’Green economic taxes’ in Finland and their impacts

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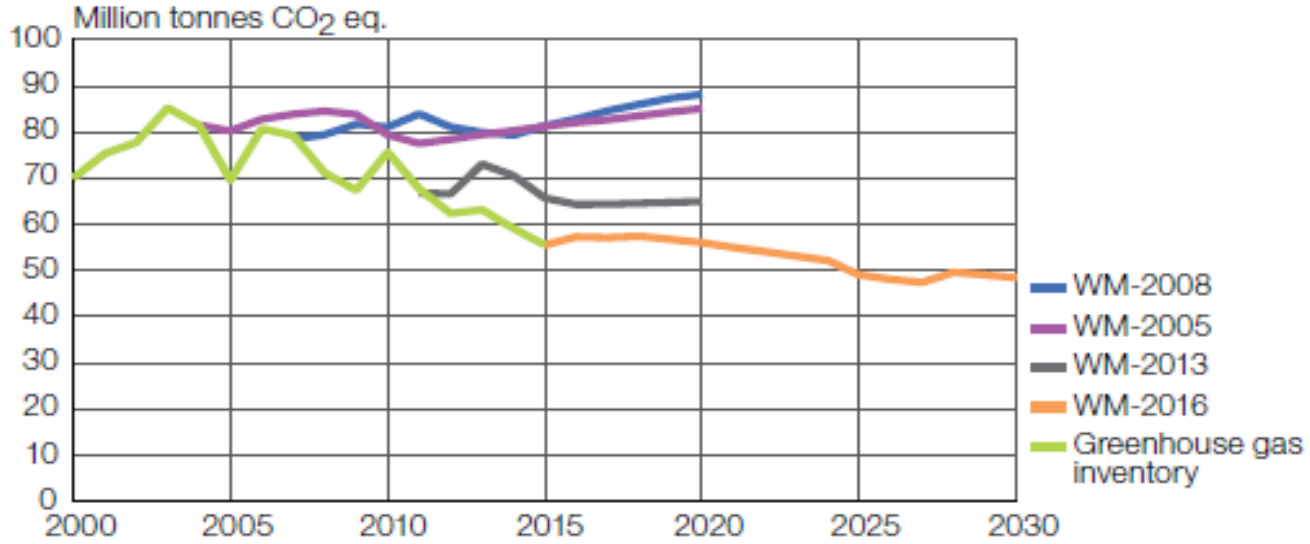
Finnish emission have fell in comparison to old estimates ‘with current policy measures’

Figure 1.1
Greenhouse gas emissions according to the most recent inventory for 2000-2015 and in the WM projections of the climate and energy strategies published in 2005, 2008, 2013 and 2016 up to 2020 and 2030 respectively.



Source: Statistics Finland report to UNFCCC, 2018

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How have different ‘green economic instruments’ affected emissions, the public finances and innovations?

- Since posing the first CO2 tax in the World in 1990, Finland has used a variety of green economic instruments
- Key national instruments:
  - **CO2 & energy tax**
  - **Vehicle taxes based on emission intensity**
  - **Waste tax**
  - Various subsidies
  - Feed-in-tariff scheme
  - Blending requirement for biofuels 2011
- In addition, Finland has participated in the EU Emission Trading Scheme since 2005
  - Emissions in the EU ETS sectors have reduced (24% in Finland since 2005) despite the early challenges and weak price, associated with the economic recession

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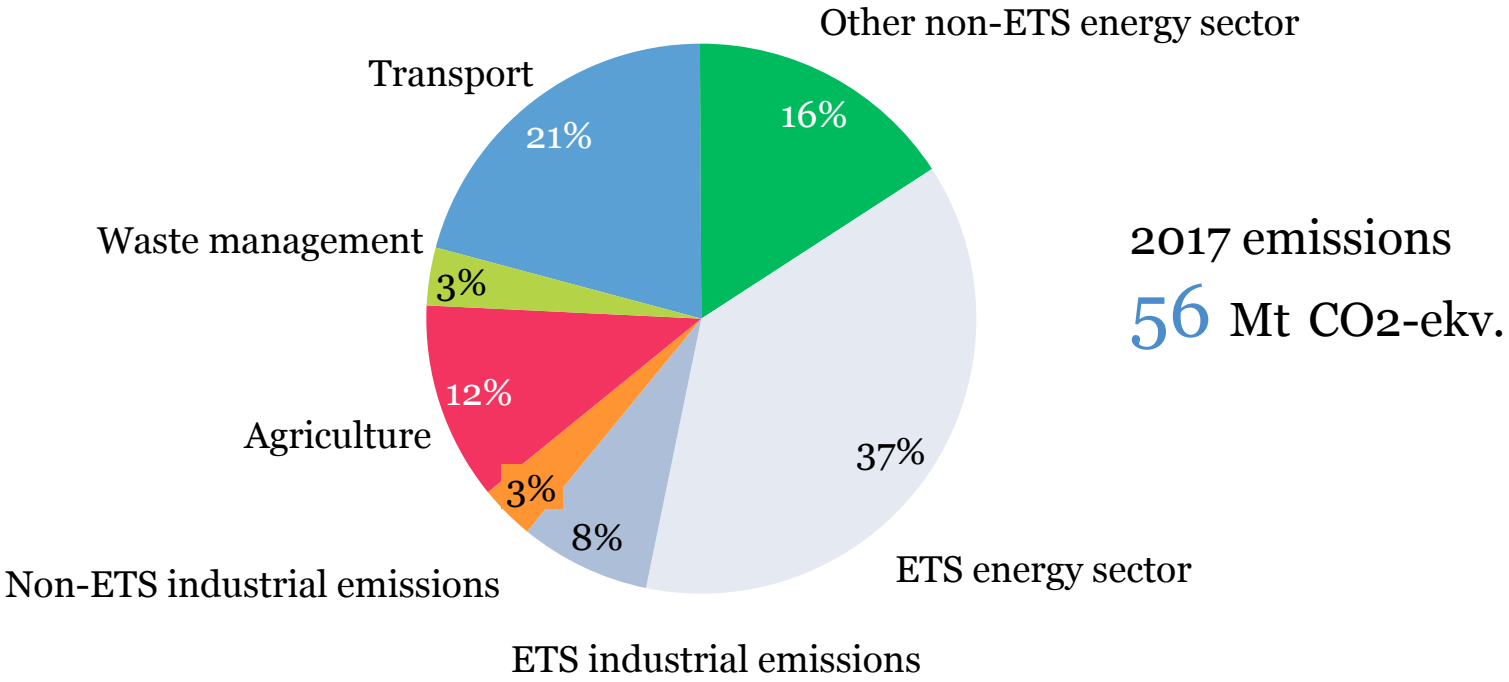
ETS covers around 45% of Finnish emissions



2017 emissions

56 Mt CO2-ekv.

Source: Statistics Finland, http://www.stat.fi/static/media/uploads/tup/khkinv/yymp_kahup_1990-2017_2018_19735_net.pdf [17.8.2018]

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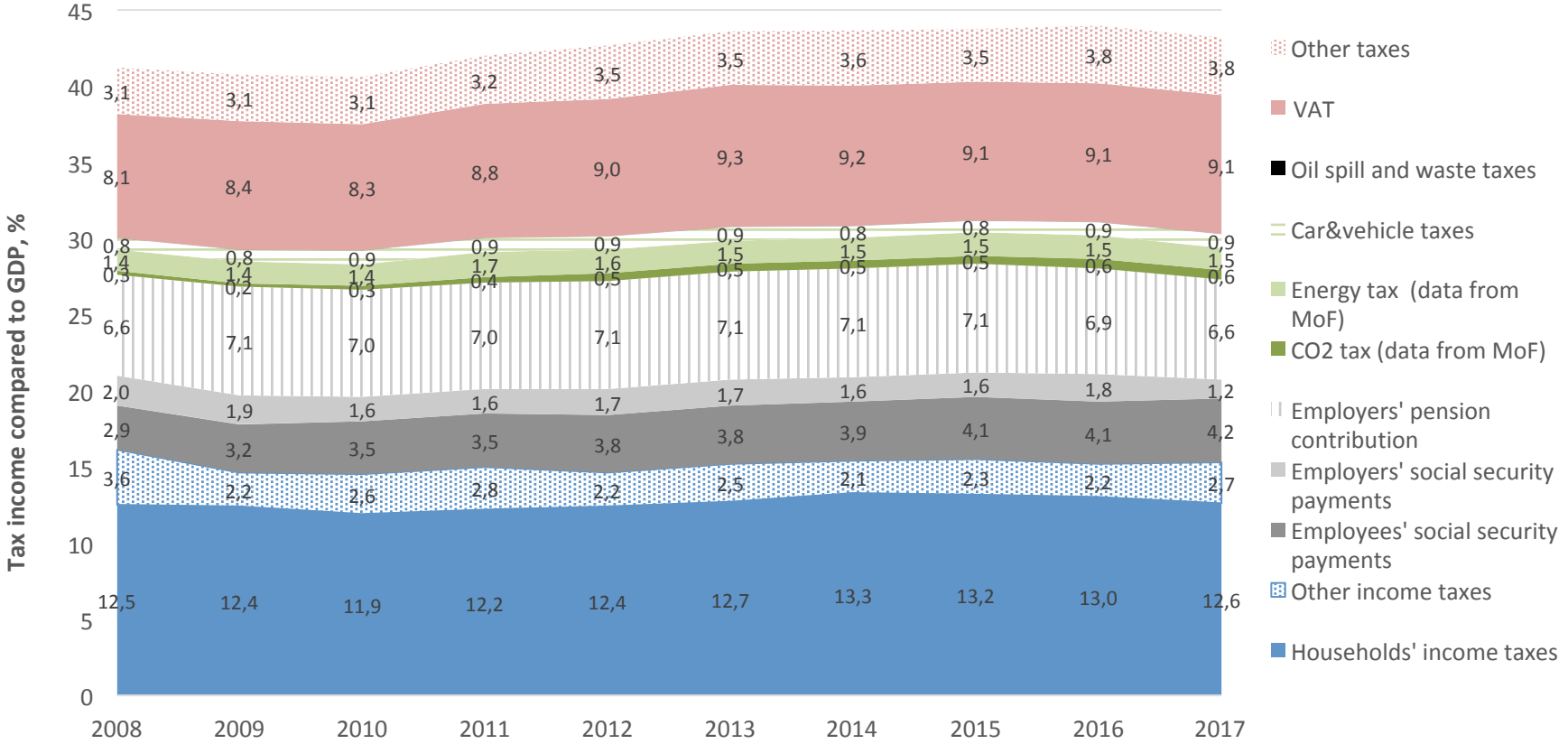
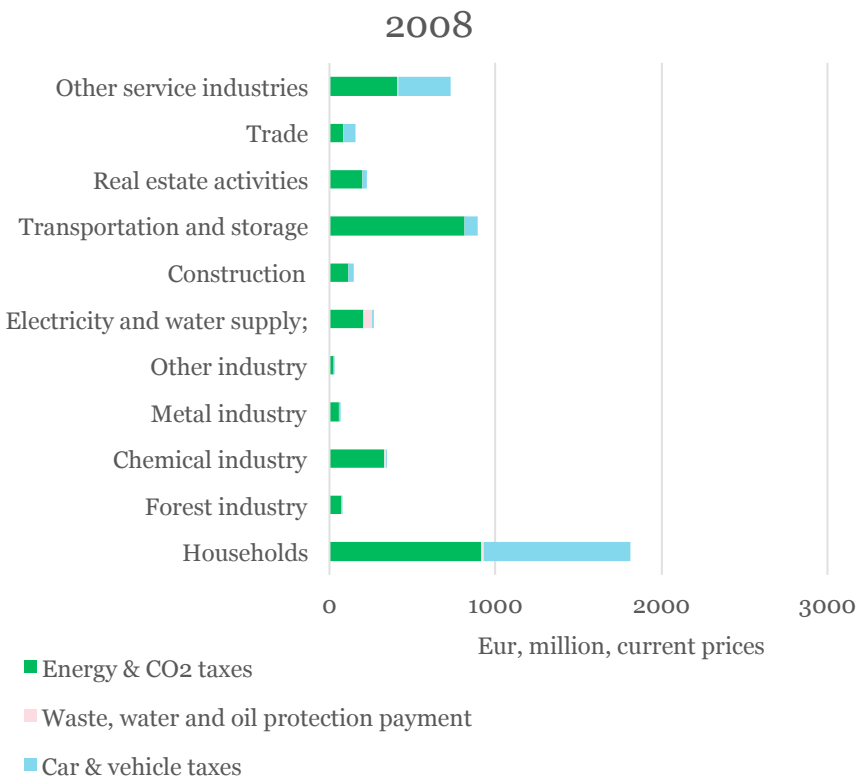
The big picture - Finnish tax income compared to GDP

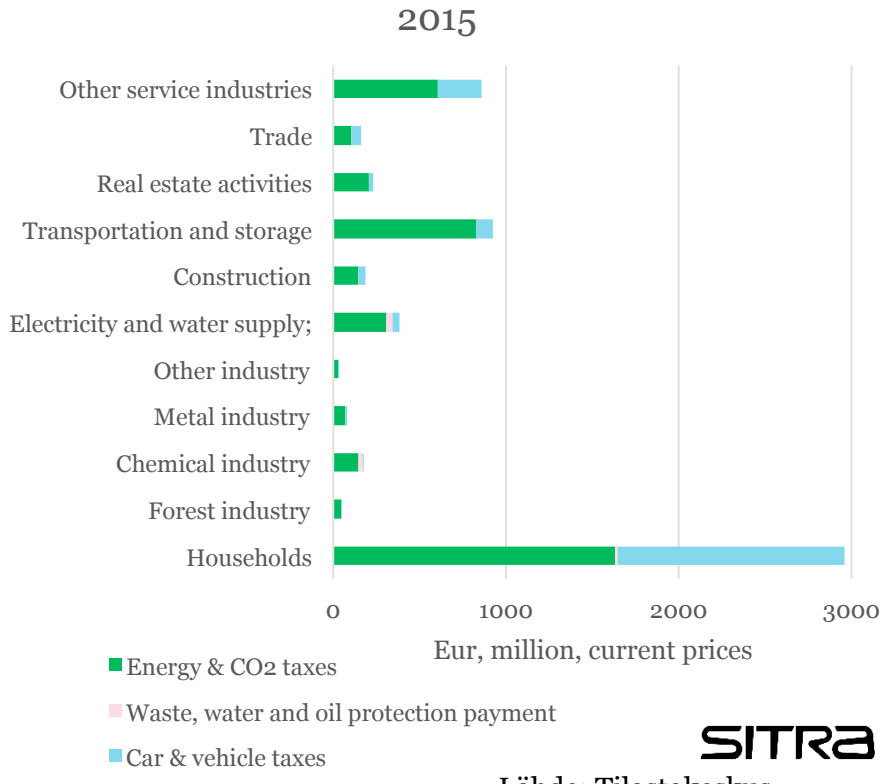


Environmental taxes, current prices

Year	CO_2 and energy taxes	Waste, water and oil protection payment	Car & vehicle taxes	Natural resource usage taxes	Environmental taxes total
2008	3220	80	1445	23	4768
2009	3101	69	1336	23	4529
2010	3220	79	1622	23	4944
2011	3921	108	1838	24	5891
2012	4009	99	1765	24	5897
2013	3975	102	1840	23	5940
2014	3955	86	1836	23	5899
2015	4120	75	1849	23	6066

Who pays environmental taxes?





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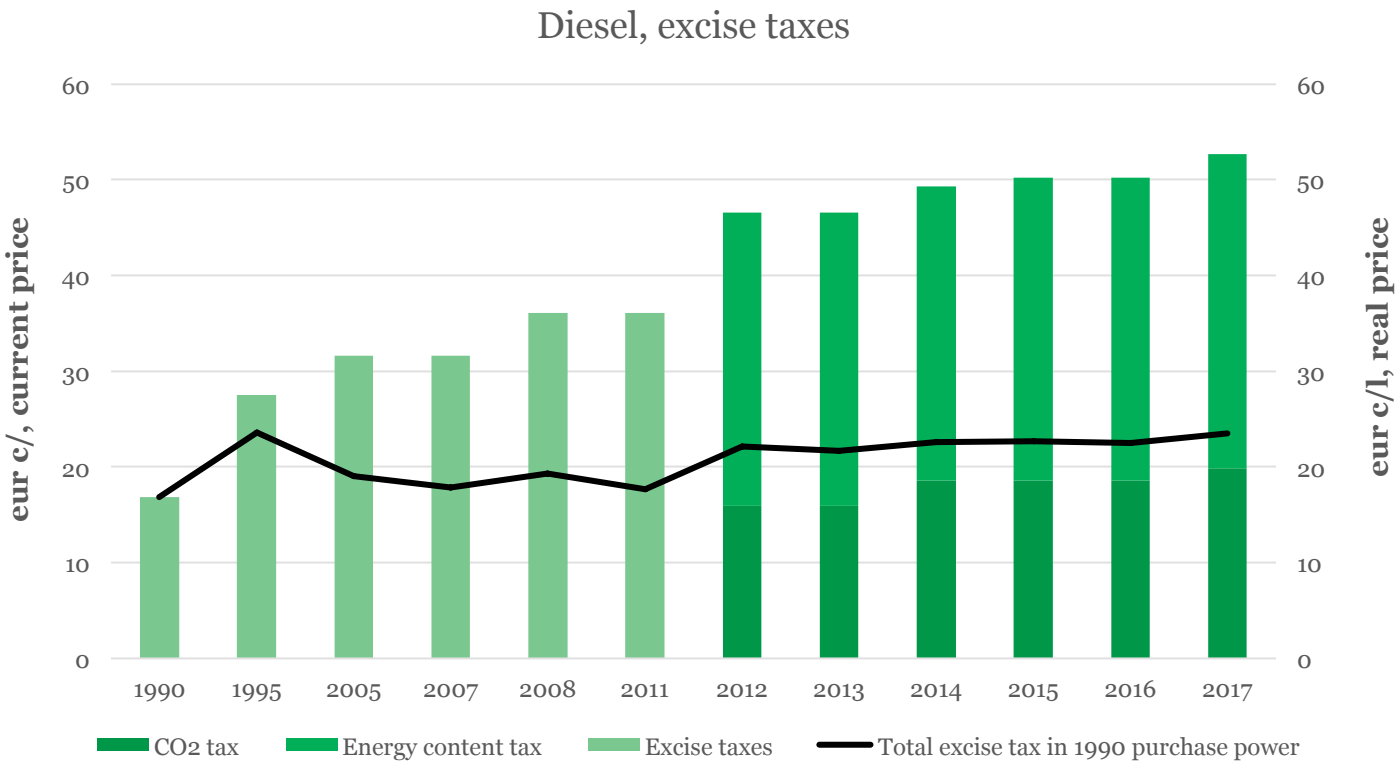
Lähde: Tilastokeskus

1. CO2 tax and energy (content) tax in short

- From 1990 to 1997 CO2/energy tax to all primary energy use
- After that tax only to final consumption of energy products
- **CO2 tax:**
  - Part of excise taxes for motor fuels, coal and natural gas
  - Current CO2 price 62 eur/tCO2 (start at around 1 eur in 1990)
  - Fuels used as intermediate inputs in industrial production excepted (e.g. fuels for plastic production)
- **Energy (content) tax:**
  - All energy forms, including electricity
  - The same electricity tax despite the CO2 emissions
  - Large repayment system for energy intensive industry

Diesel, excise taxes since 1990



Growth with current prices: over 200%

Growth compared to purchasing power: 40%

Similar picture for gasoline

Source: National communication to UNFCCC, 2018 & Income level index

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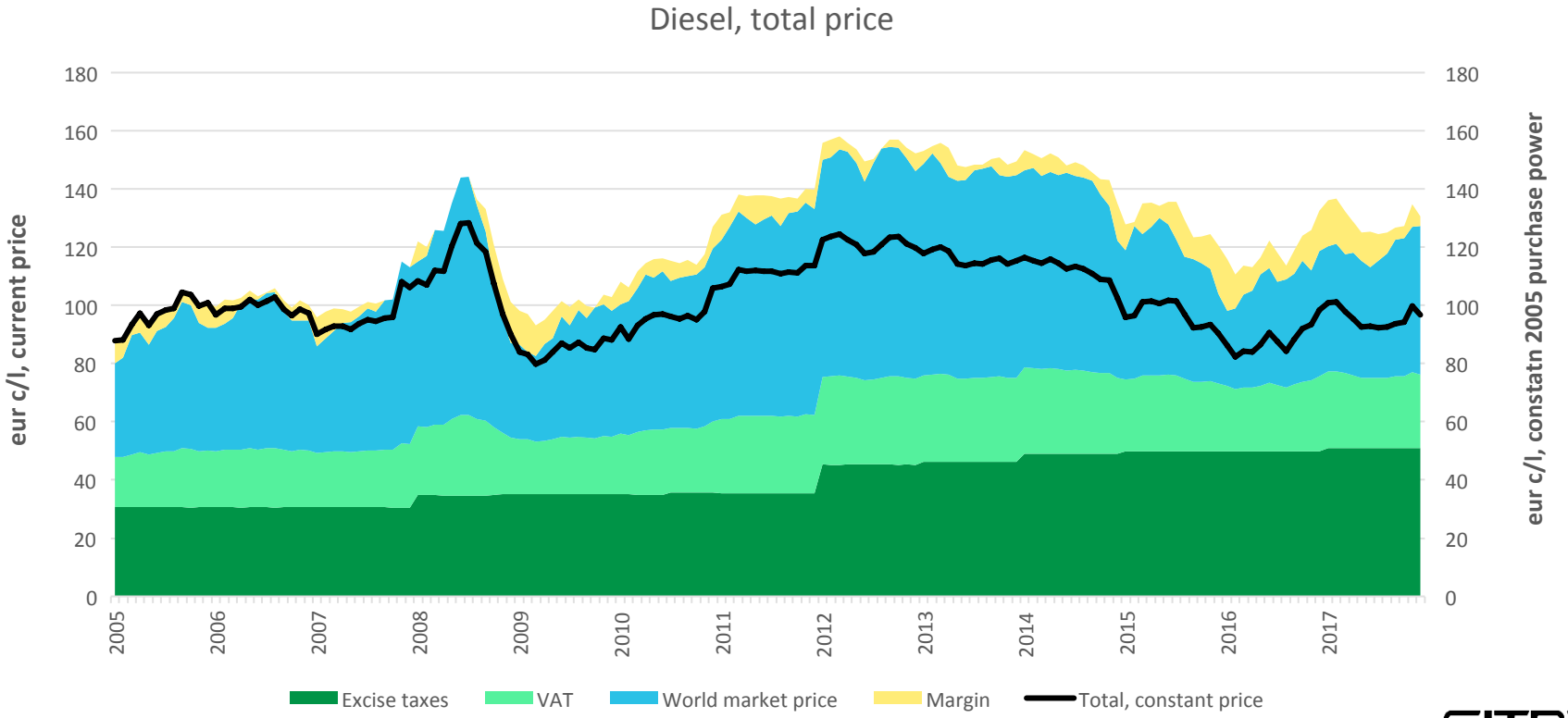
Diesel, final price over time



Sources: ÖBA & Statistics Finland

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CO2 and energy taxes impact on innovations and investments?

- No Finnish analyses on the topic
- No impact on global vehicle innovations, but more potential in energy saving technologies
  - Calel & Dechezleprêtre (2015): EU ETS increased low-carbon innovation among regulated firms by 10%, while not crowding out patenting for other technologies'
  - Tietenberg (2013): in general carbon taxes can be empirically linked to increases in innovations in many cases and countries, but the evidence is not conclusive and seems to vary per case
- Can increase investments to lower emissions vehicles and energy saving technologies
  - Electric vehicles have been historically expensive compared to ICEs (Nylund et al, 2015)
  - Li et al. (2009): a 10% increase in price leads to over 2% increase in fleet fuel economy in long run in US
  - Leard et al. (2018): Car rental companies respond the most to fuel price increases with their fleets
  - Kuo et al. (2016): Only relatively high CO2 prices will lead to actual emission reductions in firms regardless of the investment price required to change to less polluting production technology

CO2 tax in motor fuels and emissions?

- Short run impacts minimal
  - Elasticity of fuel taxes to fuel consumption in short run zero (Ministry of Finance)
- Longer run impacts:
  - Longer run price elasticities bit bigger: -0.25 to -0.8 (Brons et al, 2008, Coglianese et al, 2016, and Burke & Nishitateno, 2013)
  - Consumers also respond significantly stronger to fuel tax increases than to fuel price increases (Li et al, 2014, find even 3 times bigger elasticities)
  - Gricolon et al. (2018): Fuel taxes more effective in reducing fuel usage than product taxes in the long run
  - Perrels & Tuovinen (2012): Finnish fuel taxes in the early 2000s not very efficient in reducing CO2 emissions in transport sector. Small incentive to buy more fuel-efficient cars, but the income effect of increased purchasing power increased emissions and offset emission effects
  - Real price of taxes and potential to change to less polluting vehicles important!

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Energy taxes and emissions in general?

- Lin & Lin (2011): Finnish CO2 taxation lowered the growth rate of total CO2 emissions per capita by some 1.6 percent during 1990-2008 compared to a sample of other OECD countries that did not pose a CO2 tax
- Prime Minister's Office (2000): all energy and fuel taxes decreased Finnish CO2 emissions by maximum 7 percent between 1990 and 1998
- Anderson (2010): a 6% decrease in Finnish CO2 emissions from 1994 to 2003 and a 4% decrease in fuel demand due to the energy taxes.
- No ex-post assessments on more recent CO2 effects of Finnish energy taxes

- Tietenberg (2013): carbon taxes in some countries have resulted in high single digit emission reductions (closer to 10%), but they depend heavily on the structure of the carbon tax system. Exemptions of carbon taxes on industry have been associated significantly lower reductions
- Martin et al. (2014): significant reduction in manufacturing plants' emissions resulting from a carbon tax in UK

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2. Annual vehicle tax and on-off car tax

- Both based on CO2 emissions of vehicle type since 2008 reform

- **On-off car tax**: 3 percent of final selling price for 0 emission cars (based on CO2 emissions in g/km of use) to 50 percent for very heavy/ polluting vehicles

- **Annual vehicle tax**: 70 euros for 0 emission cars to 618 euros annually for vehicles with over 400 g/km CO2 emissions
- Additional payment to diesel cars, which have lower annual vehicle taxes

Finnish vehicle fleet, 2017

Technology	Passenger vehicles	Vans	Busses	Trucks
Gasoline	1 916 647	10 519	0	
FFV	4 397	0	0	
Diesel	731 886	308 255	12 577	94 812
Gas	3 332	324	70	23
PHEV	5 804	14	0	0
BEV	1 487	168	5	1
Total	2 663 554	319 280	12 652	94 837

Source: VTT

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Vehicle taxes impact on innovations and investments?

- **No impact on global innovations**
- Purchase price difference after taxes has remained high between EVs and ICEs
  - Average purchase price of vehicles ~15 000 eur, price of Evs ~40 000 (Nylund et al, 2015)
  - > Until price of electric vehicles comes down, potential to switch to very low emission vehicles small for majority of people
- From 2007 to 2015 the average CO2 emissions of newly registered vehicles decreased by some 30 percent (from 177 g/km to 124 g/km).
- A small share of the decrease in new vehicles' emissions and the increased sales of lower emission vehicles can be attributed to the car taxation. (Stitzing, 2016)
- **Most of the changes** in the vehicle fleet towards less emitting technology options stem **from the EU level legislation that regulates the emissions standards**

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Vehicle taxes and emissions?

- From 2007 to 2010 the sales weighted average CO2 emission level of new Finnish cars went down from 176 to 146 gCO2/km
- Stitzing (2106): around 2-3 gCO2/km of the reduction could be attributed to the car tax change, meaning a 2% reduction in total emissions
- Perrels & Tuovinen (2012): around 13-17 g/km of the reduction could be attributed to the car tax, but less detailed methodology
- In big picture, no impact:
  - 120 000 or 4.6 percent of vehicle fleet are new annual vehicle registration
  - Even the higher estimates of Perrels & Tuovinen (2012) lead to only 0,5 percent reduction in the annual CO2 emissions of the transport sector
- Also, fiscal loss from the 2008 vehicle tax reform: the cost per reduced CO2 tonne was around 300-350 euros (Perrels & Tuovinen, 2012)

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Waste tax

- Tax levied on all waste deposited at landfill sites,
- Waste tax covers ~3% of Finnish GHG emissions
- **Innovation/technology effects**: Some indication that the tax would have resulted in increased waste utilisation and supported the creation of a private waste industry
- **GHG impact**:
  - National Audit Office of Finland (2004): waste tax had no significant environmental impacts and the effects attributed to the tax had been mainly fiscal in nature.
  - KAISU: the waste tax among the measures that have led to reduced emissions from the waste sector since the beginning of the 21st century.
  - Not possible to attribute an exact share of emissions reductions to the waste tax

All environmental taxes in short

Instrument	Fiscal budget (2017)	Fiscal effect	CO2 effect	Innovation effect
Taxes and duties				
CO2 tax (motor fuels, coal, gas)	0.6% over GDP (1340 MEUR)	++	- (Ind.)	+ (Ind.)
Energy content tax (also electricity)	1.5% over GDP (3320 MEUR)	++	- (Ind.)	+ (Ind.)
Annual vehicle & new car sales tax	0.9% over GDP (2180 MEUR)	-/0	-/0	+ (Ind.)
Waste tax	12 MEUR	+	-/0 (Ind.)	+ (Ind.)
Excise duty on beverage packages	16 MEUR	+	-/0 (Ind.)	n.a.
Oil waste duty	4 MEUR	+/0	n.a.	n.a.
Oil damage duty	8 MEUR	+/0	n.a.	n.a.

Ind. = Indicative research results, (+)+ = (strong) positive effect from the tax/subsidy, 0 = no effect, (-)- = (strong) negative effect from the tax/subsidy, n.a. = effect not known.

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Key observations

- **CO2 tax to motor fuels**: Excellent for raising revenue, historically less efficient in short-term CO2 cuts (may become more efficient if low emission vehicles become cheaper)
- **Energy content tax**: Excellent for raising revenue, potential to boost innovations & cut emissions when the tax level is set sufficiently high
- **Vehicle & car sales tax**: The CO2 based tax has a better potential to cut emissions if low emission vehicles become cheaper
- **Waste tax**: Has improved waste utilization & creation of private waste industry, no major impact on emissions. Also small tax yield

Lessons learned from Finland

1. **Green economic instruments can reduce emissions**, raise tax revenue and boost green innovations
2. The **impact of each instrument depends on the way it is posed** (especially the level & target group); companies respond to price signals often stronger than consumers
3. Most efficient way to introduce a CO_2 tax is to **target primary energy consumption**
4. **Emission cuts in transport sector have been more challenging** than in non-road sectors, but drop in electric cars price could help in the future

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