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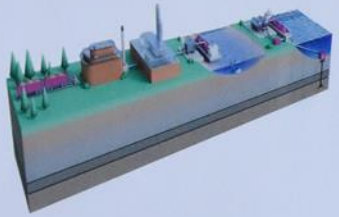
BECCS with the potential of capturing 800,000 tonnes of carbon dioxide a year

Carbon dioxide capture at Bio Heat and Power plants, BECCS, involves capturing combusted carbon dioxide from flue gases, compressing it into liquid form and then injected into porous rock under high pressure, typically under the seabed. Stockholm Exergi's calculations show that there is potential to capture 800,000 tonnes of carbon dioxide a year at the Bio Heat and Power plant in Värtan.



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Carbon capture: a key step towards achieving climate goals

We use a method known as Hot Potassium Carbonate, (HPC), which involves adding potassium carbonate to flue gases under pressure and heat.

BECCS facility 2.0

- Elongation of absorption and desorption columns from approx. 1 metre to about 25 metres.
- Recycling of flue gases to vary carbon dioxide content in incoming flue gases and simulate varying flue gas composition.
- Measurements to better understand how pH values affect reaction rates between carbon dioxide, potassium carbonate and boric acid.
- Faster, automated sample analysis enables more tests to be conducted in shorter periods.
- Improved sampling and measurement in the absorption column.
- Better insulation of the facility to max imise efficiency.
- A number of improvements to increase the ability to measure, manage and control the process.

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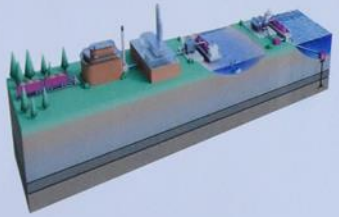

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Stockholm Exergi
50/50 ownership

Stockholms stad

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Ankhiale:

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KEVA

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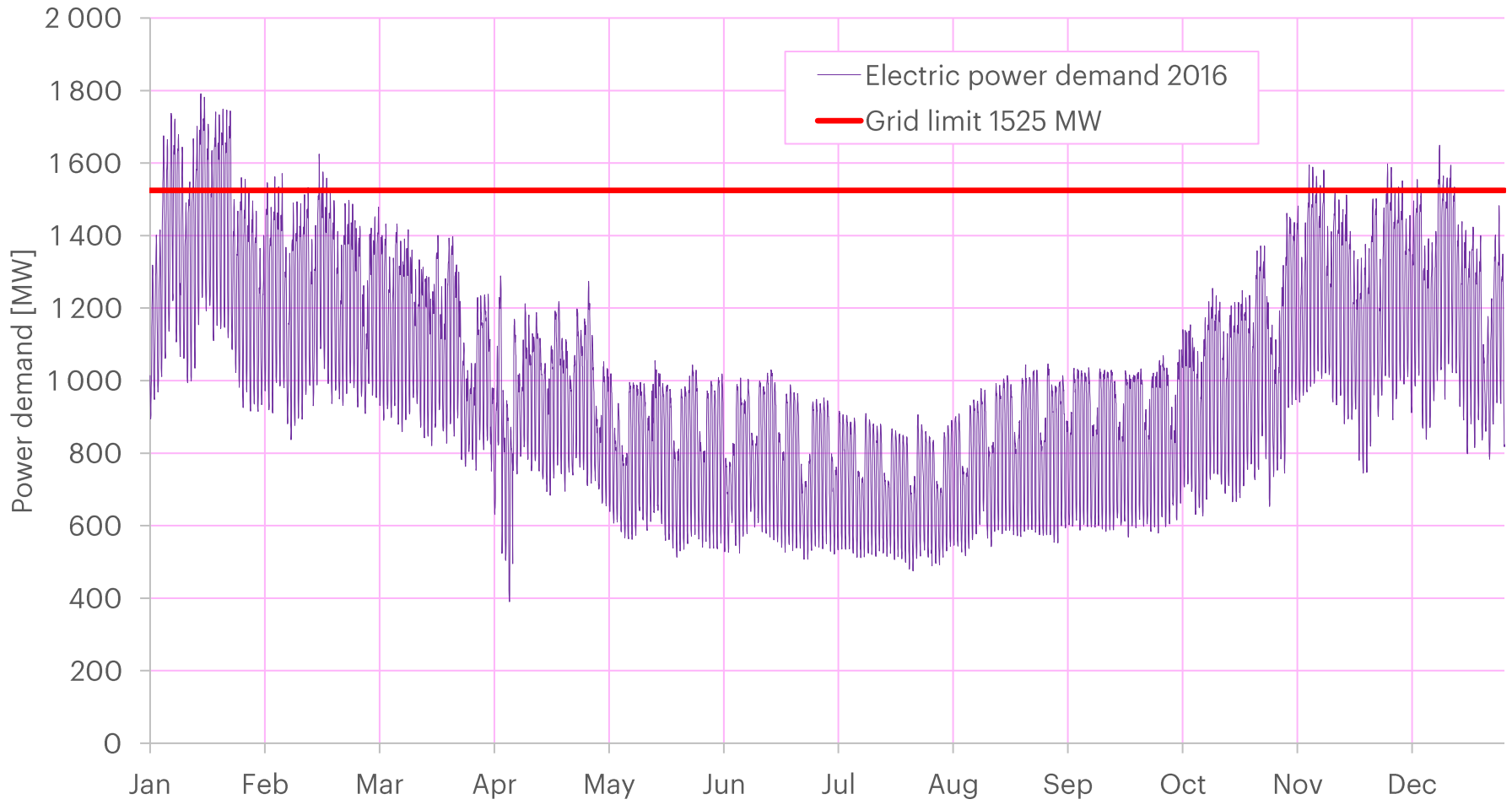
AXA

Why we exists

5 hours sunshine total in November 2014
8 hours sunshine total in November 2000

Without local electric power production from CHPs, Stockholm is short of capacity already today



2011 max 1825 MW, 47 **h** over 1525 MW
2012 max 1658 MW, 159 h over 1525 MW
2013 max 1825 MW, 263 h over 1525 MW
2014 max 1766 MW, 175 h over 1525 MW
2015 max 1616 MW, 34 h over 1525 MW
2016 max 1779 MW, 220 h over 1525 MW
2017 max 1631 MW, 44 h over 1525 MW
2018 max 1721 MW, 109 h over 1525 MW

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The deployment of CDR to counterballance hard-to-abate residual emissions is unavoidable if net CO2 or GHG emissions are to be asheived.

{IPCC AR6 WG3: 3.4, 7.4, 12.3, Cross-Chapter Box 8 in Chapter 12}

The economic impact of BECCS in Sweden

Conclusions

- EUR 1 - 8 billion annual direct savings for reaching net zero target.
- EUR 1.8 billion annual profit of exporting BECCS
- 7 000 jobs (10 Mt) to 28 000 jobs (30 Mt)
- SEK 6-24 billion contribution to Swedish GDP

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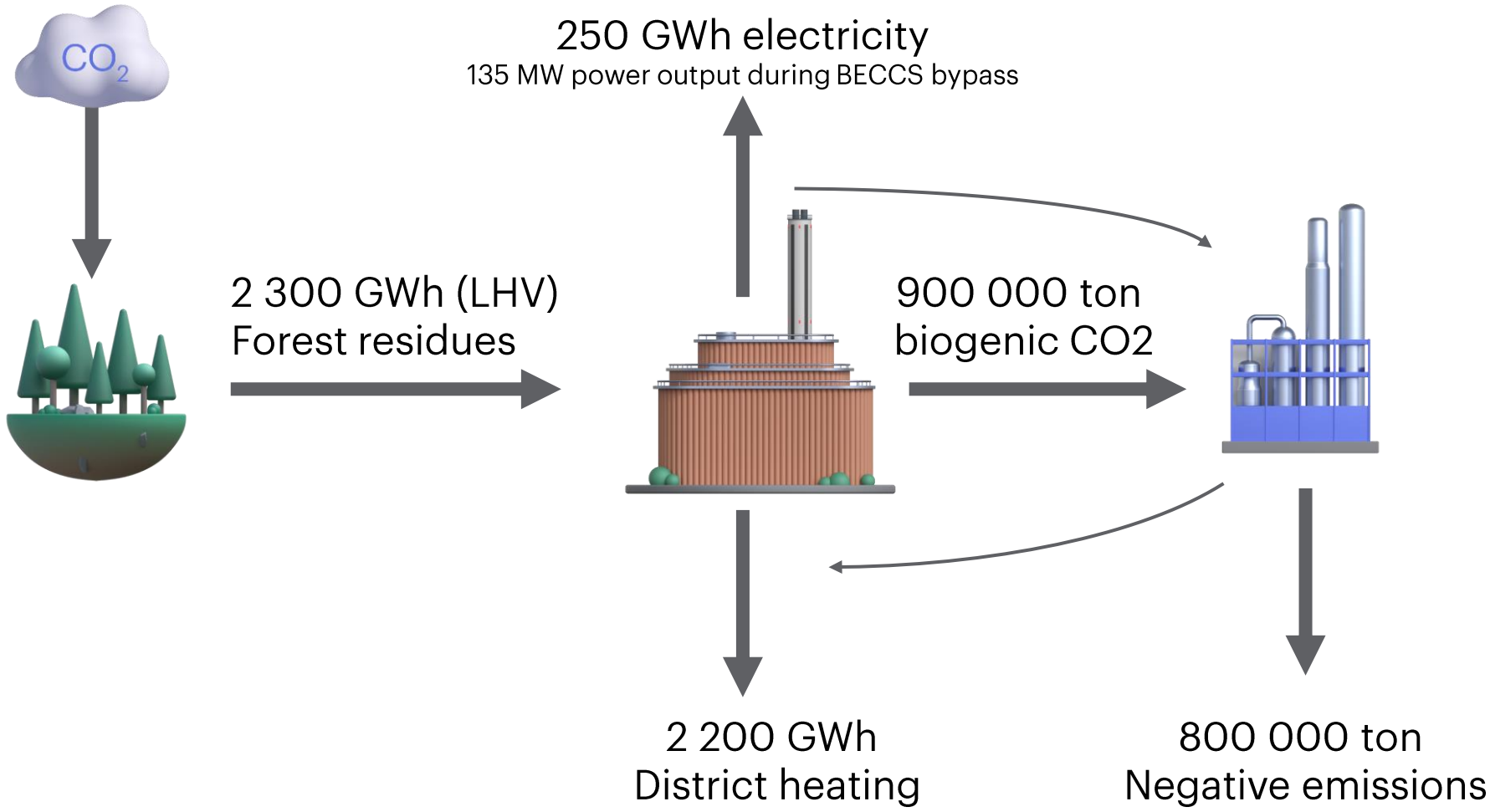

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Beccs Stockholm

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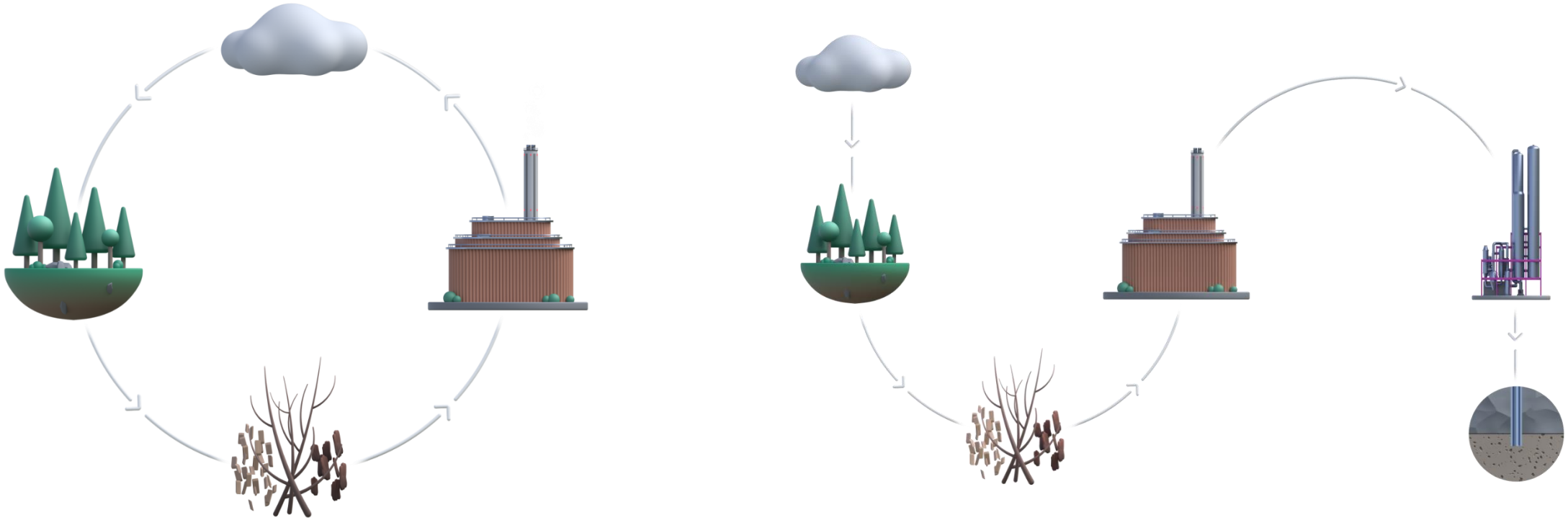
How BECCS creates negative emissions



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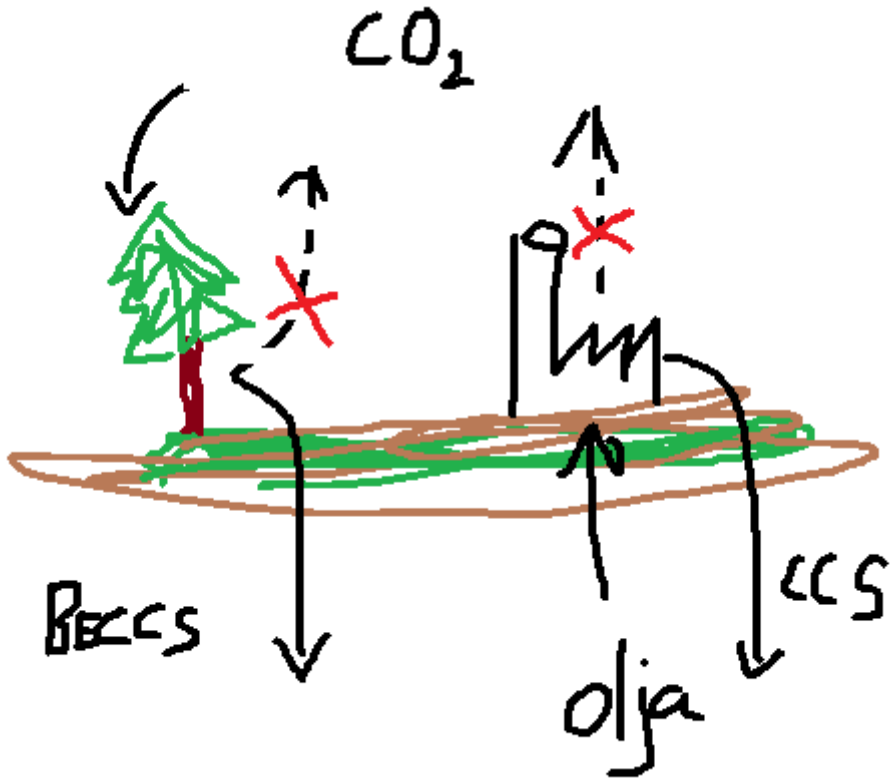
BECCS vs CCS



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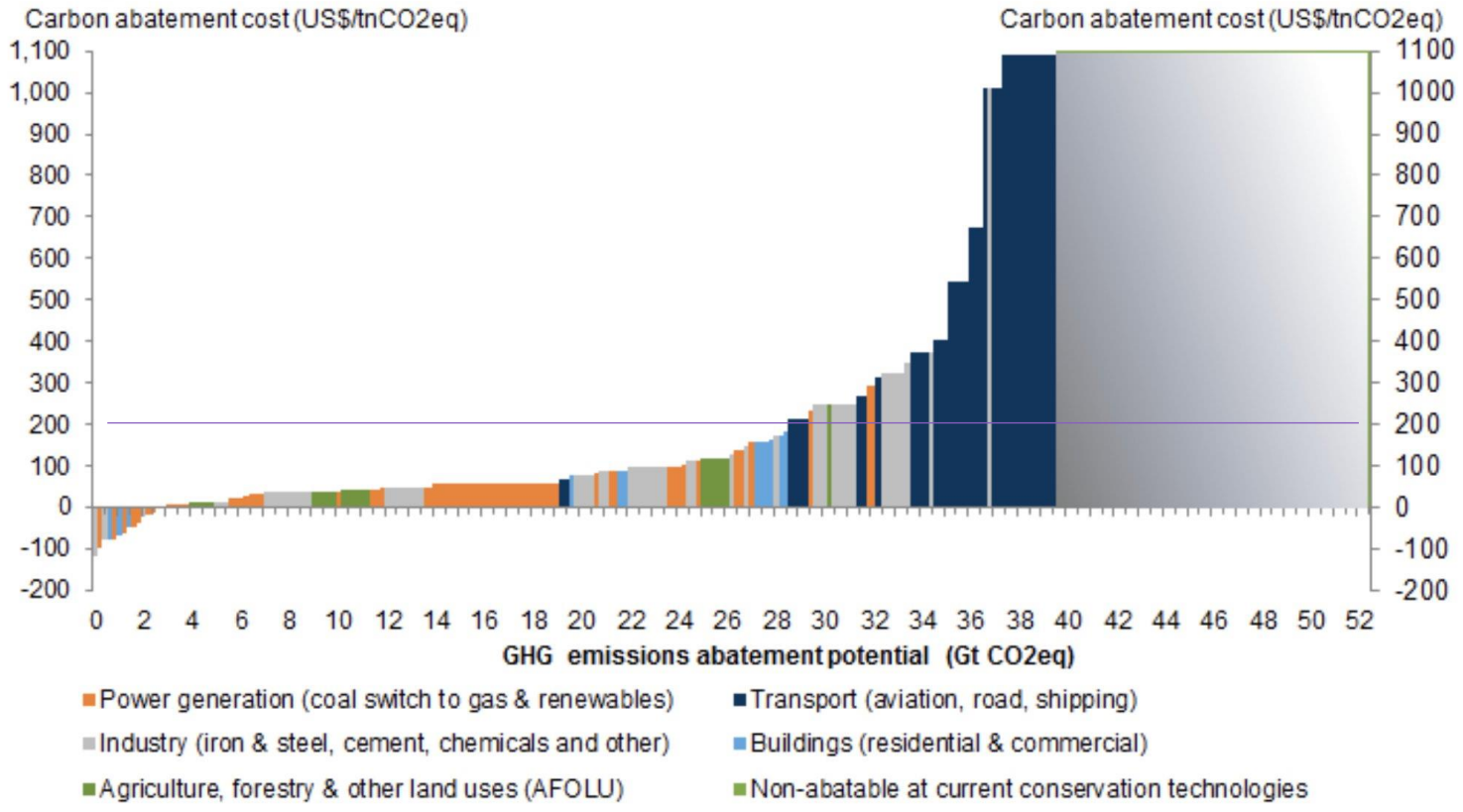
Global cost curve for reducing GHGs The Economist feb 2021

Exhibit 7: The Cost Curve of Decarbonization Shows Many Low-Cost Investment Opportunities, but Quickly Becomes Steep



Source: Goldman Sachs Global Investment Research

The last 20% of global GHG abatement cost > $ 800 / tonne or lack alternatives for reduction alltoghether.

Provides a fundamental demand for CDR

Example: CDR at $ 200 / tonne reduce cost of reaching abatement target by $ 600 /tonne

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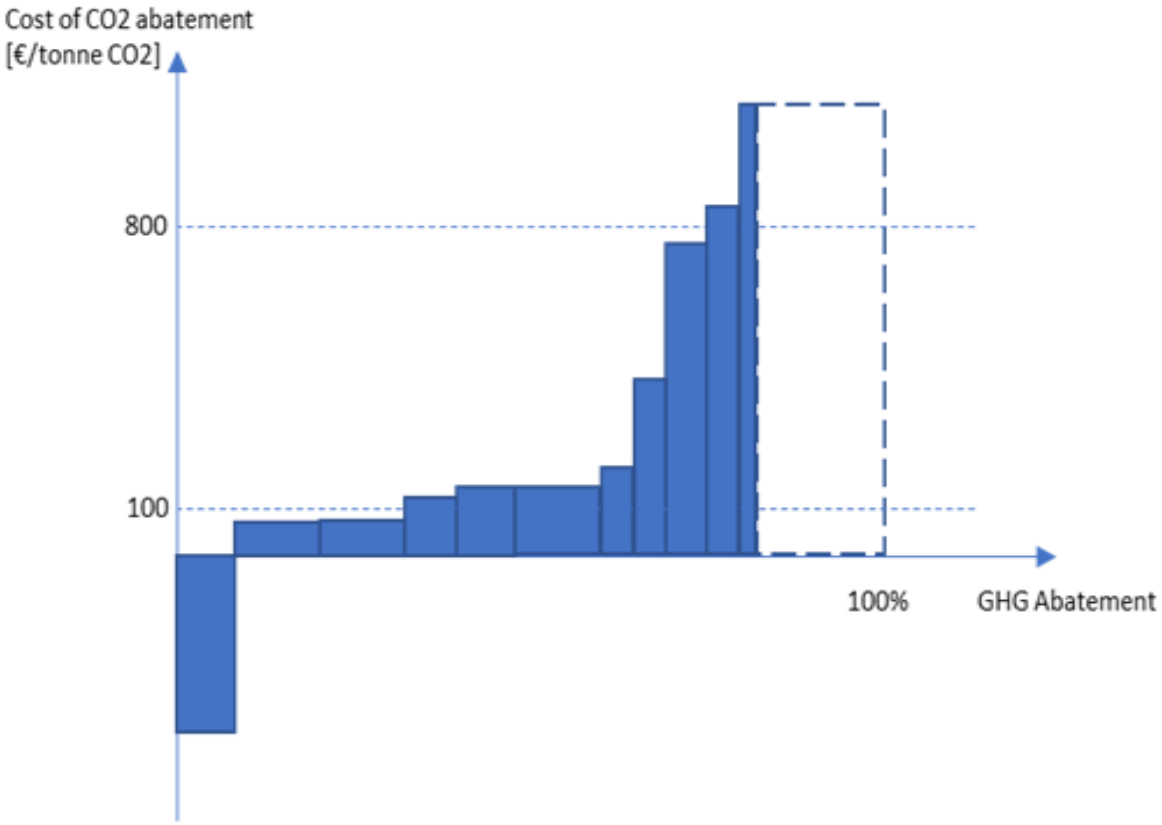
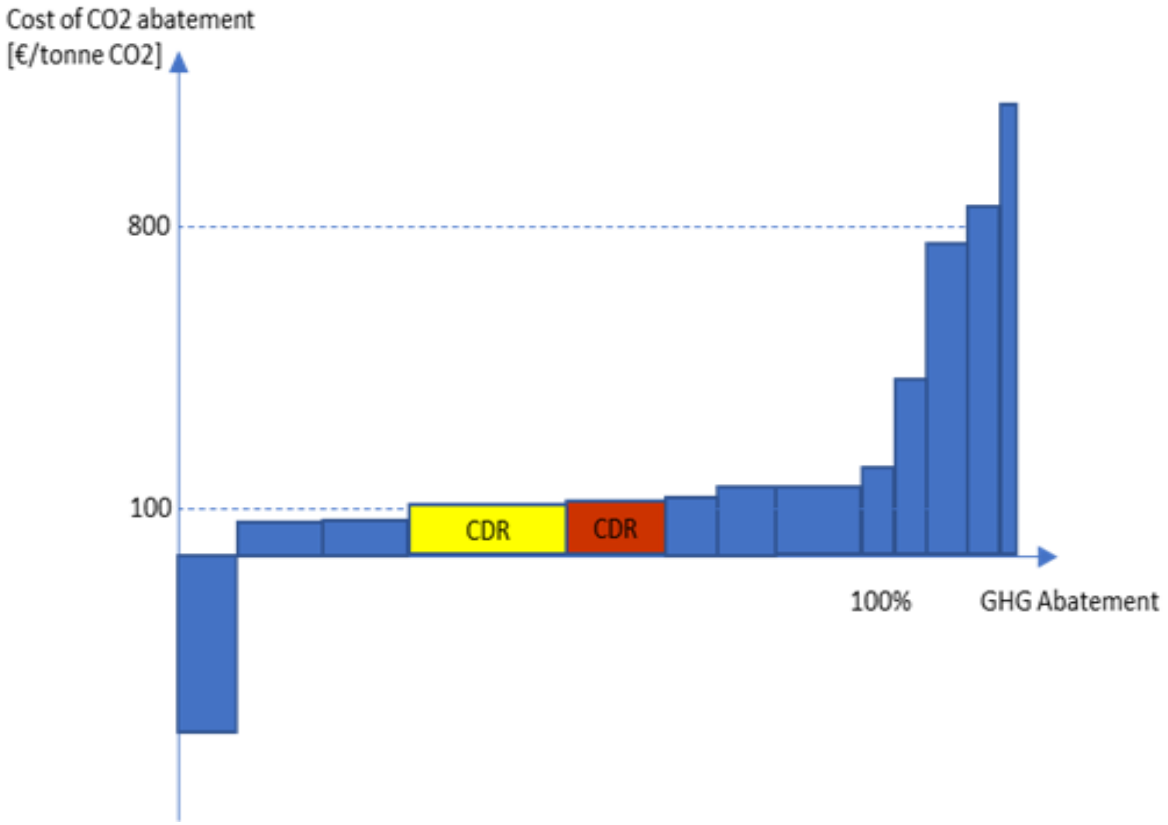
CDR reduce the cost of reaching net zero





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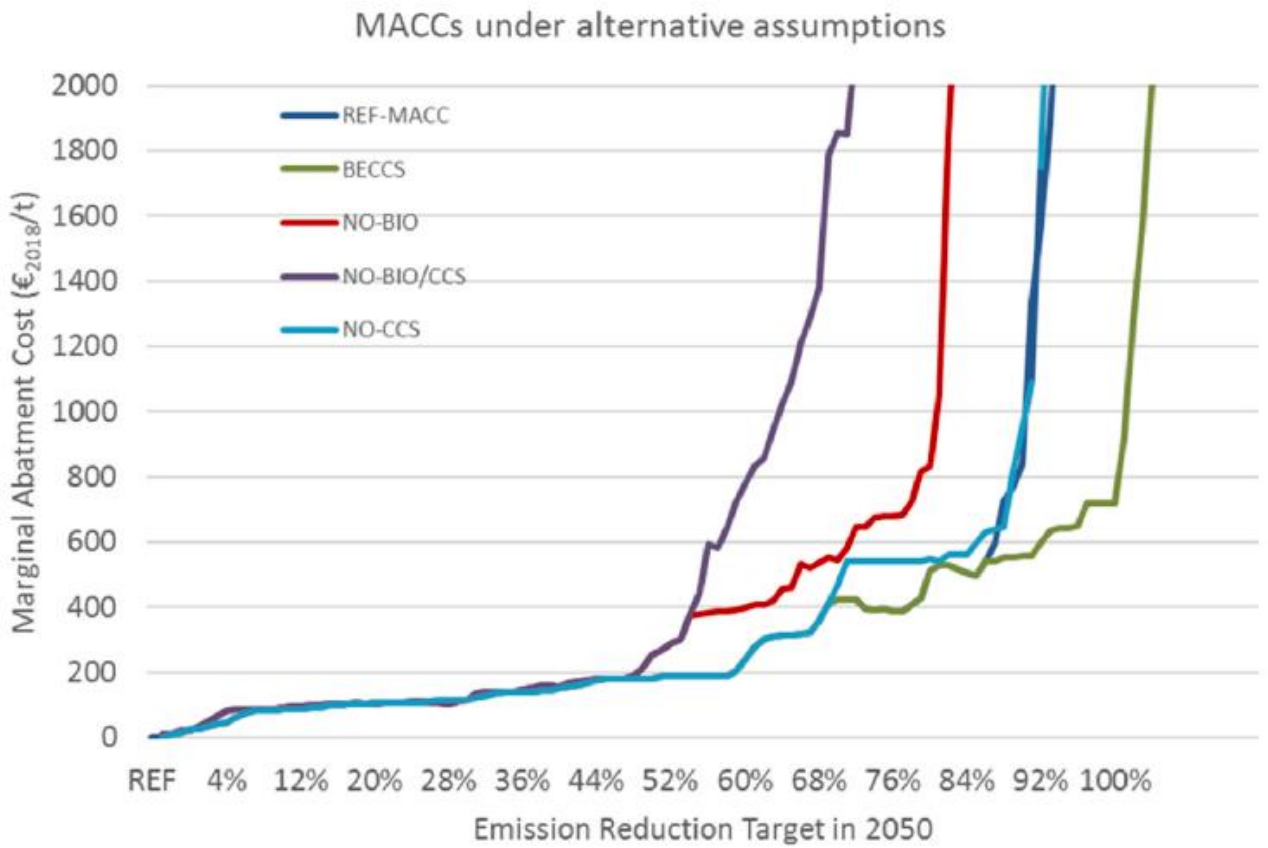

Source: Yue et al 2020, Applied Energy

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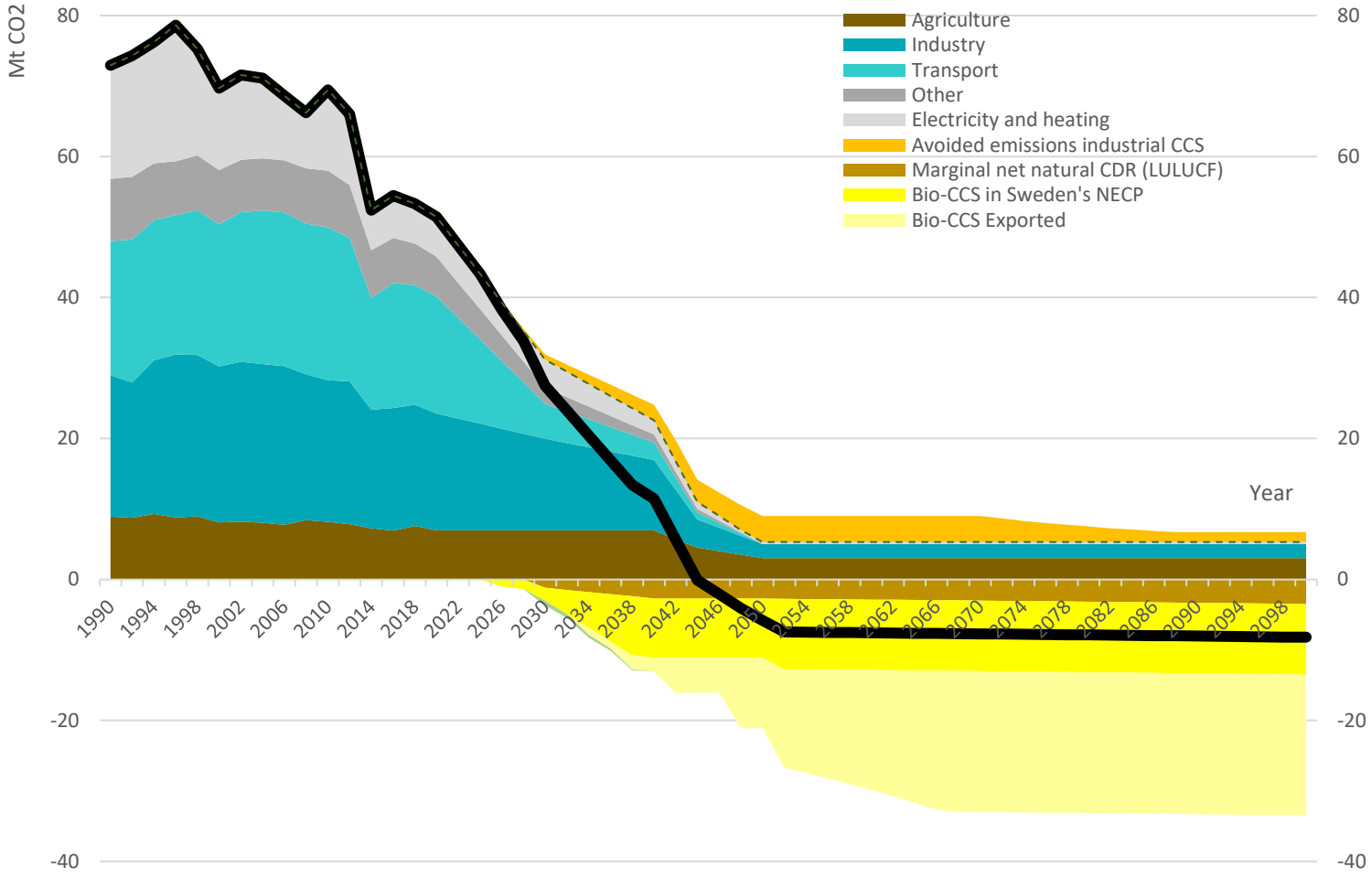
Sveriges historiska utsläpp och mål till 2050



Sveriges kolsänkemål

- Svenskt mål till 2030: knappt -2 Mton/år
- Svenskt mål till 2045: c:a -10 Mton/år
- Svensk potential till 2050: ytterligare c:a -20 Mton/år
- Detta kan uppnås med bevarad tillväxt av den naturliga kolsänkan i skogen

Källor:
Historiska data: Naturvårdsverket. Projektion till 2045: SOU 2020:4
Antagande: cirka 10 Mton/år kommer att kvarstå, främst från jordbruk men även viss annan industri, som inte går att eliminera och alltså måste mötas med komplementära tekniska kolsänkor, som bio-CCS

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