Raskaiden ajoneuvojen eri käyttövoimat

TransDigi-Seminaari

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Sisältö

- Missä mennään Euro VI raskaiden ajoneuvojen päästötason osalta?
- Polttomoottoriset Euro VI kuorma-autot
- Sähkö- ja polttokennokuorma-autot
- Miltä tulevaisuus näyttää?

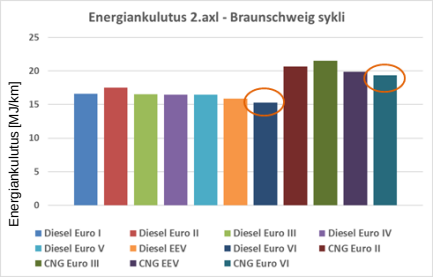
https://www.automobilemag.com/news/hyundai-creates-super-cool-fuel-cell-electric-semi-truck/

https://www.truckinginfo.com/159878/the-future-looks-familiar-for-volvos-supertruck

https://corporate.walmart.com/newsroom/2014/03/26/walmart-debuts-futuristic-truck

Missä mennään Euro VI raskaiden ajoneuvojen päästötason osalta?

- Euro VI diesel raskaat ajoneuvot ovat merkittävästi puhtaampia kuin raskaat hyötyajoneuvot koskaan aikaisemmin
- Euro VI lainsäädäntö on toiminut todella hyvin
- Erityisesti NO_x ja PM päästöt ovat laskeneet merkittävästi
  - Myös normaalin käytön aikana



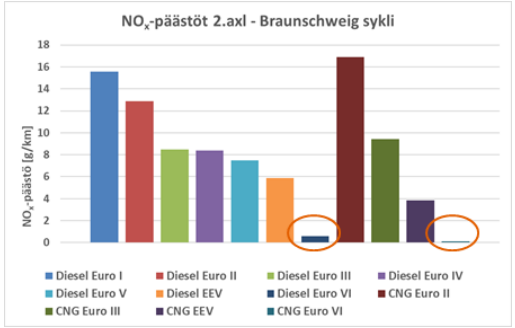
Euro VI LNG & diesel kuorma-auton NO_x pitoisuus normaalissa pitkänmatkan operoinnissa

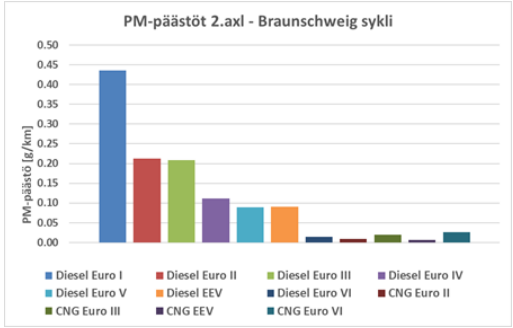
Date (UTC)		Average NOx in (ppm)	Average NOx out (ppm)	NOx reduction efficiency from ppm (%)	Average temp Inlet SCR (Deg C)	Average BP (mbar)	Running time	Counted rows	Ignored rows (MAF+NOx)	Ignored rows (NOx)	Kilometers travelled (km)	Alarm codes
Fri	1.11.	613	8	99%	258	45	12h 8min	43686	10057	10057	844 *	0
Sat	2.11.	563	5	99%	266	44	0h 14min	890	313	313	12 *	0
Sun	3.11.	N/A	N/A	N/A	N/A	N/A	0h 0min	0	0	0	N/A	0
Mon	4.11.	582	15	97%	256	49	10h 11min	36690	9204	9204	700 *	0
Tue	5.11.	662	11	98%	261	51	12h 36min	45408	5468	5468	882 *	0
Wed	6.11.	567	10	98%	251	46	13h 21min	48073	13736	13736	908 *	0
Thu	7.11.	609	7	99%	259	50	10h 54min	39283	7635	7635	764 *	0
Fri	8.11.	667	13	98%	266	48	13h 35min	48934	10611	10611	947 *	0
Sat	9.11.	623	2	100%	268	43	1h 16min	4587	182	182	69 *	0
Sun	10.11.	684	4	99%	276	49	4h 54min	17678	4073	4073	345 *	0
Mon	11.11.	646	14	98%	261	43	12h 37min	45447	9746	9746	876 *	0
Tue	12.11.	654	12	98%	275	50	15h 14min	54852	7477	7477	1017 *	0
Wed	13.11.	670	7	99%	280	54	11h 52min	42777	12937	12937	861 *	0
Average		628	9	99%	265	48	9h 54min	35692	7620	7620	685	N/A

* Distance calculated from GPS data

Date (UTC)		Average NOx in (ppm)	Average NOx out (ppm)	reduction efficiency from ppm (%)	Average temp Inlet SCR (Deg C)	Average BP (mbar)	Running time	Counted rows	Ignored rows (MAF+NOx)	Ignored rows (NOx)	Kilometers travelled (km)	Alarm codes
Fri	1.11.	565	27	95%	284	73	12h 8min	43701	12288	12288	846 *	0
Sat	2.11.	572	14	98%	242	78	0h 54min	2401	722	722	47 *	0
Sun	3.11.	549	19	96%	315	96	5h 1min	18098	1109	1109	351 *	0
Mon	4.11.	552	23	96%	297	83	12h 13min	43981	13251	13251	830 *	0
Tue	5.11.	541	27	95%	286	76	12h 22min	44560	16063	16063	816 *	0
Wed	6.11.	522	25	95%	304	94	13h 17min	47840	8438	8438	937 *	0
Thu	7.11.	491	34	93%	283	78	11h 33min	41586	19659	19659	760 *	0
Fri	8.11.	496	16	97%	303	89	8h 15min	29709	4337	4337	537 *	0
Sat	9.11.	N/A	N/A	N/A	N/A	N/A	0h 0min	0	0	0	N/A	0
Sun	10.11.	N/A	N/A	N/A	N/A	N/A	0h 0min	0	0	0	N/A	0
Mon	11.11.	580	36	94%	291	76	8h 0min	28852	5479	5479	521 *	0
Tue	12.11.	583	27	95%	313	88	8h 58min	32314	16104	16104	610 *	0
Wed	13.11.	553	31	94%	303	80	12h 43min	45784	15285	15285	836 *	0
Average		546	25	95%	296	83	9h 35min	34530	10247	10247	646	N/A

* Distance calculated from GPS data





Polttomoottoriset Euro VI kuorma-autot

- Euro VI lainsäädännön vaatimukset täyttäviä polttomoottorikuorma-autoja on monella eri käyttövoimalla
  - Diesel
  - CNG/CBG
  - LNG/LBG
  - Etanoli
  - Hybridi
- Useat eri valmistajat tarjoavat eri käyttövoimia

Take Control: Hybrid truck for city use

Press kit: Take control

Scania is introducing a Euro 6 hybrid truck, a P 320 that can be driven electric-only or with renewable FAME or HVO biofuels.

https://www.scania.com/group/en/take-control-hybrid-truck-for-city-use/

Scania introduces a 410 hp ethanol engine for long-distance applications

https://bioenergyinternational.com/storage-logistics/scania-introduces-410-hp-ethanol-engine-long-distance-applications

A PERFECT FIT FOR "STOP AND GO" APPLICATIONS

Like the Volvo FM Hybrid, the Volvo FE Hybrid is equipped with a diesel engine and an electric motor. The latter powers the truck from startup and up to 20 km/h. At higher speeds, the diesel engine kicks in.

When the vehicles stops, the diesel engine automatically shuts down to avoid unnecessary idling.

Since braking energy is used to charge the lithium-ion batteries powering the electric motor, the greatest fuel saving potential is in applications with a lot of "stop and go" driving.

- up to 20% for refuse handling (up to 30% if the superstructure also rely on the electric motor)
- between 10-20% for city distribution

LOW ON EMISSIONS AND CLOSE TO NOISELESS

Any savings in fuel means equal savings in CO_2 emissions, meaning that the Volvo FE Hybrid will contribute some 15 - 30% less to global warming.

The emissions of NO_x and particulates are at zero level when the truck is operated in electric drive - and it is a very silent truck when accelerating and idling. These are both strong benefits when operating in sensitive urban areas.

https://www.volvotrucks.co.uk/en-gb/about/environment/volvohybridconcept/volvofehybrid.html

Iveco LNG

https://www.iveco.com/finland/tuotteet/pages/gas-powered-for-long-haulage-new-stralis.aspx

Scania CNG/LNG

Scania is launching a alternative fuel initiativ the new generation of tr with the world premiere new 13-litre gas engine a Ecomondo trade fair in R Italy.

https://www.scania.com/group/en/home/experience-scania/news-and-events/events/2017/latest-gas-engine-designed-for-long-distance-transport.html/

Volvo Dual-fuel LNG-diesel

https://www.volvotrucks.fi/fi-fi/trucks/volvo-fh/volvo-fh-lng.html

DAF CF Hybrid Innovation Truck

The DAF CF Hybrid has been developed for driving electrically with zero emissions in urban areas, while offering a much longer range to operate beyond those urban areas, thanks to the latest, ultra-clean diesel technology. The combination of electric and diesel power ensures the highest logistical efficiency.

The sophisticated DAF CF Hybrid features the very efficient 10.8 litre PACCAR MX-11 engine (330 kW/450 hp), a ZF electric motor (75 kW/100 hp / peak: 130 kW/175 hp), in combination with a dedicated ZF TraXon gearbox for hybrid drivelines.

The electric motor is powered by an 85 kWh battery pack, which allows for a full electric, zero emission range of 30 to 50 kilometres, depending on the Gross Combination Weight. The batteries can be charged by the diesel engine during on-highway operations, and by using a DC charger at a charging location. The vehicle is designed with a fast charge capability that takes 30 minutes for a full charge and only 20 minutes for a charge of up to 80%.

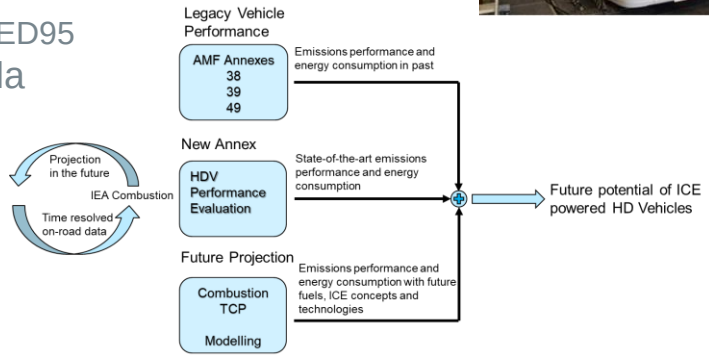
https://www.daf.com/en/about-daf/innovation/electric-and-hybrid-trucks

Polttomoottoriset Euro VI kuorma-autot

VTT:llä raskaiden Euro VI kuorma-autojen tutkimusprojekti

- IEA AMF ***H**DV **Per**formance Evaluat**ion**, HYPERION* –tutkimusprojekti 2018-2020
- Mukana Chile, Etelä-Korea, Kanada, Ruotsi ja Suomi sekä Japani
- VTT toteuttaa yhdessä Gasumin, Nesteen, Postin, Proventian, St1:sen ja Traficomin kanssa Suomen projektin
  - Alustadynamometrimittaukset
    - Diesel (EN590, biopohjainen EN15940), CNG, LNG, ED95
  - Mittaukset maantiellä PEMS-mittalaitteella
  - NO_x-päästöjen ja polttoaineenkulutuksen kenttäseuranta
  - Simulointimalli HCT-ajoneuvojen energiankulutuksen mallintamiseen

https://paivinoin.kaukokiito.fi/hct-yhdistelma-kaksikymmentakuusi-pyoraa/



Sähkö- ja polttokennokuorma-autot

- Akkusähkö sekä polttokennokuorma-autoja on jo markkinoilla muutamia
  - Lisää on tulossa

https://www.truck.man.eu/de/en/man-etruck.html

The IAA 2016 marked the time to shine: for the first time, MAN presented a fully electrically driven semitrailer tractor for use in inner-city night-time distribution, e.g. for food markets. In the following months, MAN built further fully electric concept vehicles based on the MAN TGM in the weight class from 18 to 26 tonnes. Since 2018, the MAN eTruck has been in use in test operations at nine CNL partner companies.

https://en.byd.com/truck/#models

Hyundai Motor and H2 Energy to bring the world's first fleet of fuel cell electric trucks into commercial operation

https://www.hyundai.co.nz/hyundai-motor-and-h2-energy-to-bring-the-world-s-first-fleet-of-fuel-cell-electric-trucks-into-commercial-operation-

Navistar unveiled this prototype battery-electric version of its medium-duty International MV truck. A regular

The vehicle was designed to accommodate multiple battery capacity options that range from 107 to 321 kWh. The OEM stated that "customers operating a truck with a 321 kWh battery in typical pickup and delivery cycles should expect to be able to travel up to 250 miles on a single charge."

https://www.truckinginfo.com/343408/navistar-unwraps-electric-truck

Tarjolla olevia tai suunniteltuja akkusähkö ja polttokennokuorma-autoja

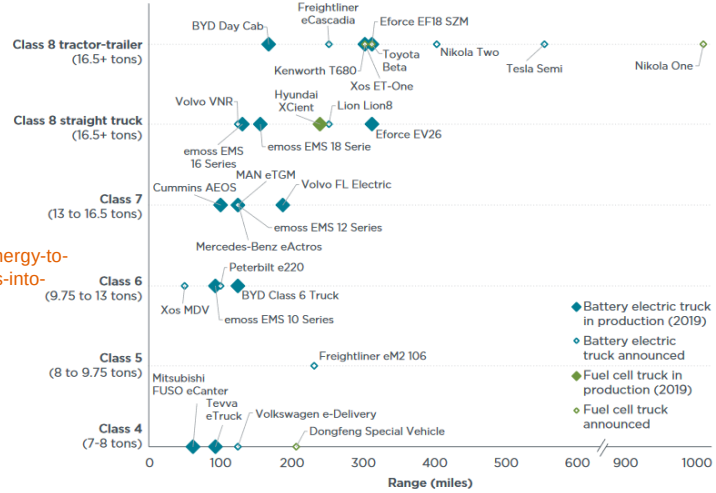


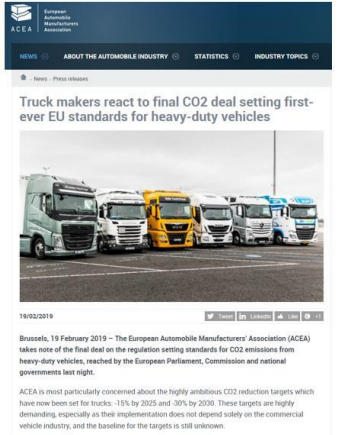
Figure 2. Range and GVWR class of announced or in-production zero-emission trucks

The ICCT: https://theicct.org/sites/default/files/publications/ICCT_EV_HDVs_Infrastructure_20190809.pdf

Miltä tulevaisuus näyttää?

- Lainsäädäntö ohjaa kohti matalia CO_2-päästöjä
  - EU CO_2 vaatimukset HD-ajoneuvoille
  - Päivitetty Puhtaiden ajoneuvojen direktiivi CVD (2019/1161)
  - Päivitetty Renewable Energy Directive
  - RED II (2018/2001)

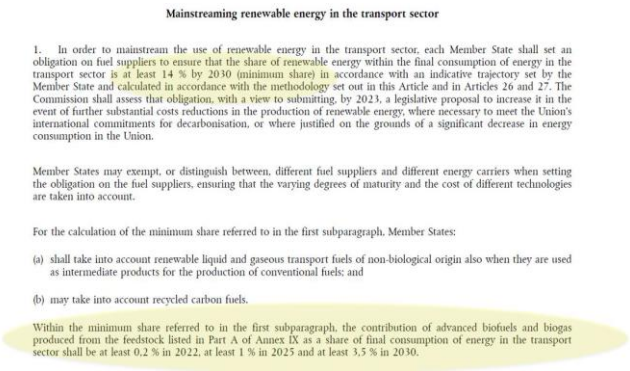
Dario Dubolino 2019



- Final decision:
  - -15 % reduction by 2025
  - -30 % reduction by 2030
- Baseline still not defined

- Toolbox:
  - Improved engines
  - Improved interacting control systems
  - Improved aerodynamics
  - Reduced rolling resistance
  - Reduced weight
  - Hybridization/electrification

https://www.acea.be/press-releases/article/truck-makers-react-to-final-co2-deal-setting-first-ever-eu-standards-for-he



Mainstreaming renewable energy in the transport sector

1. In order to mainstream the use of renewable energy in the transport sector, each Member State shall set an obligation on fuel suppliers to ensure that the share of renewable energy within the final consumption of energy in the transport sector is at least 14 % by 2030 (minimum share) in accordance with an indicative trajectory set by the Member State and calculated in accordance with the methodology set out in this Article and in Articles 26 and 27. The Commission shall assess that obligation, with a view to submitting, by 2023, a legislative proposal to increase it in the event of further substantial costs reductions in the production of renewable energy, where necessary to meet the Union's international commitments for decarbonisation, or where justified on the grounds of a significant decrease in energy consumption in the Union.

Member States may exempt, or distinguish between, different fuel suppliers and different energy carriers when setting the obligation on the fuel suppliers, ensuring that the varying degrees of maturity and the cost of different technologies are taken into account.

For the calculation of the minimum share referred to in the first subparagraph, Member States:

(a) shall take into account renewable liquid and gaseous transport fuels of non-biological origin also when they are used as intermediate products for the production of conventional fuels; and

(b) may take into account recycled carbon fuels.

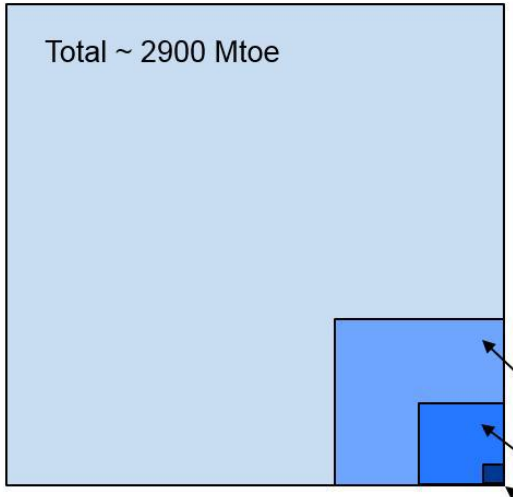
Within the minimum share referred to in the first subparagraph, the contribution of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX as a share of final consumption of energy in the transport sector shall be at least 0,2 % in 2022, at least 1 % in 2025 and at least 3,5 % in 2030.

Miltä tulevaisuus näyttää?

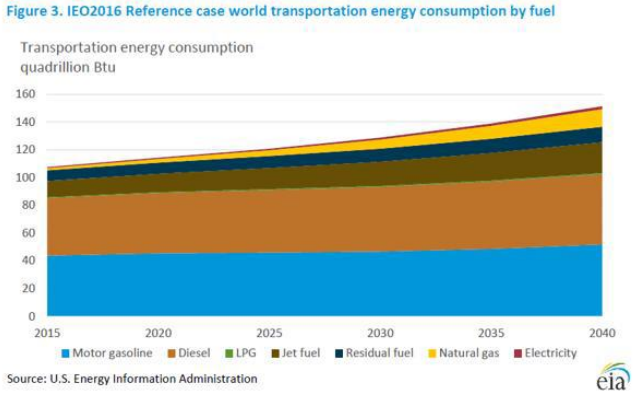
- Liikenteen energiankulutus on valtava
- Esimerkki: Yhdistelmä (30 ton.) longhaul
  - Työtä renkailla noin 1.6 kWh/km (diesel)
    - Oletetaan, että sähkövoimalinjalla 20 % regenerointia longhaul-operoinnissa -> työtä renkailla 1.3 kWh/km
  - Ajosuorite/päivä 600 – 900 km
  - Tehty työmäärä:
    - Diesel: 960 kWh – 1920 kWh
    - Sähkö: 780 kWh – 1560 kWh
  - Tarvittava energia*/polttoainemäärä**:
    - Diesel: 240 litraa – 480 litraa
    - Akkusähkö: 920 kWh – 1835 kWh
      - (4600 kg – 9200 kg & 92 k€ – 183,5 k€) ***

* Oletettu akkusähköisen voimalinjan hyötysuhteeksi 85 %
**Dieselin tiheys 831 kg/m3 ja voimalinjan hyötysuhde 40 %
*** Akun energiatiheys 0,2 kWh/kg ja hinta 100 €/kWh

Miltä tulevaisuus näyttää?



Data: US DOE, IEA & EC



Global jet fuel ~ 330 Mtoe
EU road ~ 290 Mtoe
Global biofuel ~ 85 Mtoe
Global renewable diesel ~ 5 Mtoe
Finland road ~ 4 Mtoe

Miltä tulevaisuus näyttää?

- Mikään yksittäinen vaihtoehtoinen energiamuoto ei todennäköisesti kykene globaalisti korvaamaan täysin nykyisten fossiilisten polttoaineiden käyttöä, **tarvitaan ne kaikki**
  - Sähkö, uusiutuvat polttoaineet, hybridit, polttokennot + muuta (ajosuoritteet, älyliikenne, liikennejärjestelmät yms..)
  - Käyttövoima käyttökohteen sekä -paikan mukaan
    - Uusiutuvat polttoaineet pitkillä matkoilla, raskaimmilla yhdistelmillä ja etäällä taajamista
    - Akkusähkö jakeluliikenteessä, kaupunkiliikenteessä kuten bussit ja valikoiduilla pidemmillä reiteillä
    - Hybridit (ml. MHEV*) kaikkialla
    - Polttoaineet (myös vety ja polttokenno) käytettävissä olevien resurssien (energia, biomassa jne..) mukaan

*MHEV = Mild-Hybrid Electriv Vehicle

beyond
the obvious

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