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Country Update Sweden

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Swedish Politics

A labour-green minority government supported by a leftist party since 2014.

- Decision on any replacement of nuclear power plants is postponed beyound the mandate period of four years.
- New ”power tax” on nuclear power to finance decommissioning introduced in 2014.
- The new governement formed a ”broad” parliamentary Energy Commission with main focus on electrical power, to report in 2017.
- Transport biofuels tax exemption retained to 2018, biogas to 2020, after discussion on state aid with the EC.
- Porpose a robust biofuel support system than annual tax exemptions
- ”Climate proposition expected in first half of 2017”

Broad energy agreement in 2016 (excl. biofuels)

Swedish Politics

- Planning and investment decisions on reactors were taken in the 1960's
- Referendum to phase out reactors by 2010 in 1981
- The reactor program of 12 plants fully attained in 1985
- The two reactors at Barsebäck were closed in 1999 and 2005
- The reactor development law (SFS1984:3) revoked in 2012
- Up to 10 new replacement reactors on present sites??????

Due to the new "Power Tax" on nuclear energy Vattenfall in April 2015 announced the premature stop of two reactors in 2018 and 2020 for "commercial reasons", and EON has in September decided to phase out yet two reactors due to post-Fukushima investments and taxes.

Energy agreement decision to gradually phase out the "power tax" to 2017 causes power companies to reconsider three premature reactor shut-downs.

Energy Agreement 2016

Goals

- Sweden should have no net GHG emissions by 2045, and achieve negative GHG emissions after this date.
- Sweden should have 100 % RE prower after 2040. This is a goal and ”not an ultimate stop date prohibiting nuclear power or implies a decommissioning of nuclear power by political decision”

Actions

- Decision to gradually phase out the ”power tax” to 2017
- Expand the SE RE Certificate target by 18 TWh to 2030

Energy Commission 2017

Electric energy use 116-162 TWh 2030, 107-195 TWh 2050

Stuctural changes in generation, increasing variability

Power sector economics not in favour of new investments

Goals

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Actions

- Decision to gradually phase out the ”power tax” to 2017
- Expand the SE RE Certificate target by 18 TWh to 2030
- Sectorial energy savings strategies, in particular for energy-intensive industries
- Revision on re-permitting process for hydrogenerators, and streamlining of property taxation with other generation plants
- Energy market development in view of new services, variability promotion of energy savings etc.

Climate Proposition 2017

”The global average temperature increase should be limited to well below 2 °C and efforts should be made to reach below 1.5 °C. Sweden shall engage internationally to direct global efforts towards this goal.”

Instrument

That parliament passes a law, to be in force as of 2018, to define the obligations of the governemt in the climate area

- To work against long-term goals set by the parliament
- That climate impacts should be considered and used as guidance in parallel to other goals in all policy areas
- Modalities for planning and follow-up
- Reporting to parliament

Climate Proposition 2017

* ESR= EU effort sharing mechanism, i.e. non-ETS sector

Proposed Goals

- No net GHG emissions post-2045, negative emissions thereafter.
- GHG emissions on Swedish territory reduced by 85 %, rel. 1990.
- ESR* sector emission reduction 63 % by 2030, 75 % by 2040, rel. 1990
- Of which only 8 and 2 %, respectively, from complimentary actions
- Transport sector emission reduction 70 % by 2030, rel. 2010, excl. aviation incl. in ETS
- Goals are only intermediate and part of overall environmental goals

Conditions

- An increased ambition also in the EU ETS system is assumed and aslo basis for possible adjustements of goals for 2030 and later
- Also other reduction measures, e.g. fossil or bio-CCS, C captured in soil and forestry, actions outside Sweden can be included.
- Does not include emissions and capture from land-use, land-use change and in forestry (LULUCF) estimated as per international climate reporting methods.

Proposal: GHG reduction in Transport 2017

Proposed Goals

- Transport sector GHG reduction 70 % by 2030, rel. 2010, excl. aviation

Instrument

- GHG reduction obligation for diesel and gasoline by biofuel blends (energy)

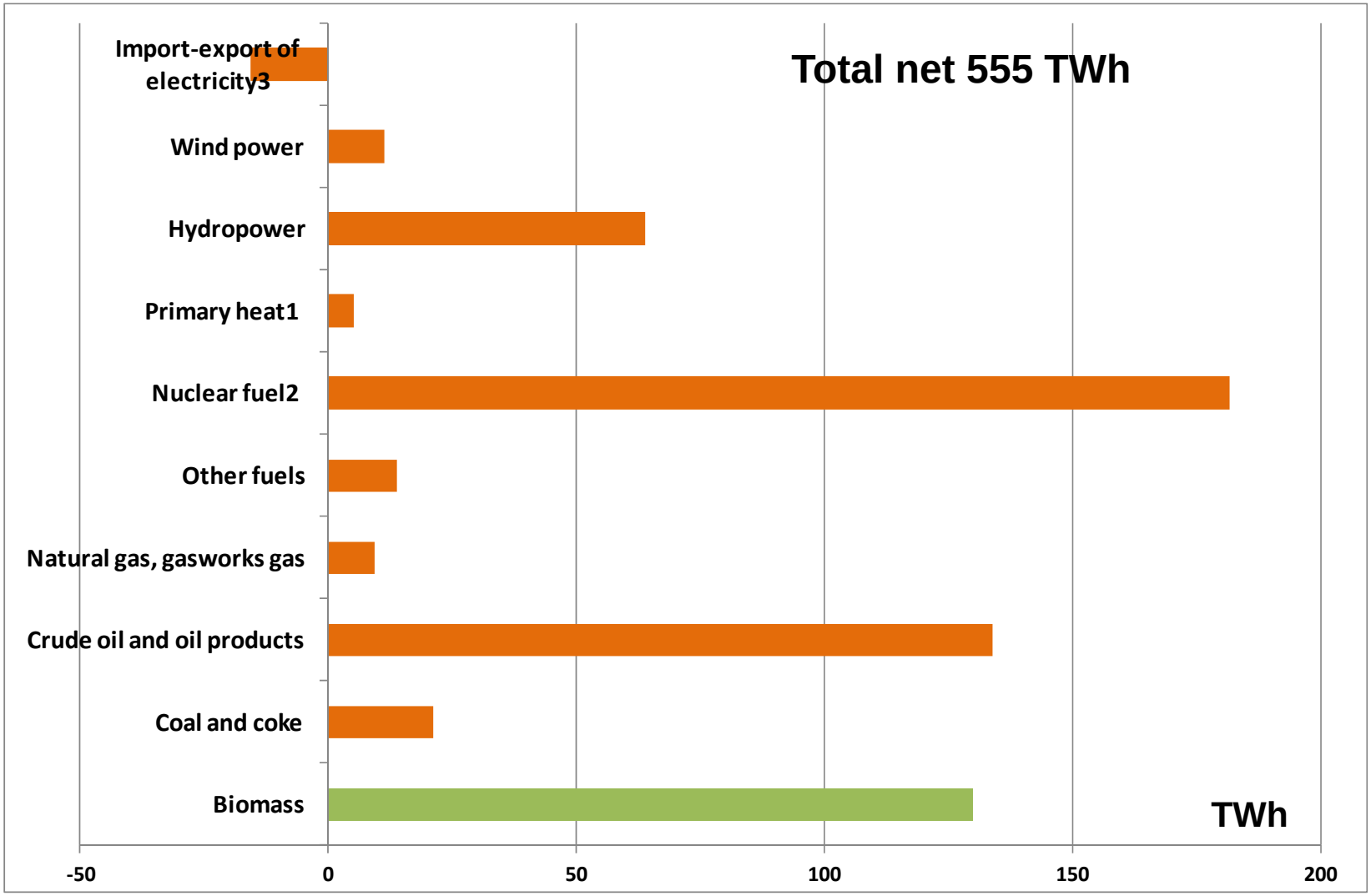
2018	2019	2020	2030
G 2.6%, D 19.3 %	G 2.6 % D 20 %	G 4.2%, D 21 %	Overall 40 %

- Sanction for non-complience **7 SEK/kg CO2 (700 €/ton) or biofuel premium value cap ~1.5 €/l fossil eqv.**
- Uniform energy tax and CO2 tax for gasoline and diesel products on the market, adjusted for of blending, i.e. decreases over time on a volume basis.
- Not applicable to neat of high-blends biogas, E85, ED 95, B100 etc., where 100 % CO2 tax reduction and also 100 % energy tax reduction is proposed

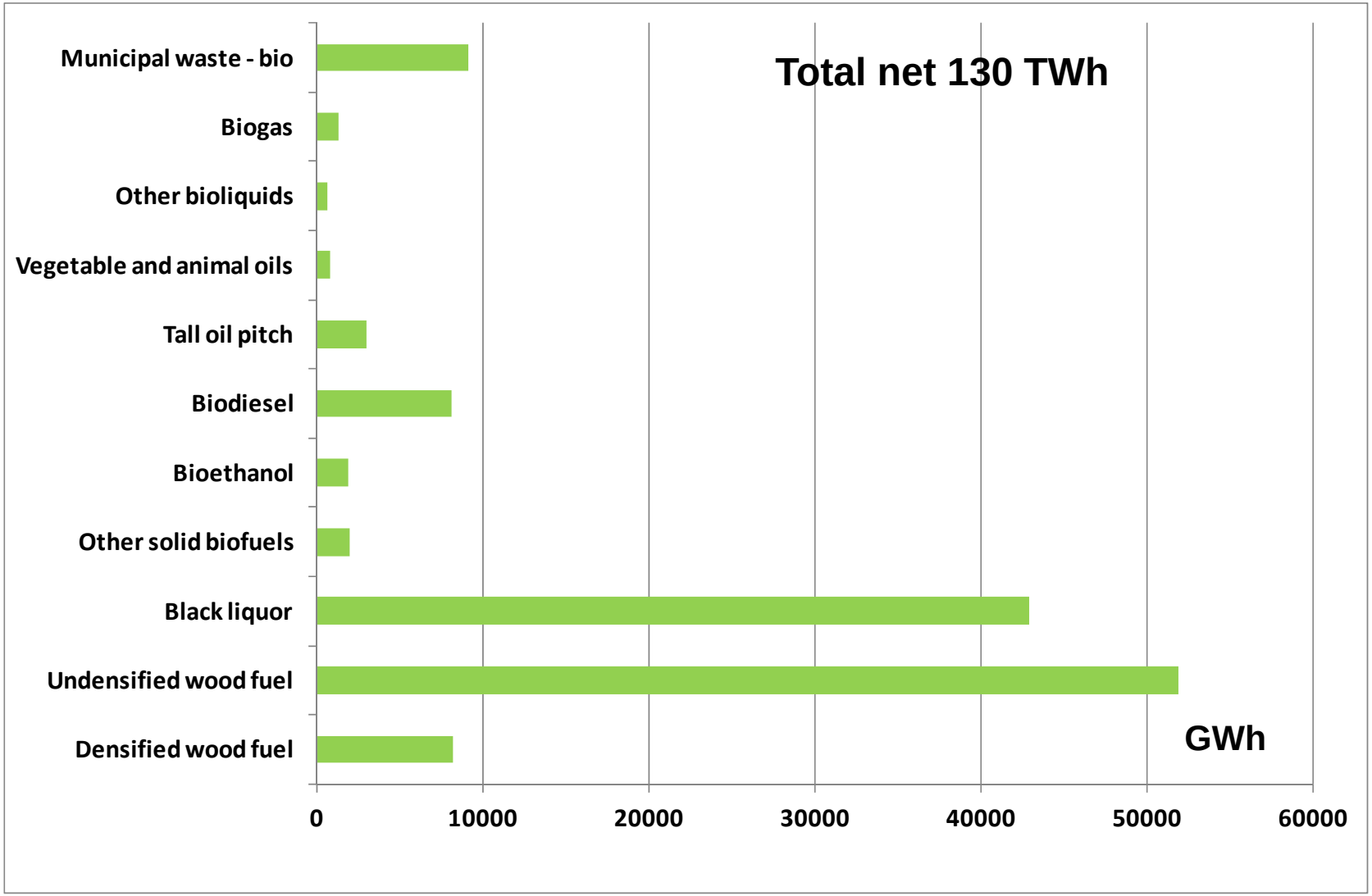
Other modalities in parallel actions

- Bonus-malus system in vehicle taxation based on emissions per km
- Promotion of e-mobility and low emission vehicles
- Changes to the taxation of company cars

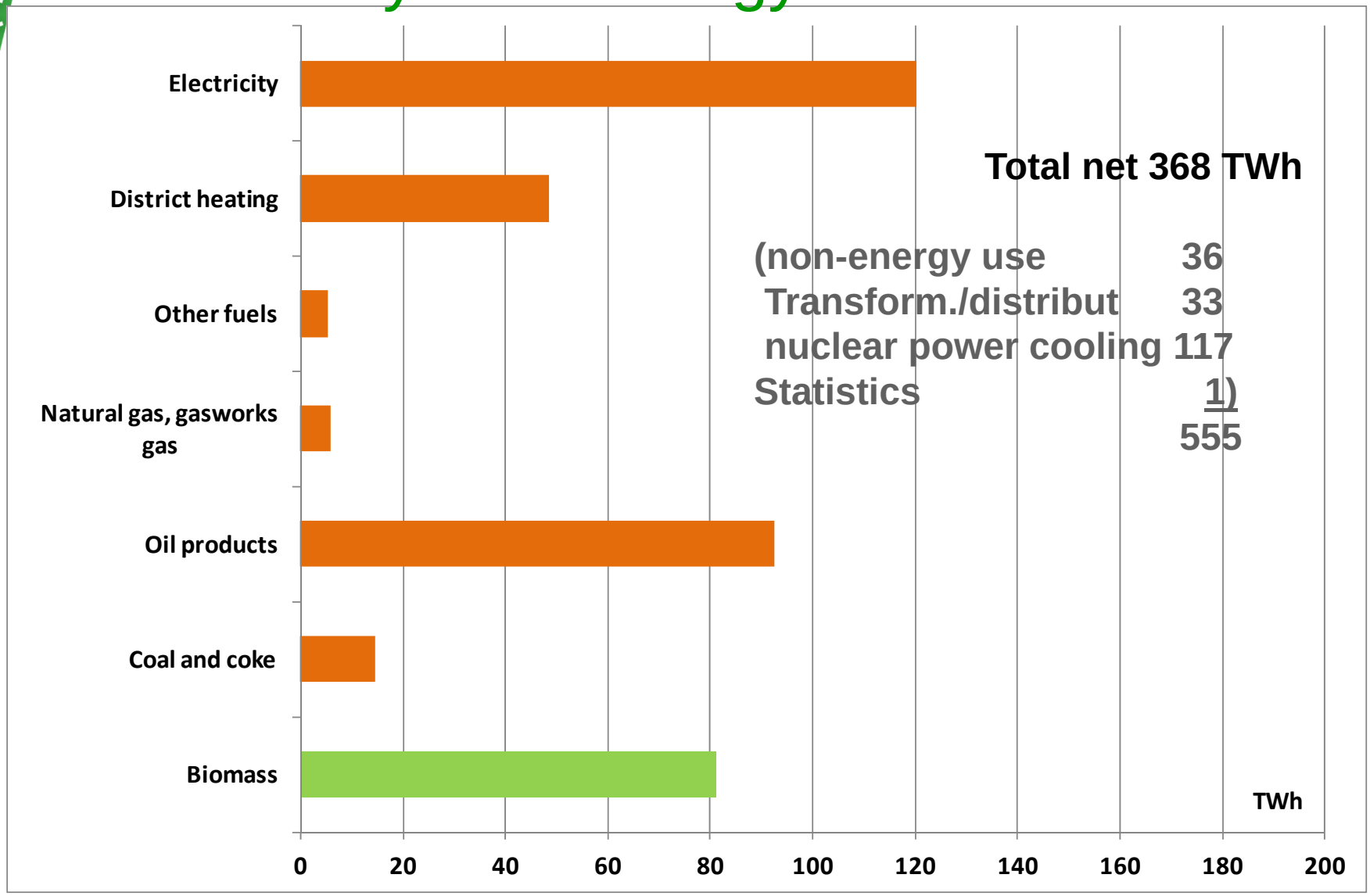
Primary Energy Supply 2014



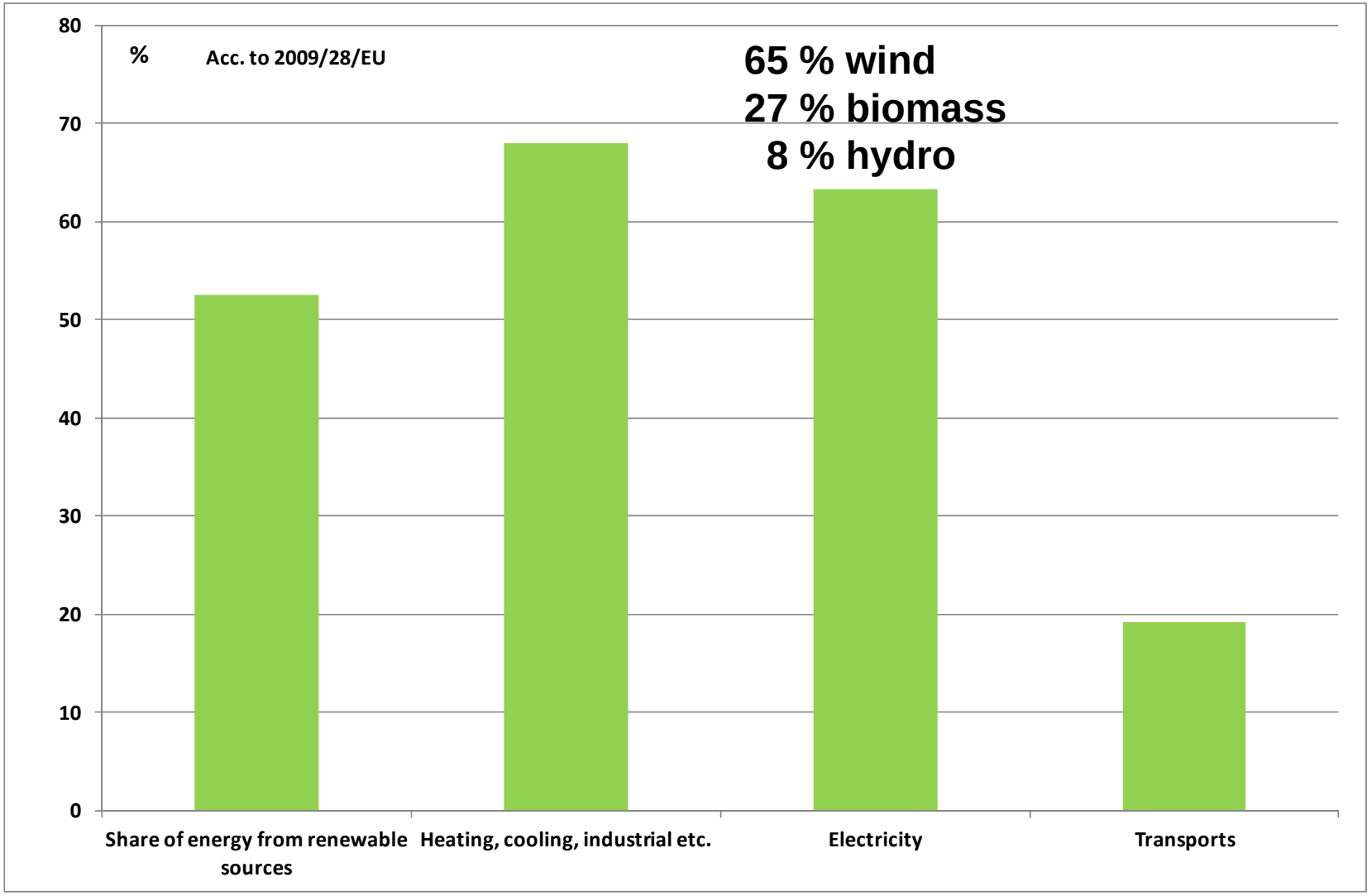
Biomass Energy Supply 2014



Primary Final energy Use 2014



Use of RE energy 2014



RE Promotion Green Certificates

2002 datum **6.7 TWh**
2002 target **+ 10 TWh 2010**
2006 target **+ 17 TWh 2016**
2009 target **+ 25 TWh 2020**

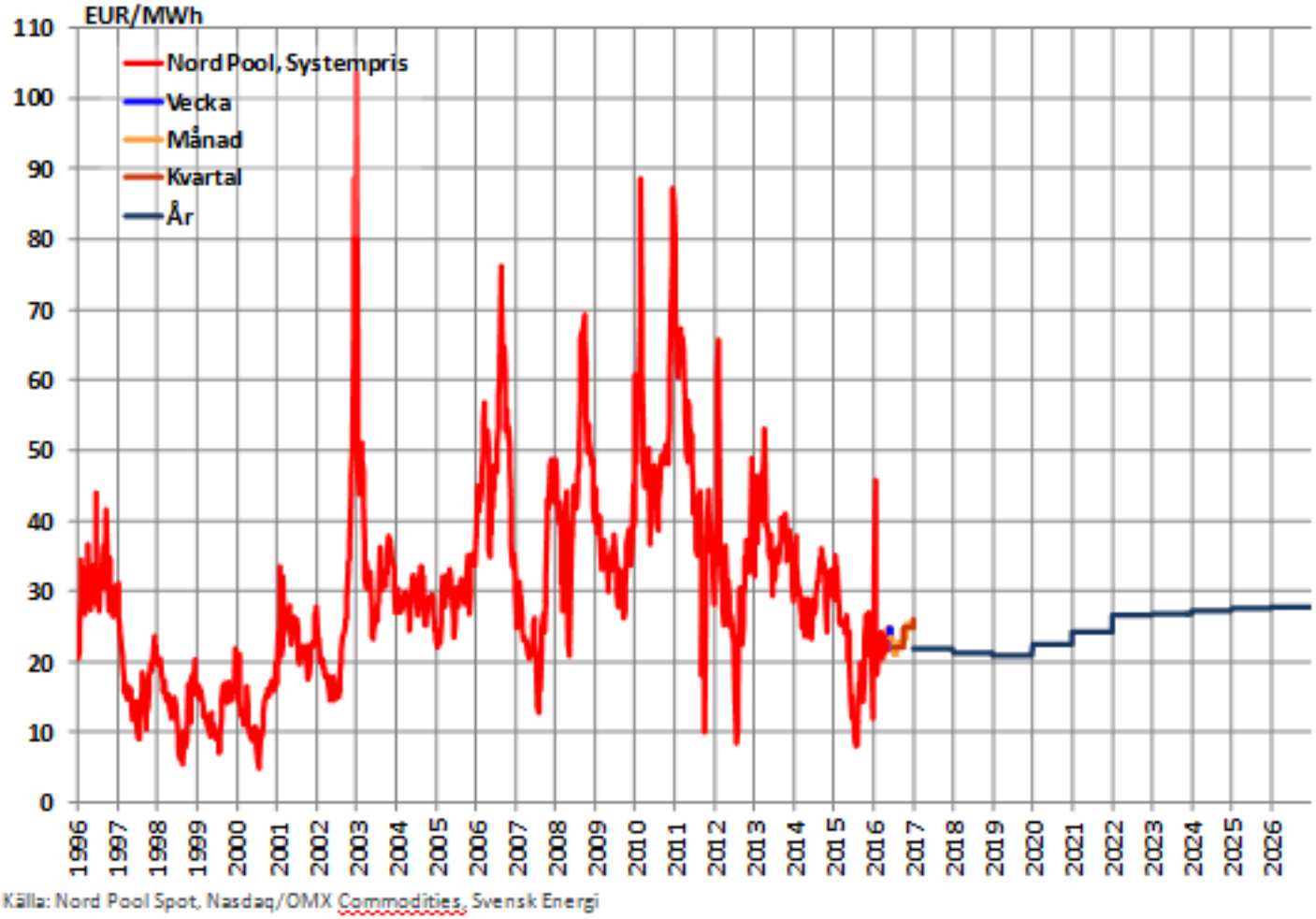
2012 SE+NO common target
SE **+ 13.2 TWh 2020** **to meet previous target**
NO **+ 13.2 TWh 2020**

2015 SE target **Increase 5 TWh to + 30 TWh 2020**

June 2016 SE target **Increase 18 TWh to + 48 TWH 2030**

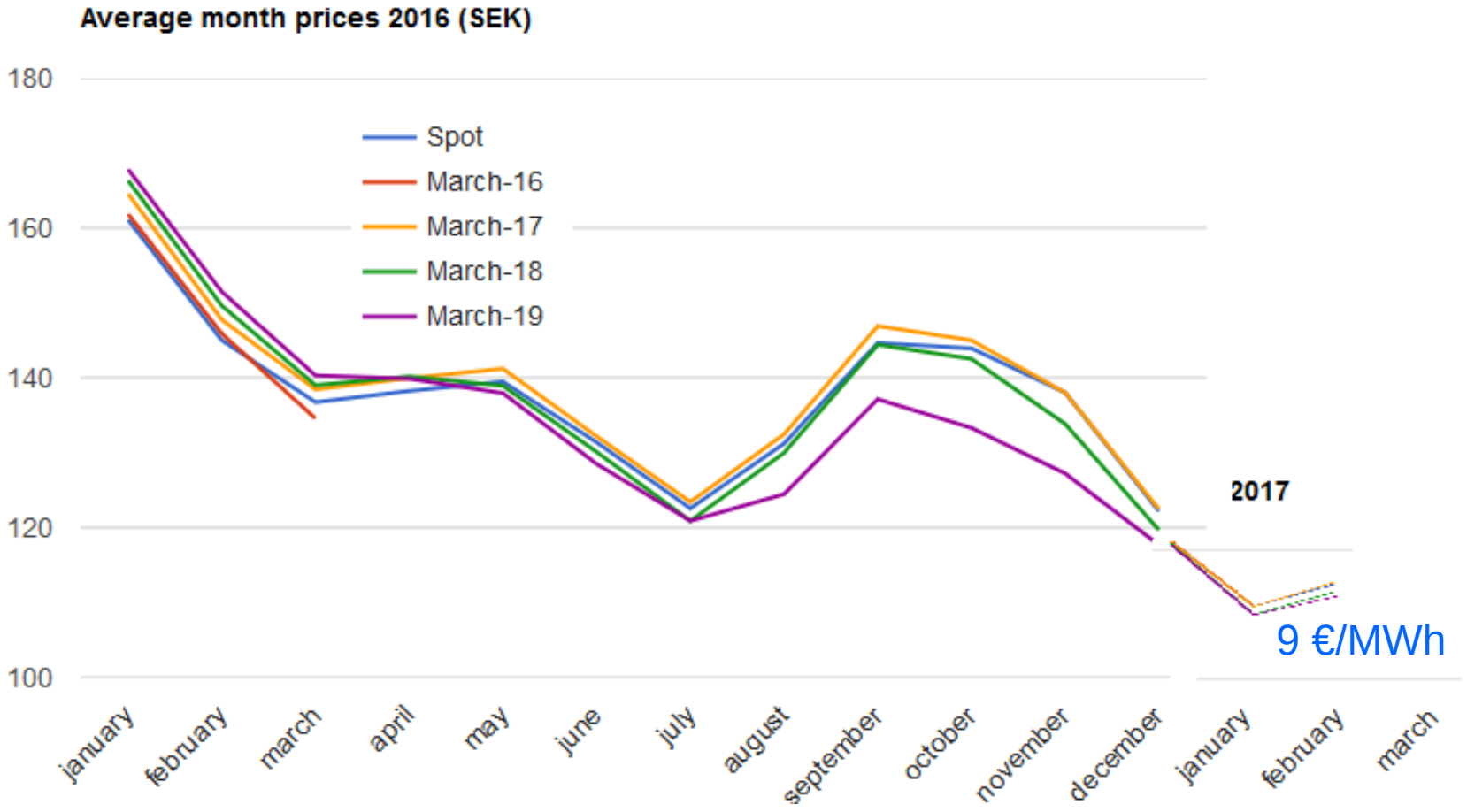
(total final power usage in 2014, 120TWh)

Noordpool spot



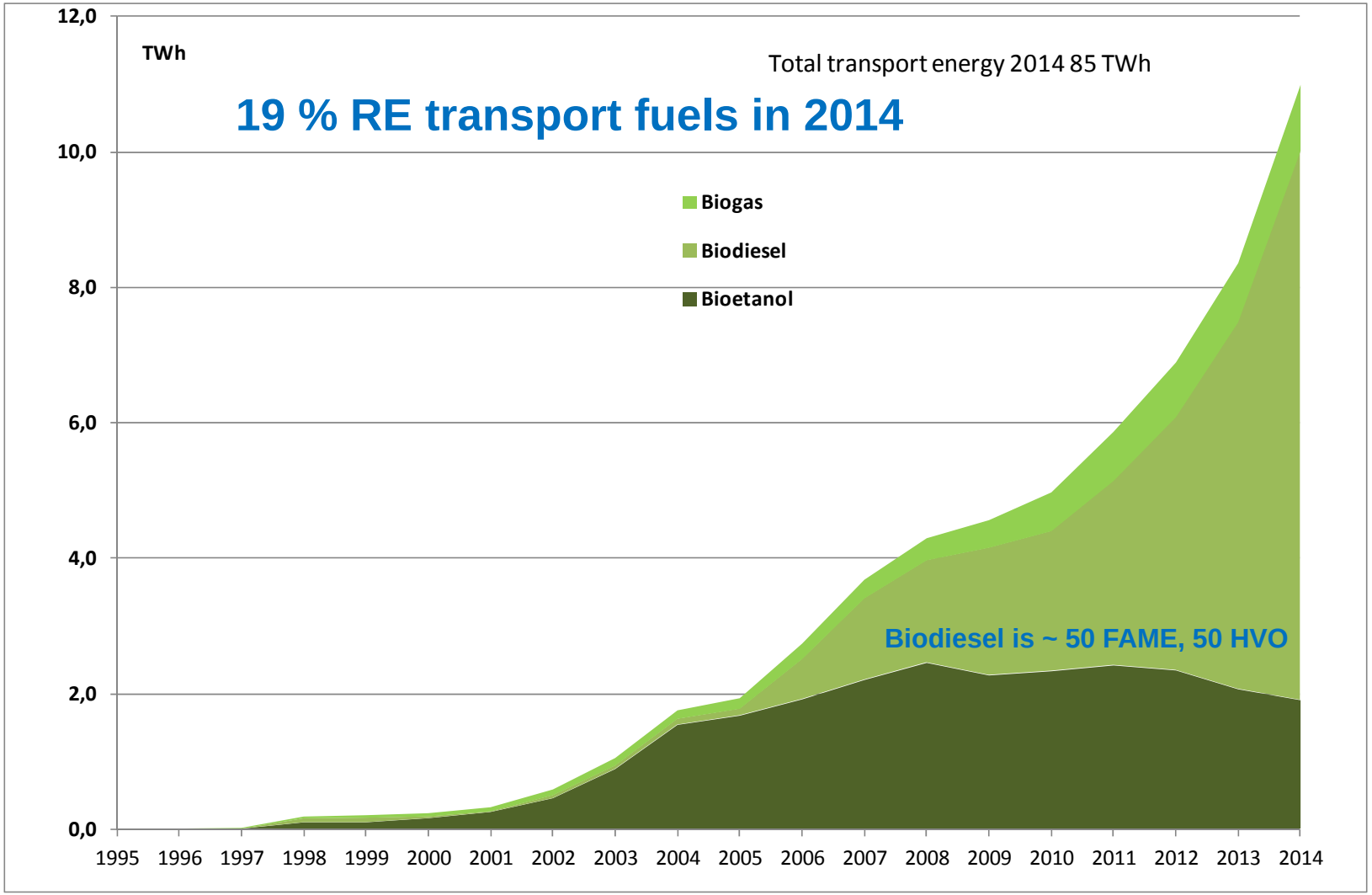
Källa: Nord Pool Spot, Nasdaq/OMX Commodities, Svensk Energi

RE Certificates 2016



Source Svenska Kraftmäklarna

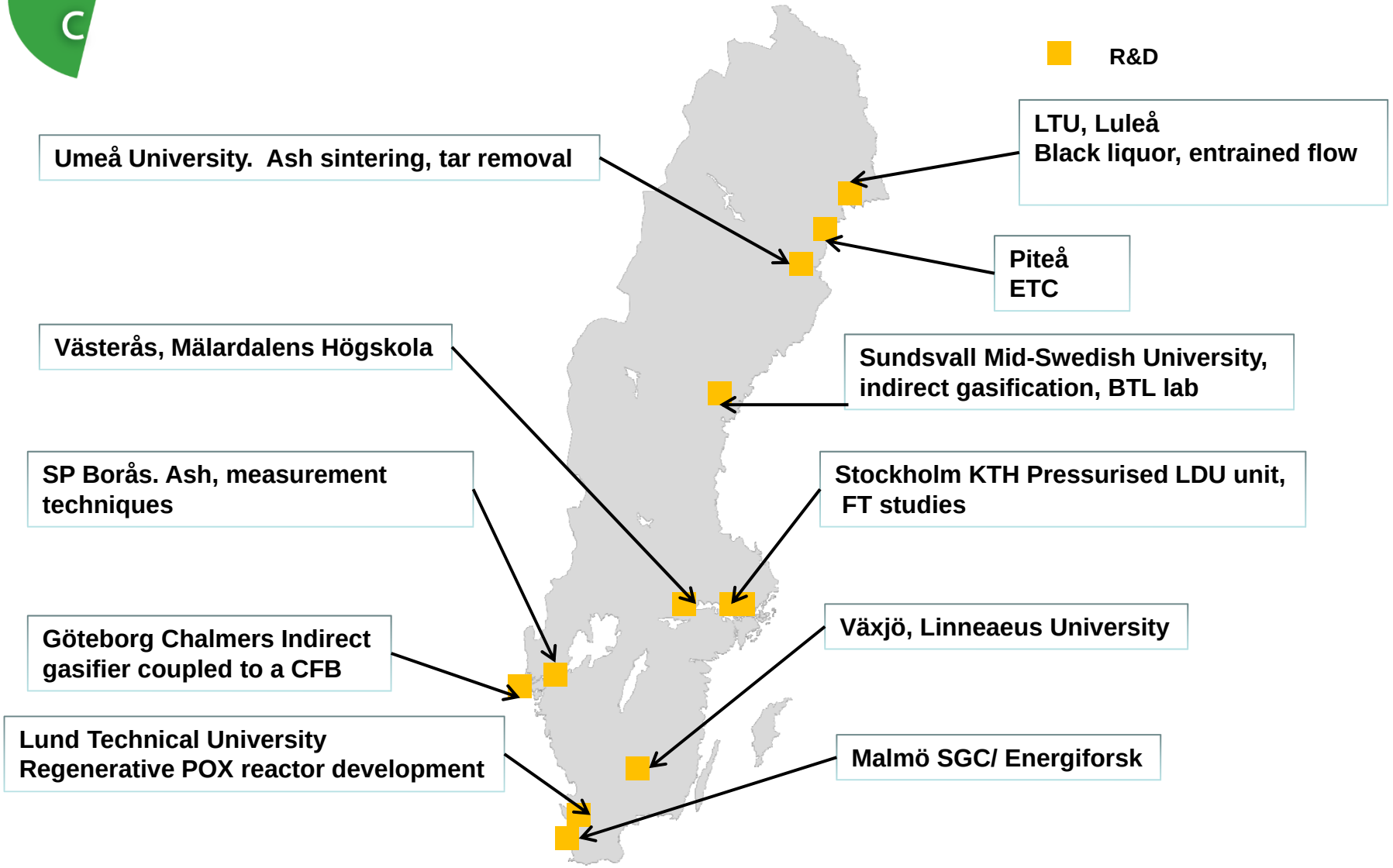
Renewable Transport Fuels



Renewable transport fuels

- **Present situation**
  - 19 % RE transport fuels in 2014
  - 5.9 % of all vehicles predominant RE fuels in 2013
  - Energy taxes levied on low-level blends in gasoline and diesel
    as of 2013 to comply with EU state aid rules, but no CO_2 tax.
  - Tax exemptions retained for high-level blends or neat fuels
    (e.g. E85, B100, CBG, but also for HVO < 15 % in diesel)
  - RED Sustainability criteria to qualify for tax exemptions
  - New support system in discussion since 2012. All options on the table
  - Present tax based system accepted by the EC to 2018 (biogas 2020)

Biomass Gasification R&D Sweden



Swedish Research Program

SFC	Separate slide
LTU-Biosyngas centre	Separate slide
Energy gas program	Terminated 2016, no new program
f^3	65 million SEK, of which part is a joint program of 44 MSEK, “Renewable transport fuels” 50% co-funded by Energy Agency
Thermochemical Conversion	Biomass including lignin, gasification, HTL, HTC, pyrolysis, hydrogenation, 80 MSEK 2015-19 (allocations 40 in 2015, 20 in 2016)

Swedish Gasification Centre (SFC)

CDGB - *Centre for Direct Gasification of Biomass*

CIGB – Centre for Indirect Gasification of Biomass

B4G – Biomass for Gasification, Entrained Flow Centre

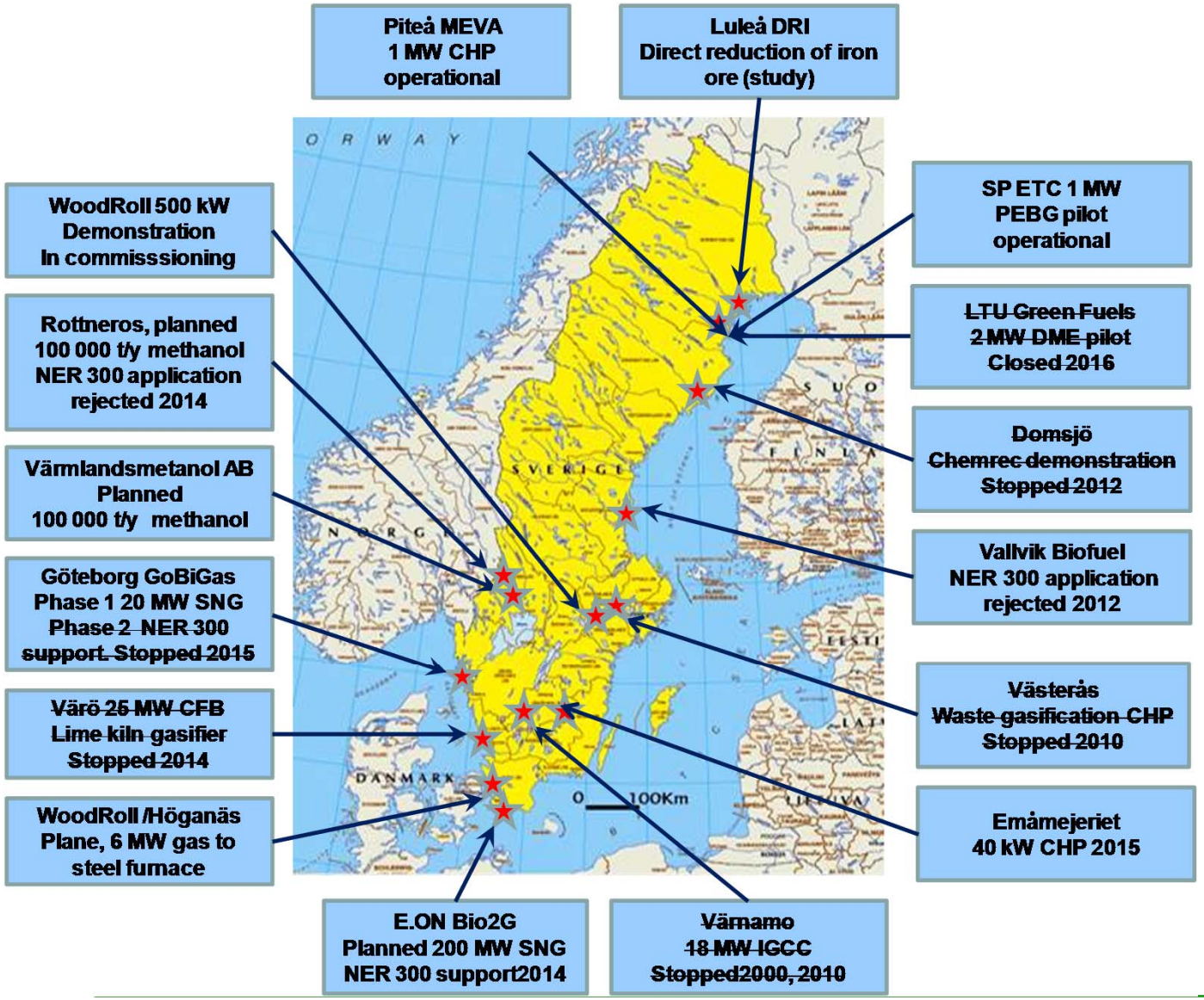
Academies Chalmers, Gothenburg Univ., KTH, Linneaeus Univ., Luleå Technical Univ., Lund Univ., Mid-Swedish Univ., Umeå Univ.

Companies E.ON, Valmet, Fortum, Göteborg Energi, Cortus, Nynäs, Sveaskog, Holmen, MEVA, Bioendev. Luleå Energi, Umeå Energi Pite Energi, LKAB, Akademiska Hus

2013-2017 activity, 58 MSEK/year

2017-2021 3rd phase 58 MSEK/year

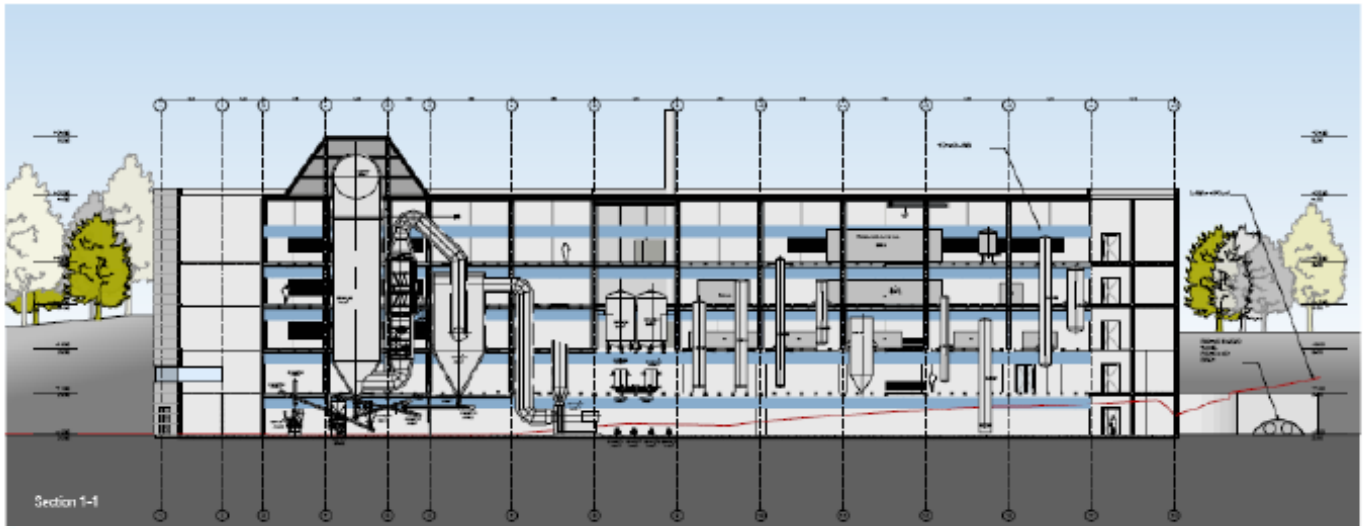
Biomass Gasification Developments 2010-



Biomass to SNG: GOBIGAS

GoBiGas – phase 1

Production:		Consumption:	
Bio-SNG	20 MW	Fuel (pellets)	32 MW
District heating	4 MW	Electricity	2,5 MW
Heat to heat pumps	8 MW	RME (bio-oil)	0,5 MW

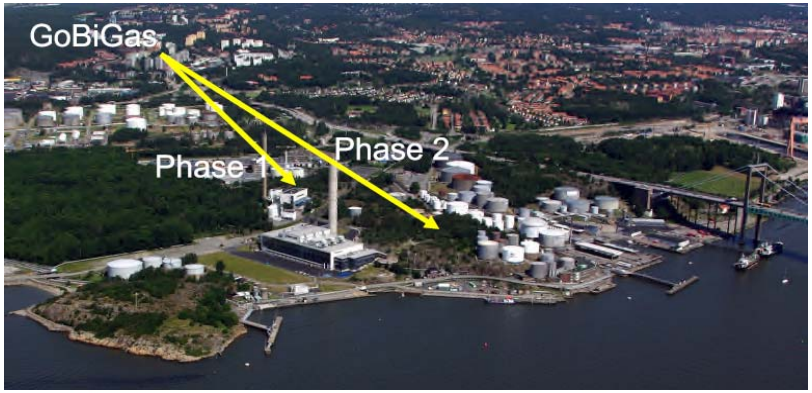


Göteborg Energi

Biomass to SNG: GOBIGAS

GoBiGas – step by step

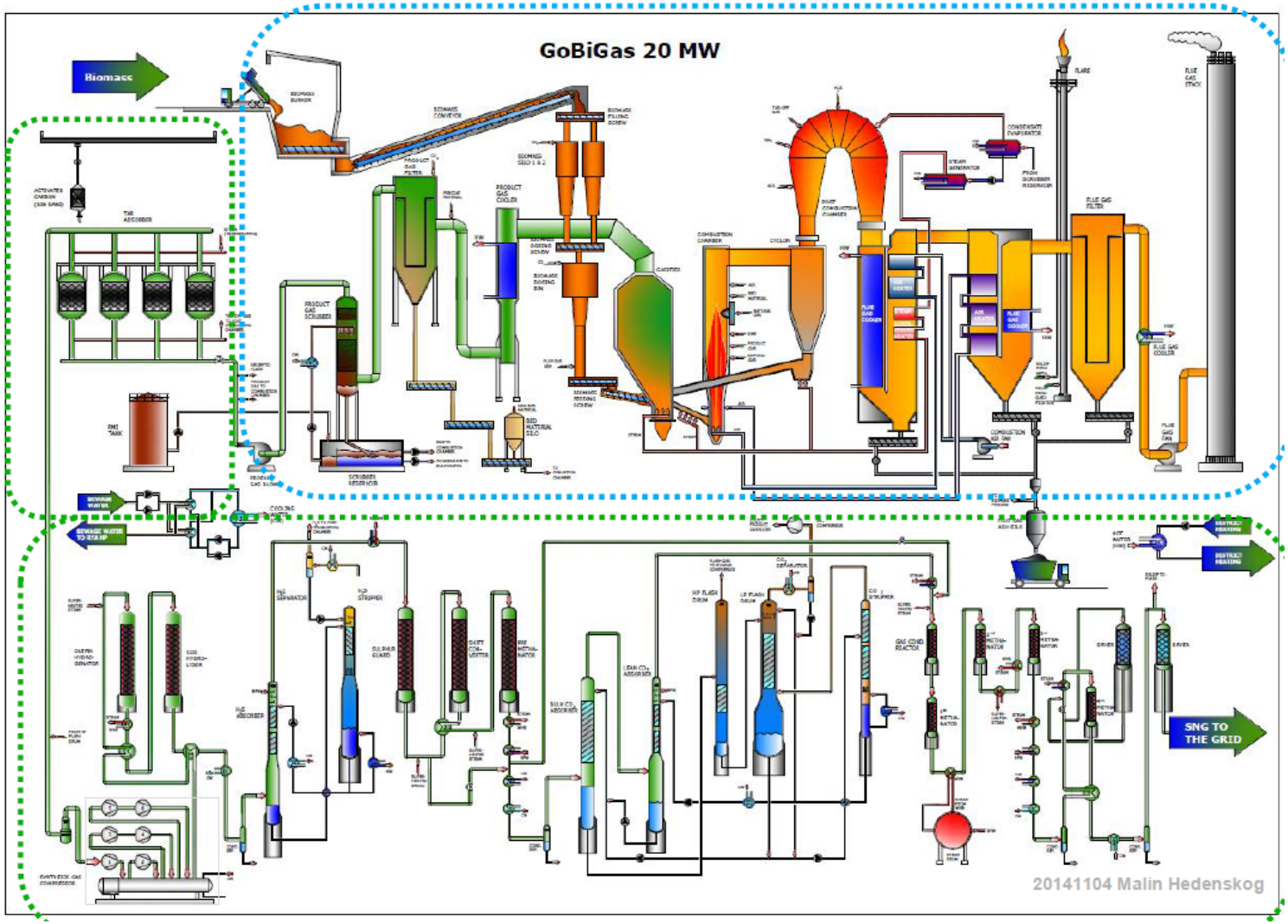
- **Performance goals:**
  - Biomass to biomethane 65 - 70%
  - Energy efficiency > 90%
- **Phase 1:**
  - Demonstration plant
  - Evaluation, R&D programme
  - 20 MW generating 160 GWh/year
  - In operation early 2013
  - Allothermal (in-direct) gasification
- **Phase 2:**
  - 80-100 MW generating 640-800 GWh/year
  - In operation after evaluation of Phase 1
  - Technology not yet chosen



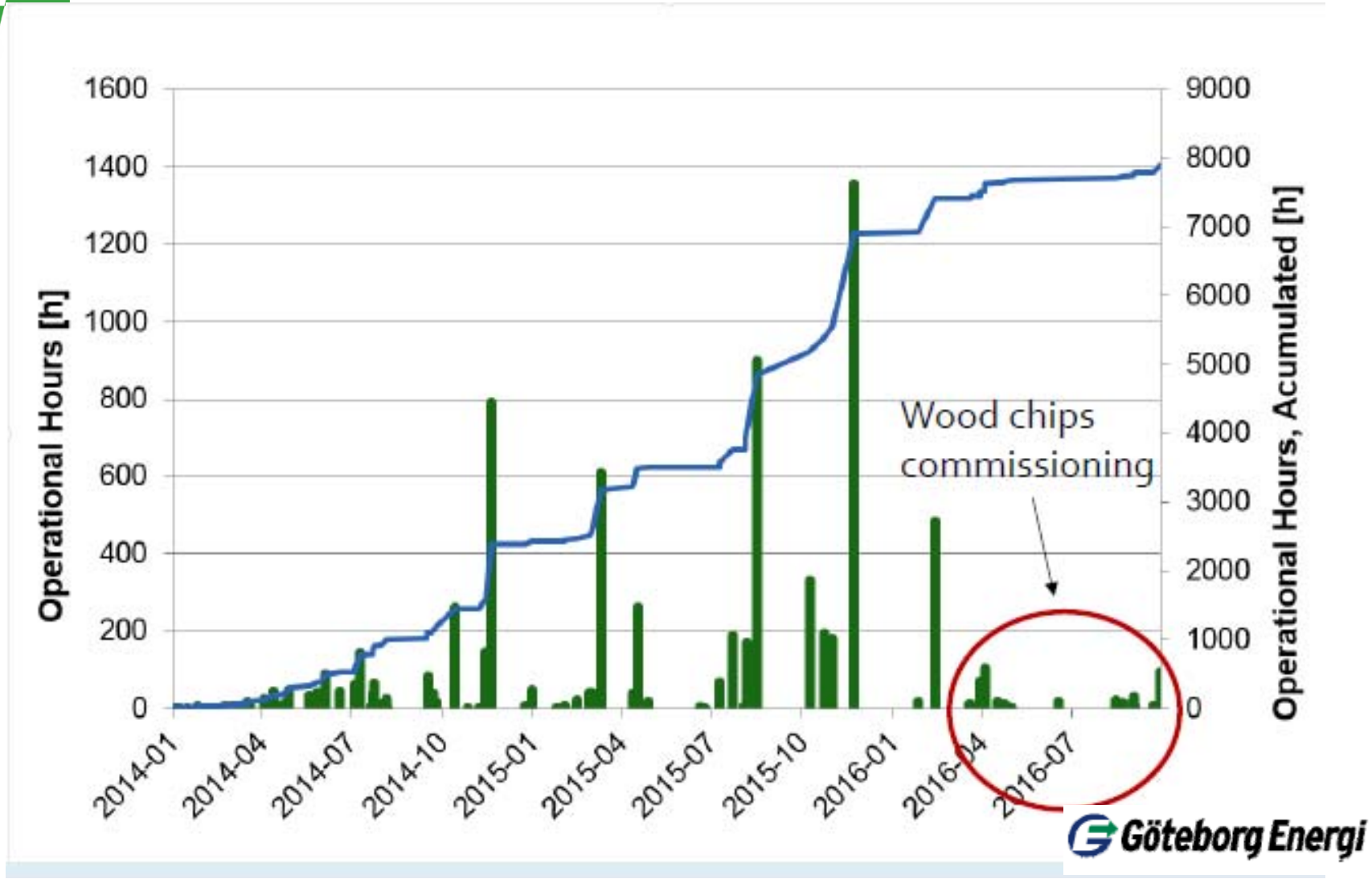
Official start-up October 28, 2013.

Göteborg Energi

Biomass to SNG: GOBIGAS



Biomass to SNG: GOBIGAS



Biomass to SNG: GOBIGAS

Gasification - Performance Test (Wood Pellets)

Flue gas emissions	Guarantee	Measured	
Dust (24 hr average)	10	< 1.4	mg/Nm³ @ 6% O2
CO (24 hr average)	500	109	mg/Nm³ @ 6% O2
NOx as NO2 (1 year average)	95	96	mg/Nm³ @ 6% O2
N2O (24 hr average)	20	3.2	mg/Nm³ @ 11% O2
NH3 (24 hr average)	10	4	mg/Nm³ @ 11% O2
Product gas	**Guarantee**	**Measured**	**Unit**
Capacity	24.3	23.5	MW
Flow	6890	6900	Nm³/h
CH_4	8.3-11.4	8.6	Vol-%
O_2	<0.1	<0.01	Vol-%
C_6H_6	<15	14.4	g/Nm³
N2	<0.85	0.3	Vol-%
Tar	<20	<10	mg/Nm³

Göteborg Energi

Biomass to SNG GOBIGAS

Status October 2016.

- Gasifier operation approx. 8 000 hours
- MCR load proven on pellets
- Gas quality good, bio-methane quality better (rel. to design spec.)
- Pellets are very clean and generates certain specific issues.
- Bed material activation has been a learning experience

- SNG product for extended periods since August 2015
- 80 % of design capacity
- 44 GWh SNG produced
-Chip fuel commissioning is on-going
-Initial issue with chip quality too high / too varying moisture

GOBIGAS

The City Council decided to discontinue plans for Phase II in December 2016.

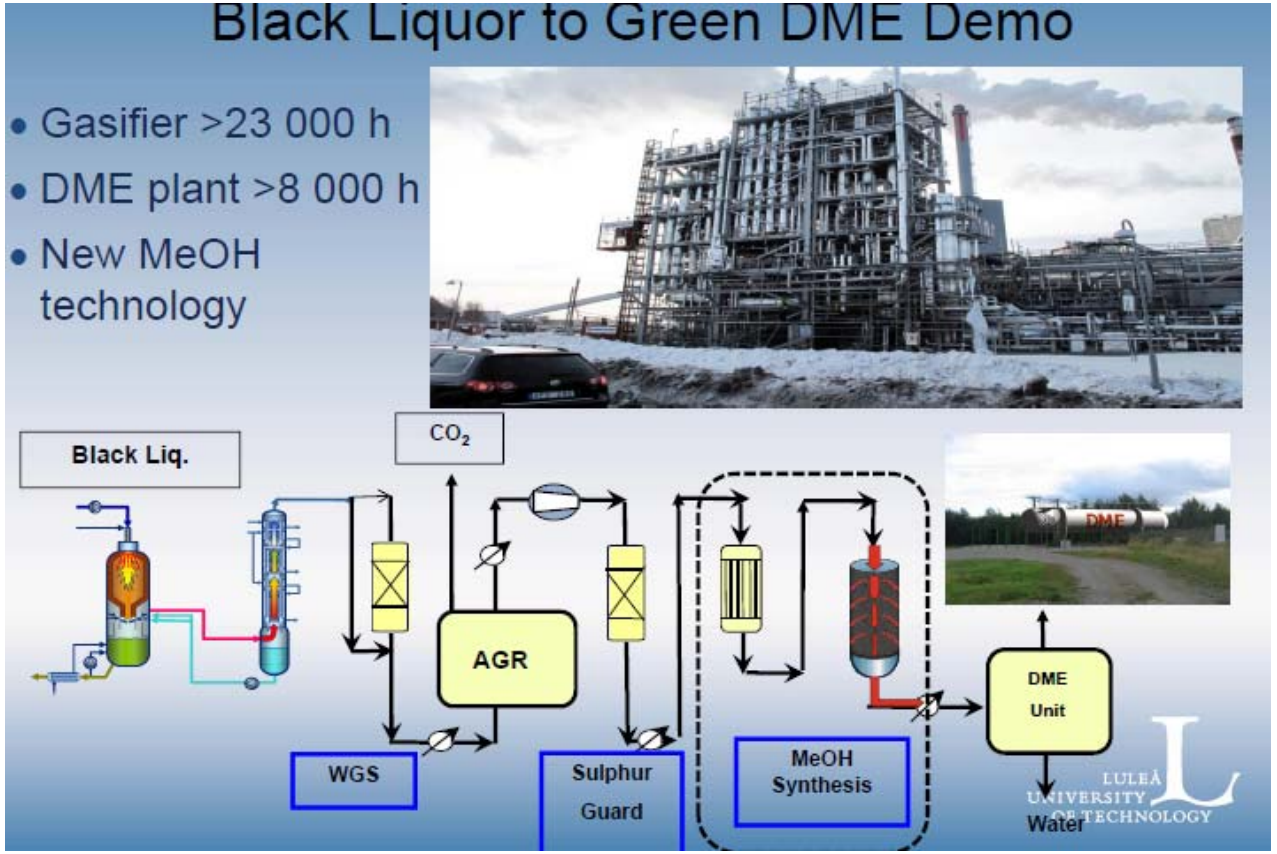
Lack of sufficiently dry forestry residue fuel forces operation on pellets in 2016-2017.

Early 2017, explosion/fire in pellets silo, standstill.
In June dry forest residue fuel becomes available, re-start.

DK biogas, with DK subsidies, enters Swedish market via the grid, and gets SE tax benefits, distorting the Swedish, grid connected bio-methane market by price dumping.

End of April 2017, the board gave an assignment to the company to “speedily explore the possibility of finding new owners/financiers for the plant”.

LTU Biosyngas program



Previously Chemrec BL pilot, bio-DME pilot
LTU Biosyngas program, approx. 160 MSEK, 2014-2016
Program ended in May 2016 and no additional funding secured
Mothballing for a period has been decided.

Other Projects

Other projects, no known development

- Bio2G, EON 300 MW SNG, S. Sweden

- Värmlandsmetanol, 100 000 tpa methanol, Värmland
  (New IPO on-going, 1.5 Millon €)

-Rottneros biorefinery, 150- 200 000 tpa methanol, Värmland

-Cortus, MEVA presenters at workshop tomorrow.

Tax exemptions and state-aid

The EC view on support by tax exemptions

- cannot make biofuels cheaper than fossil fuels ("over-compensation").
- cannot apply to new plants (2014)
- cannot be applied to crop based biofuels as of 2020
- cannot be combined with other policy measures such as a quota obligation
- CO2 tax not mentioned in tax directive
- CO2 tax requires differentiation on a fuel basis

SE government actions to avoid issues for enterprises

- More price supervision to avoid over-compensation.
- Stepwise increase in biofuels taxation to avoid over-compensation
- Differentiated taxation for different biofuels depnding on type and level of blend-in (even CO2 tax!)
- New tax conditions for new plants (after 2014)
- Proposal for new system in 2017 for implementation 2018

Renewable transport fuel taxation 2015

Fuel type	Usage	Energy tax reduction %	CO2 tax reduction %	Notes
Ethanol ETBE	Low blend-in	(74) 88	100	Max. 5 % blend (10 % 2016)
Ethanol, Other biofuel	High blend-in	(73) 92	100	E85, No fossil component
Ethanol ED 95	High blend-in	100	100	No fossil component
FAME	Low blend-in	(8) 36	100	Max. 5 % blend
FAME	High blend-in	50 (63)	100	
HVO		100	100	
Biogas		100	100	To 2020

taxes changed twice in 2016 to avoid “over-compensation”