a honeycomb pattern, a DNA double helix, wind turbines, a chemical structure, a city street with a car and a pedestrian, and various geometric shapes and lines representing technology and business.

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