

2009 National CIBE - Symposium

FOREST FUELS; SWEDISH EXPERIENCE

Combustibles forestiers; expérience suédoise

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Based on presentations by Söderenergi, EFO and SLU, Skogforsk

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Content

- General aspects
- Some examples
- Söderenergi; a major user of biofuels
 - Quality assurance
 - New CHP

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THE OWNERS OF EFO AB AND THE FUELS THEY USE



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Biofuels = Mainly from forest

- Forest (logging)residues
- Shavings
- Saw dust
- Bark
- Low diameter stems
- Rotten wood
- Dry wood chips

Other solid biofuel

- From agriculture (salix, willow, red canary grass)
- Recycled wood chips
- Olive meat/kernels
- Palm Oil kernels
- Peat
- waste

Taxes

Without heavy taxes on fossil fuels and support eg for "green electricity" and well built-out system of district heating which makes co-generation of heat and electricity feasible, **biofuels would not have been so successful in Sweden**

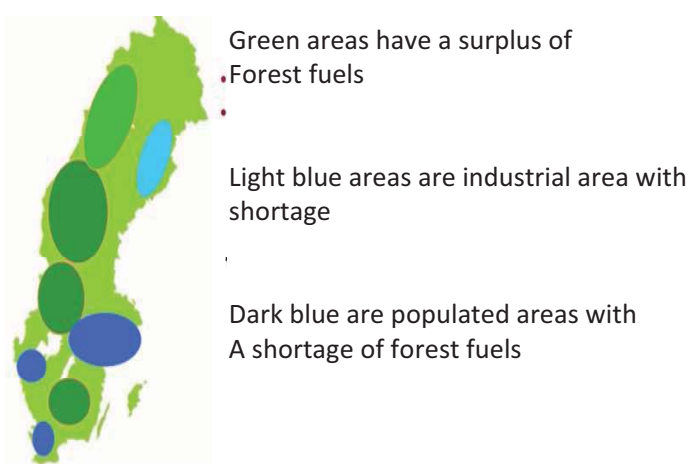
Taxes: SEK (1 EURO = 10,4 SEK)

Remark: The energysector + some industries must then also buy CO2-allowances

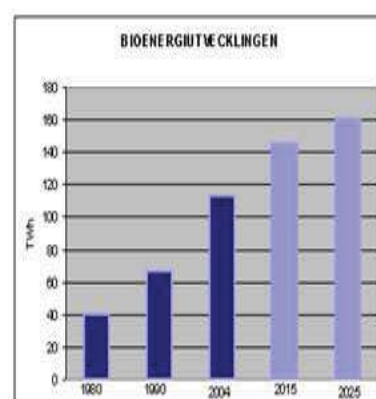
	Energy tax	CO2 tax	Sulphur tax	TOTAL	SEK/kWh
Fueloil / m3	797	3007	108	3912	0,37
Coal /t	339	2617	150	3106	0,41
Naturalgas/ 1000 m3	258	2252	-	2510	0,23
Peat /t	-	-	50	50	0,02

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Bioenergy in Sweden



Cogeneration of electricity and heating yields >90 % efficiency compared to approx 30 % for only electricity



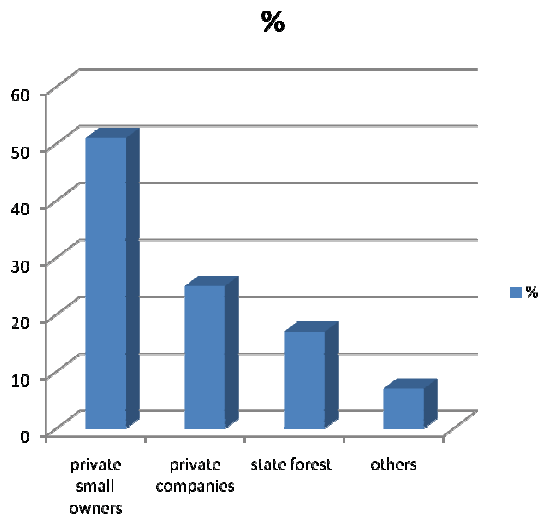
Steady increase since the 1980:ies
Mainly forest fuels, waste and peat

Total energy : 624 TWh of which bioenergy accounts for 125 TWh 2008
more than nuclear and hydropower

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Swedish situation

Ownership of the forests in Sweden

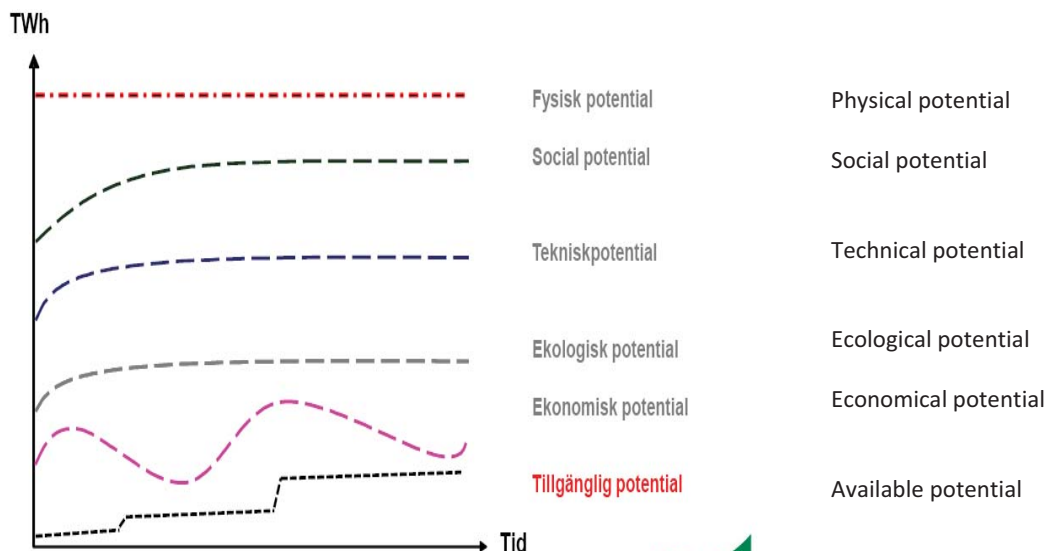


Actors on the forest fuel supply side

- Associations of private forest owners. May have saw mills and even paper/pulp mills. Use contractors for biofuels but handle marketing, sales and logistics
- Associations of private forest owners. May have saw mills and even paper/pulp mills. Use contractors but sell to intermediate biofuels-marketing company
- Forest industries with own forest or no forest of their own. Sells biofuels themselves or to a marketing company. Sometimes they have wood pellets factories.
- Biofuels companies with no forests nor forest industries of their own. They might have wood pellets factories though.
- Traders especially for import

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How much can we take out of the forest?



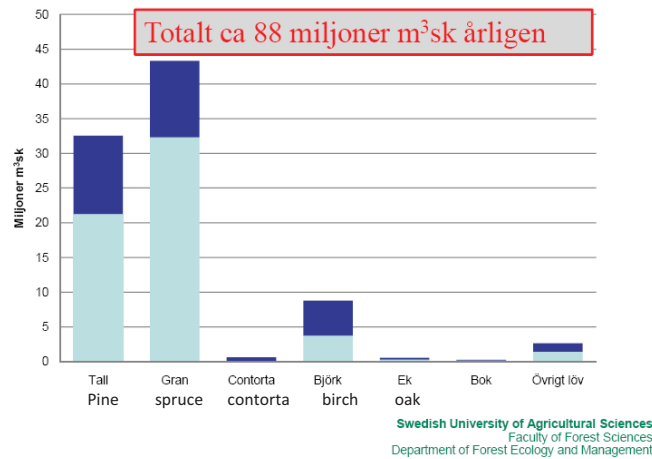
Swedish University of Agricultural Sciences
Faculty of Forest Sciences
Department of Forest Ecology and Management



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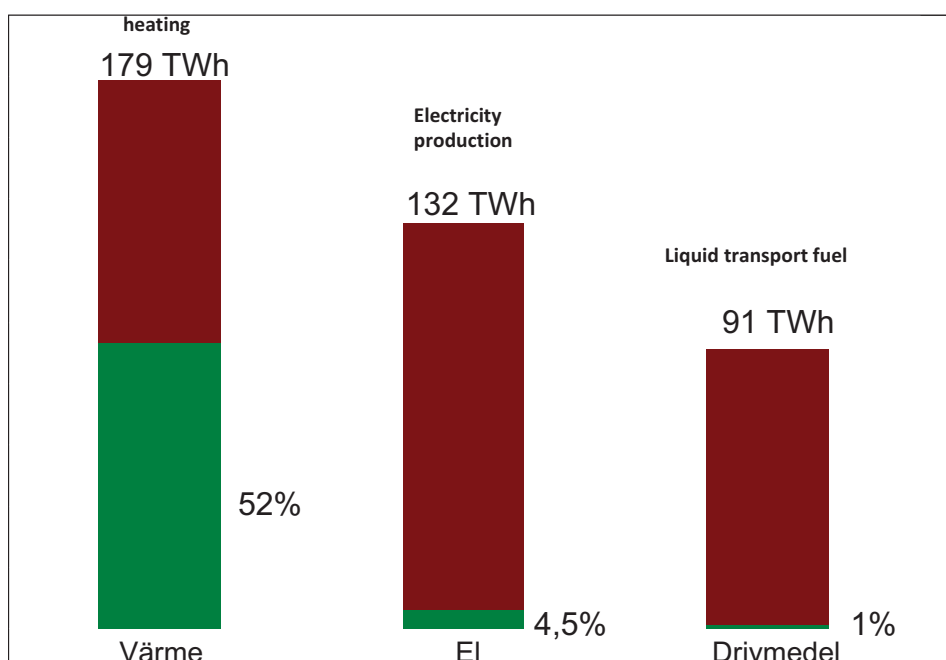
Cuttings in Sweden 2011 - 2020

Årlig bruttoavverkning i landet 2011-2020 fördelad på trädslag, samtliga ägare
SKA 99, "90-talets skogsbruk"



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Andelen biobränsle av slutlig energianvändning amount of biofuel in various sectors



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Forest residues
tops and branches

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Low diameter stems



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STUMPS

Great potential but many restrictions

Stump harvest

20 – 25 % of the tree volume
is in the stump and twice
as much biomass/ha as
tops and branches

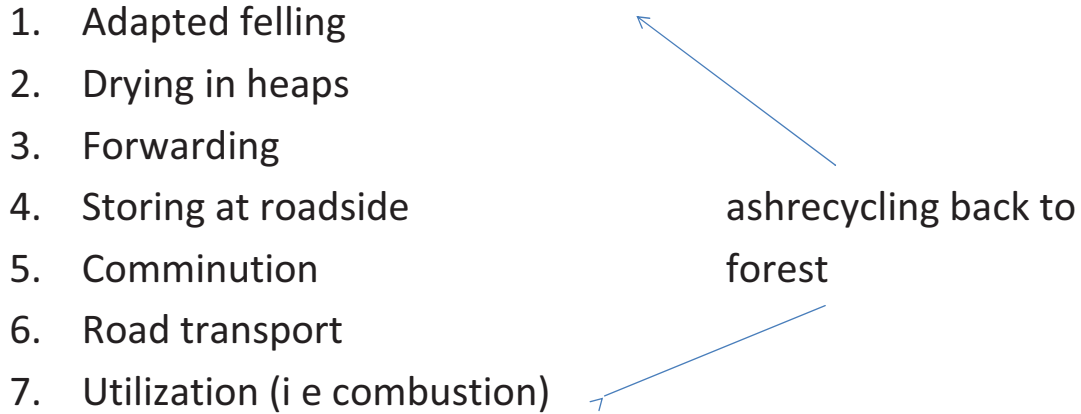
Approx 50 tonnes of
stumps/ha

Lifting of stumps, capacity
approx. 70 stumps/hour
4,2 – 4,9 tons/hour



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Main system for forest residues (final fellingsresidues)



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Although solid biofuels is a major source of energy in Sweden since the 80:ies, a lot of R&D-work goes on to further develop and make the systems more efficient along the whole chain from source to ashes.

Eg by SKOGFORSK Forestry Research Foundation
VÄRMEFORSK Thermal Engineering Research
TORVFORSK Peat Research Foundation
SLU/JTI Agrocultural R&D

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Forwarding to storage at roadside



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Logistics; a key factor

Today's forest fuel comes by trucks from the near by maximum 150 km to the plant

IKV and other large projects will get supply also from distance: Per Railway, truck or boat (from Sweden, the Baltic region as well as "overseas flows" from Brazil and others). This implies a need for terminals for rail / ship for transshipment / chipping / storage / buffer storage accommodation.

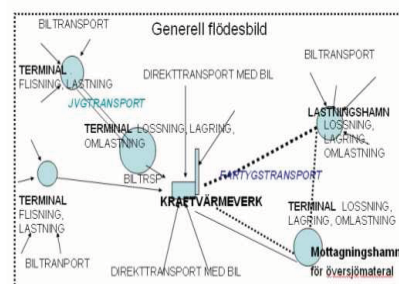
For IKV is therefore very important to have broad bands of forest fuel, supplemented by local willow, return fuel type brk-pellets and "overseas materials (wood chips, nut shells, etc.)

For 20 EURO you can transport 1 t

200 kms by truck
600 kms by railway
10000 kms by ship

But trucks are flexible. Both railways and ships requires larger volumes per shipment and installations to receive the material

FLÖDE BIOBRÄNSLE TILL ENERGIVERK



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Quality parameters of some biofuels

Egenskaper properties	GROT residues	Bark bark	Salix willow	Stubbflis stumps	Returflis recycled wood chips	Stycketorv sod peat	Brk-pellets waste pellets
Fukt moisture	45	55	55	40	26	55	5
Form shape	Spån shavings		Flak flakes	Ev långa fibrer long fibres		Korvar "sausages"	Korvar "sausages"
Finsvans fines content	Stor large		Liten small		Hög High		
Damning dustiness	Kan damma may be dusty		Liten small		Kan damma may be dusty	Mkt stor very dusty	Dammar dusty
Föroreningar impurities	Sten Metall stones, metals		-	Sten jord metall stones, metals	Rel mkt skrot scrap	Stubb stumps	Rel lite Small amounts

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EXAMPLE

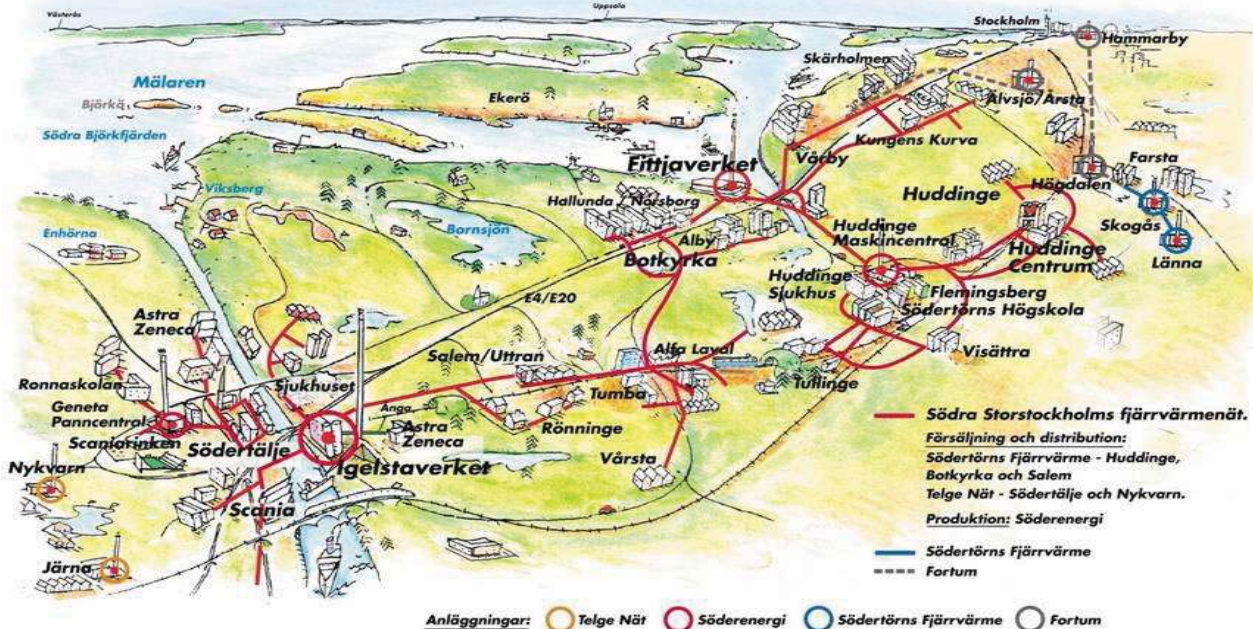
SÖDERENERGI AB: A regional energy producing company SW of Stockholm

4 plants; 2 with their own harbour
converted from fossil fuel to biofuels in the
90:ies. Is right now taking a new, large CHP for
wood chips + some processed biowaste into
operation. Per day approx 10 000 m³ at Igelsta

District heating system in SW Stockholm-area

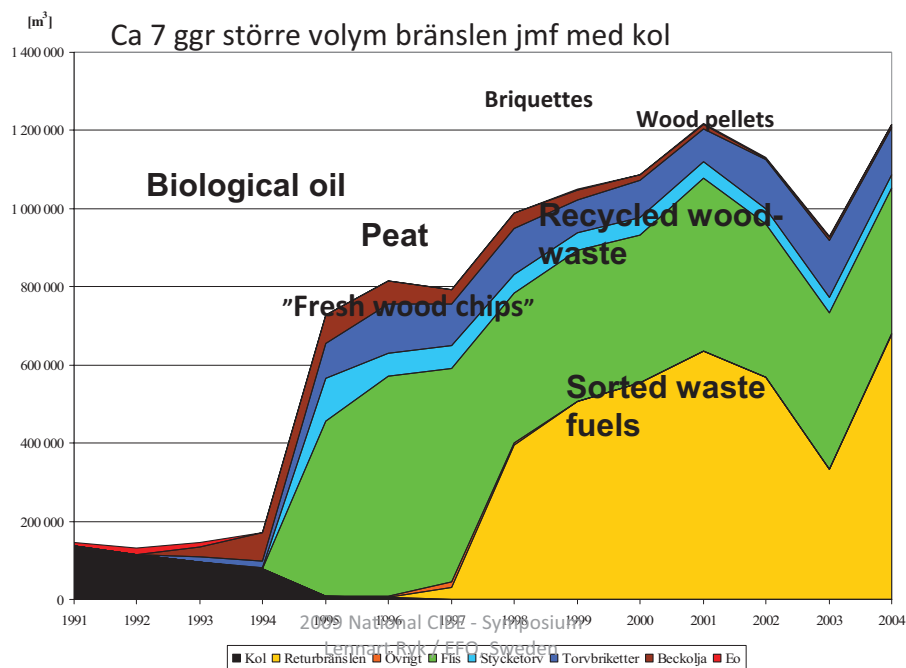
Söderenergi:s system approx 400 km. Connected to Fortum in Central Stockholm

Fjärrvärmesystemet i södra Stockholm



Söderenergis bränslen 1990-2004

ÅTERVUNNA "SEKUNDÄRBRÄNSLEN OCH BIOBRÄNSLEN INKL. TORV" ung 40 % import



Mottagningskontroll träflis/stycketorv

Control at trucks receiving, wood chips and sod peat

- Visuell kontroll / visual control
- Provtagning / sampling
- Analysering XRF / fast analyzing by XRF
- Plockanalys / checking of composition
- Skrotest / scraptest
- Stickprov / random sampling



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 Söderenergi				
Dokumentets namn Kvalitetsspecifikation Skogsbränsle (By-products e.g. sawdust, cutter chips, bark)				
Uttfärdare	Signatur	Godkänd	Regnr Bth 5.1.1.20	Sida 1(1)
			Signatur	Datum för giltighet 2009-09-21

Med skogsbränsle menas bränsleråvaror med VMR kod 57 = Blandbränsle

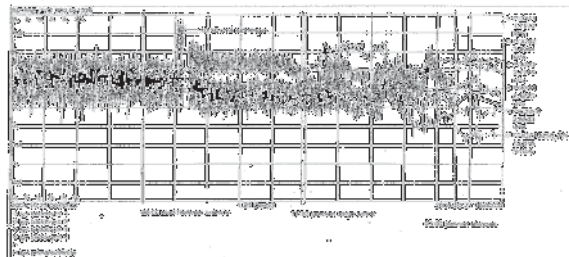
Genomsnittsvärden för leveranser levererade under en 24-timmars period.

BRÄNSLEDATA	METOD	ENHET	TYPVÄRDE	MIN	MAX
Fysikaliska parametrar					
<100 mm	CEN/TS 15149-1	viktt %		≥ 90	
<3 mm		viktt %	20		
<50 mm		viktt %	80		
<150 x 50 x 50 mm		viktt %	100		
Densitet	CEN/TS 15103	kg/m ³ lös	300-350 ± 200 (200-400)		
Änals					
Fukthalt	CEN/TS 14774-1-2	%	45,0 (10,0-55,0)	30	60,0 (enskild leverans) ≤ 55,0
Askhalt	CEN/TS 14775	% ts	1,5		3,0 ± 3,0
Cl	CEN/TS 15289	% ts	≤ 0,05		
S	CEN/TS 15289, ASTM D 4239	% ts	≤ 0,1		
N	CEN/TS 15104	% ts	0,5 ± 3,0		
Effektivt värmevärde	CEN/TS 14918	MW/h/ton	2,3	≥ 2,0	
Effektivt värmevärde	CEN/TS 14918	MJ/kg		≥ 7,2	
Effektivt värmevärde	CEN/TS 14918	MJ/kg ts			
Föroreningar/avvikelser					
Metall får ej förekomma					
Sten, oorganiskt material samt överstort bränsle får ej förekomma i sådan omfattning och storlek att det anses störa driften eller skada anläggningen					
Tjälklumpar, lätt sammanfruset bränsle > 150 x 50 x 50 mm					
Tjälblock, hårt sammanfruset material, får ej förekomma					
Mögel och damm i sådan omfattning att det innebär störning i arbetsmiljön					
Temperatur i bränsle > 55°C					
Frysningshämmande medel som kan medföra miljöpåverkan eller materialskador får ej förekomma (t.ex. NaCl)					
Slip- och putsdamm får ej förekomma					

Materiallet ska vara väl synligt vid leveransmottagningen. Eventuell snö eller dylika avlägsnas från ytan på lastet så att visuell kontroll och provtagning kan utföras störningsfritt.

Leverans innehållande avvikelse uppfyller ej kvalitetsspecifikation och är därmed inte leveransgill. Leverantören ansvarar för att återta materialet.

Problems caused by recycled wood chips in FB-combustion , Boiler 3 at Igelsta



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Panna 2 bränsle Fuels for Boiler no 2

Torvbriketter

peatbriquettes

Träpellets

wood and barkpellets

Torvpellets

peatpellets



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Kajen i Igelsta At the quay at igelsta

recycled wood chips

returflis

waste-pellets

brk-pellets



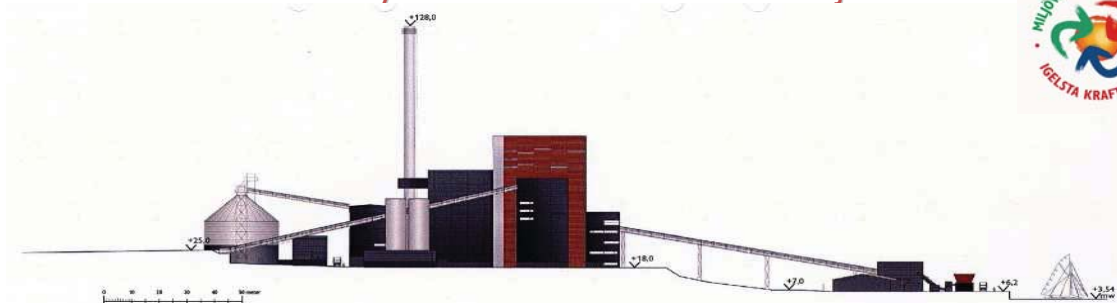
vessel with recycled wood chips

returflisbåt



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IKV: Nytt kraftvärmeverk i Södertälje



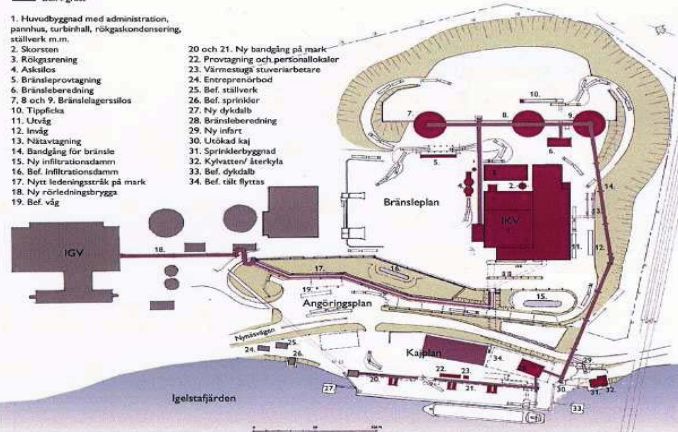
FÖRKLARINGAR

— Nya byggnader i rött

— Bef. i grön

1. Huvudbyggnad med administration, pannhus, turbinhall, rökgaskondensering, ställverk m.m.
2. Skorsten
3. Rökgasrening
4. Askstos
5. Bränsleportstagn
6. Bränsleberedning
7. 8 och 9. Bränslelagarsilos
10. Tipplatta
11. Utlösl
12. Inlösl
13. Näststagn
14. Bandgång för bränsle
15. Ny infiltrationsdamm
16. Bef. Infiltrationsdamm
17. Nytt ledningsstråk på mark
18. Ny röledningsbrygga
19. Bef. väg

- 20 och 21. Ny bandgång på mark
22. Provstagn och personallokaler
23. Värmestagn stuvor/betare
24. Ennegransierad
25. Bef. ställverk
26. Bef. sprinkler
27. Ny dykeldb
28. Bränsleberedning
29. Ny infort
30. Utökad kaj
31. Sprinklerbyggnad
32. Kylstent/sterkyla
33. Bef. dykeldb
34. Bef. salt flyttas



Orienteringsplan

Bränslen grundkalkyl



Årlig bränslemängd cirka 1,8 TWh. Hela Söderenergi 3,1 TWh bränsle
10000 m3 per day to Igelsta-plant

IKV, Södertälje

Vy över Igelstaverket och IKV från Södertäljesidan



New CHP – plant at Igelsta

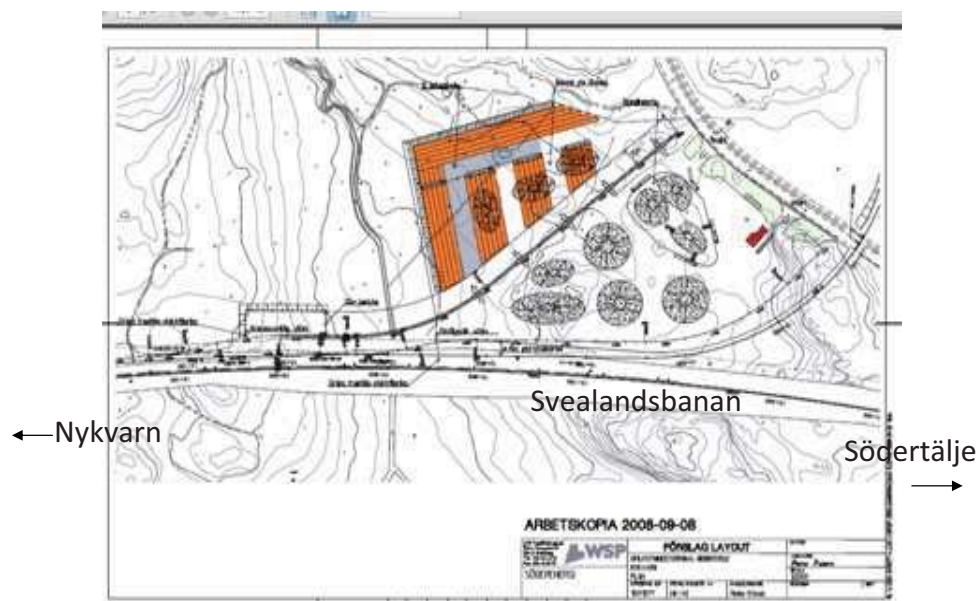
Nouvelle CHP - plante à Igelsta



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TERMINAL NYKVARN

HUVUDSAKLIGEN FLIS, EN DEL BUNTAR, EN DEL STAMVED
OMLASTNING JVG TILL BIL, MELLANLAGRING, EV. FLISNING



8 ha, ca 15 km från verket

Samarbete med Green Cargo
Och Brinova

New railway terminal at Nykvarn

5 unittrains 560 m long/week



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