

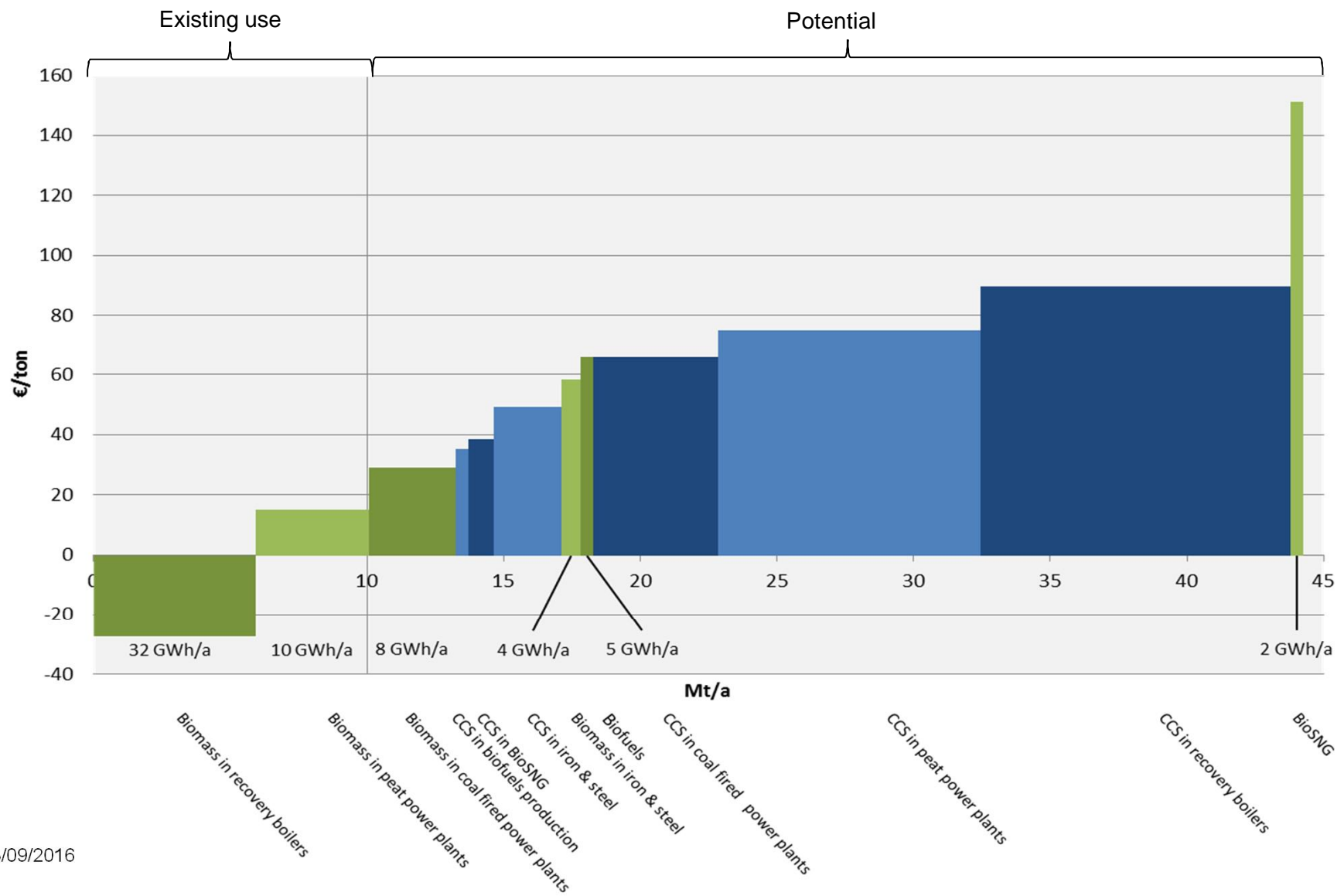


Scenarios for Bio-CCS in Finland

IEA Bioenergy Bio-CC(U)S project 1st workshop
Oslo 10.5.2016

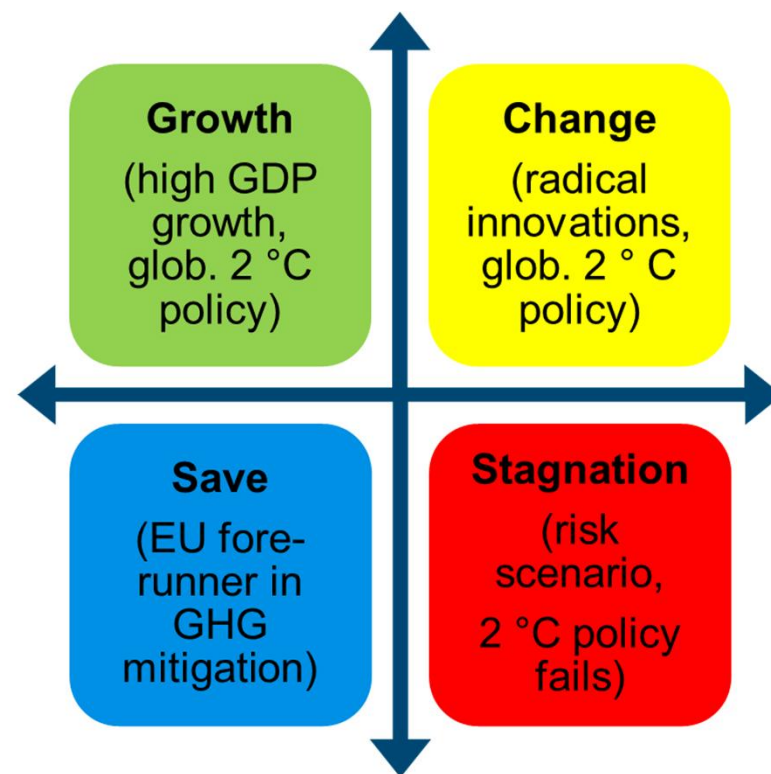
Antti Arasto, Tiina Koljonen

Techno-political Bio-CCS potential in Finland 2025



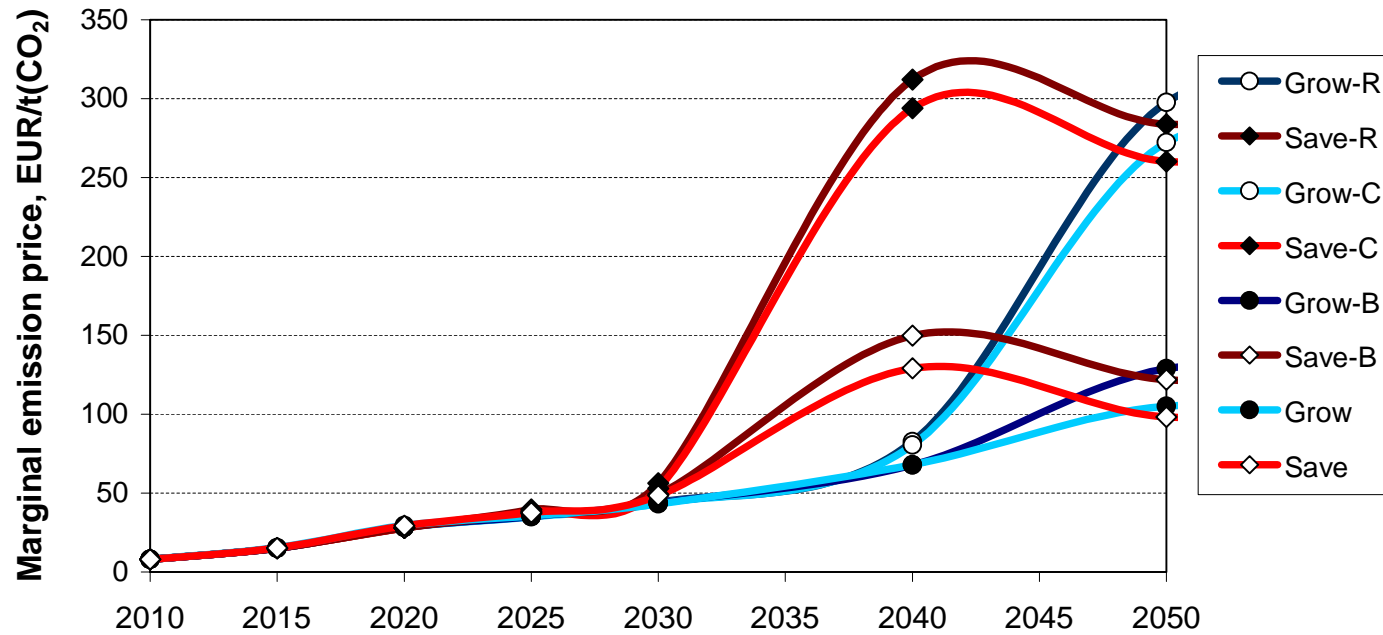
Description of the Low Carbon Finland 2050 scenarios

- **80% GHG mitigation target** by 2050 is achieved in all the scenarios both in Finland in the EU (except in the Baseline)
- **Global climate agreement** is implemented in all the scenarios, except in Stagnation
- **New technology development and implementation** rapid (Growth and Change) or conservative (Save and Stagnate)
- **The industrial structure in Finland** comparable with today's structure (Base-80%, Save), strongly renewing (Growth, Change), reducing production (Stagnate)
- **Community structure** no urban sprawl (Growth), high urban sprawl (Change) or small urban sprawl (other scenarios)

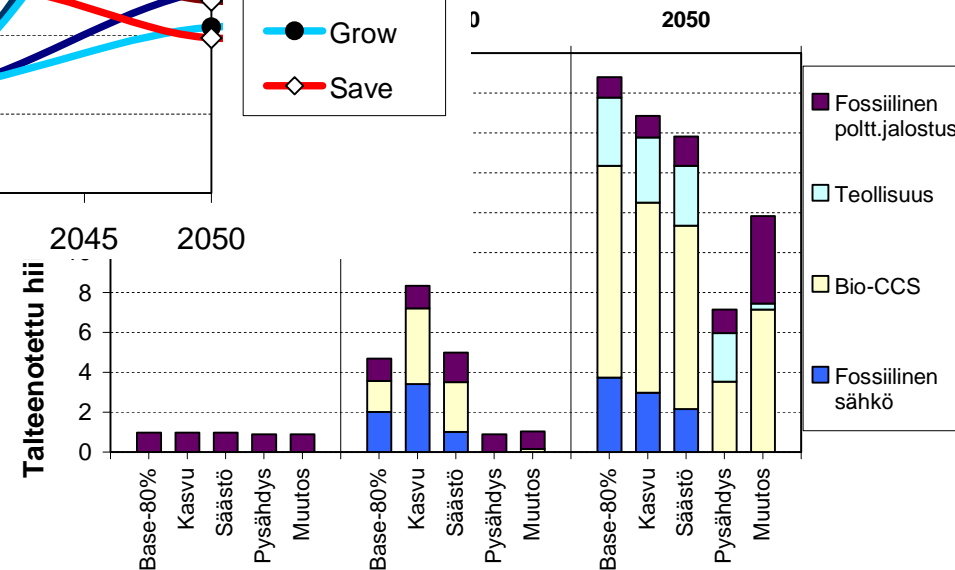


www.lowcarbonplatform.fi

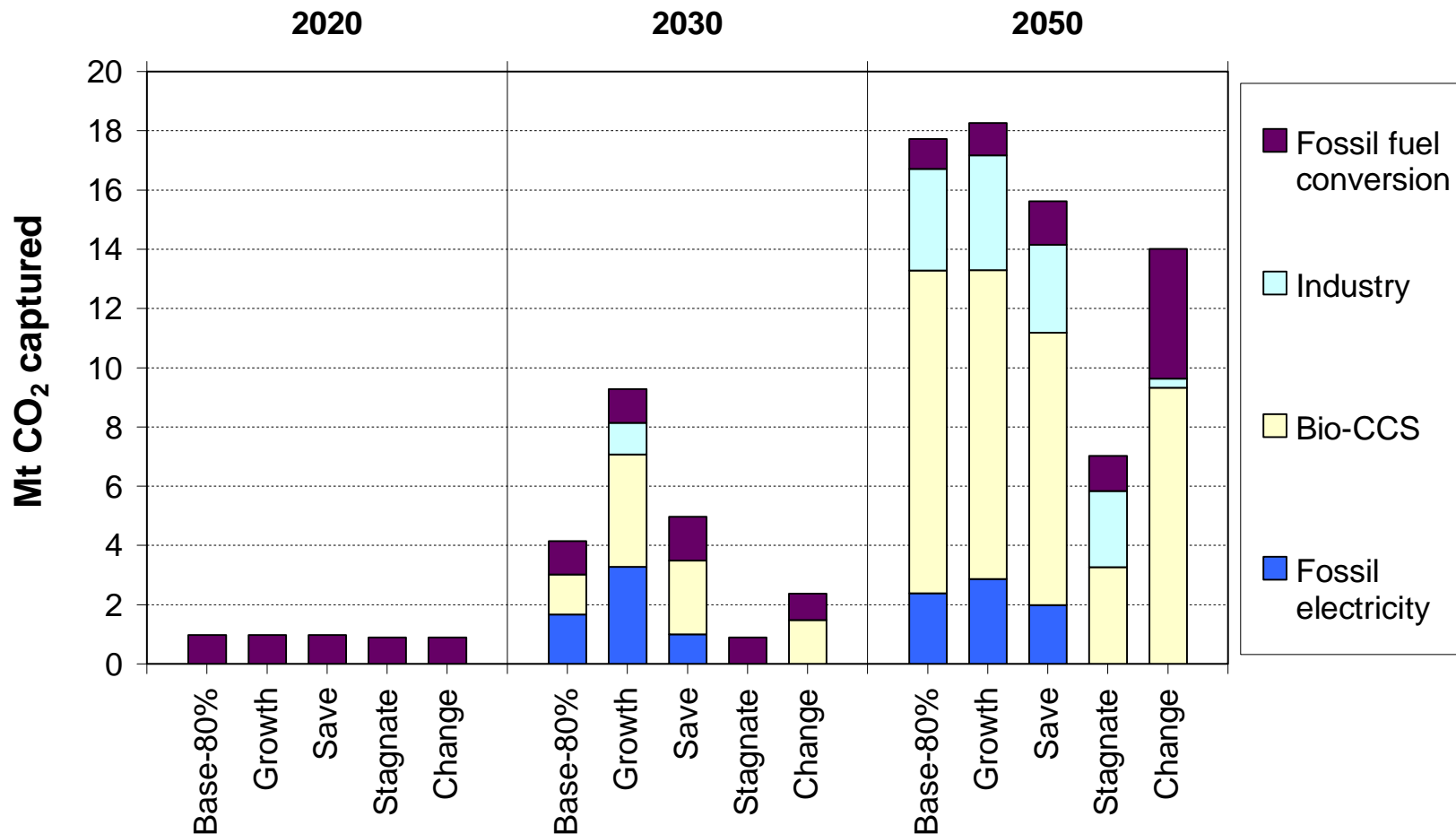
The costs of emissions reduction are dependent on the timing of new technology implementation



Commercial implementation of carbon capture and storage (CCS) by 2030 would be essential for Finland



Emission abatement by CCS in Finland

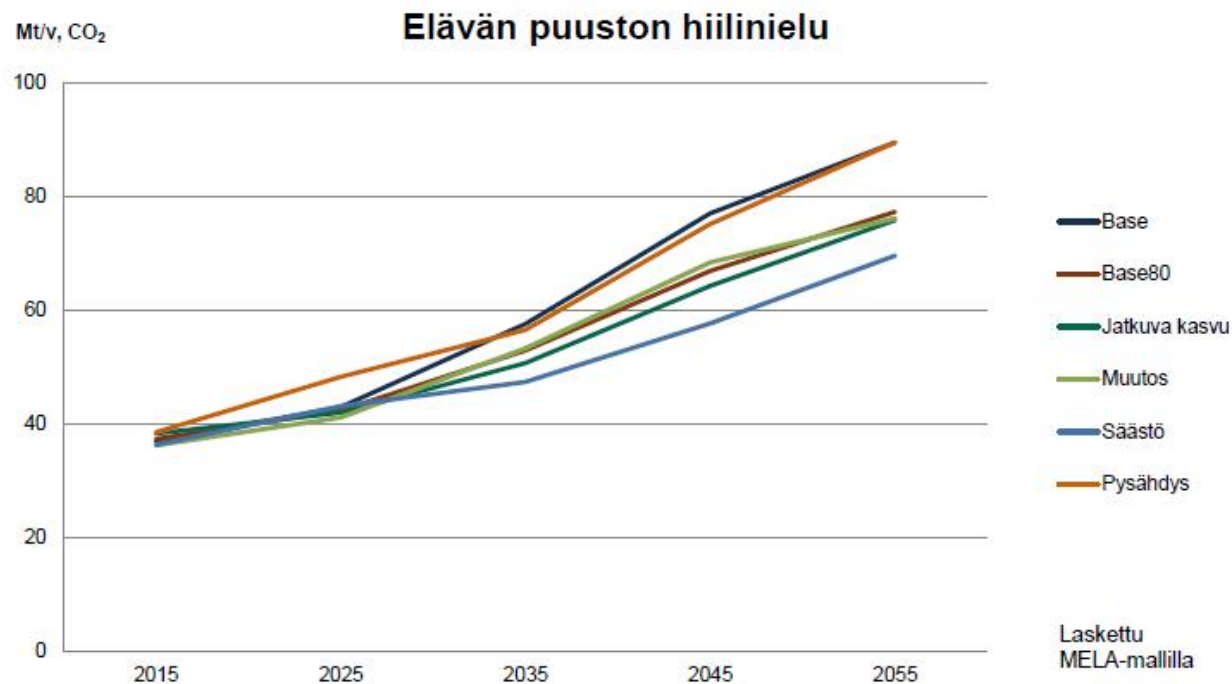


Low Carbon Finland 2050

Net carbon sinks increase even though increased use of wood in all the scenarios

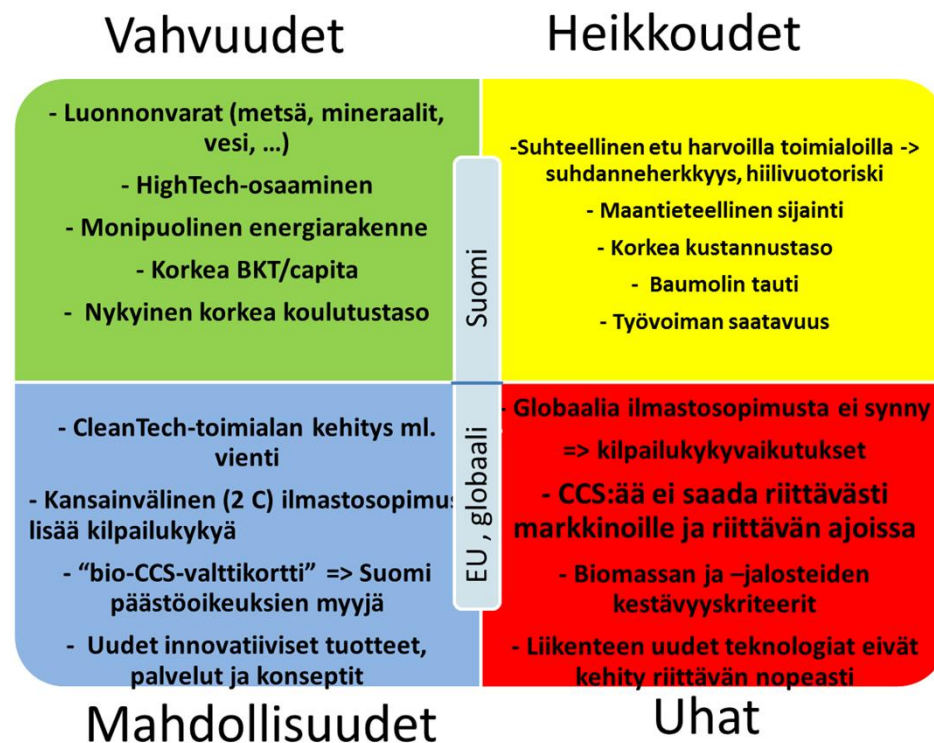
Metsissä on jatkossakin puuta ”enemmän kuin koskaan” ja metsät sitovat vuosittain yhä enemmän hiiltä ts. metsien hiilinielu kasvaa.

Jakson loppupuolella metsien nielu voi olla suurempi kuin Suomen khk-päästöt vuonna 1990.



Conclusions and SWOT analysis of Finland's opportunities and threats

- **Finland is able to achieve the low carbon targets but not alone.** There are several alternative pathways.
- **Accelerated new technology development and implementation may increase Finland's competitiveness.** Finland's strengths are related to the natural resources and strong cleantech cluster. Also high GDP/capita and high level of education are advantages.
- The greatest **uncertainties** are related to commercialization of CCS early enough and to **possible implementation of sustainability criteria of wood based biomass in future energy and climate policies.**



Baumolin tauti: ilmiö, jossa tuottavuuden ja palkkojen kasvaessa useilla talouden aloilla palkkoja joudutaan nostamaan myös niillä aloilla, joilla tuottavuuden kasvua ei ole juuri tapahtunut.

Conclusions regarding CCS and Bio-CCS in Finland

- Bio-CCS accounts for the majority of the CCS potential in Finland
 - It appears to be a particularly attractive option in bio-refinery plants, where carbon can be captured from an almost pure CO₂ stream.
 - The potential for fossil-based CCS appears to be limited, and is mostly related to large multi-fuel CHP plants using also biomass, as well as hydrogen production.
 - Within industry, the most promising CCS option appears to be enhanced blast furnace process with top gas recycling and oxygen injection.
- The possibility of using bioenergy in combination with carbon capture and storage Bio-CCS is one of the key factors improving the competitiveness of bio-refineries under tight climate policies.
- As already indicated above, applying CCS and Bio-CCS appear, indeed, almost necessary for achieving the climate policy targets, roughly leading to at most 2°C temperature increase.
- It is thus obvious that without achieving higher cuts or even negative emissions in some systems, such as Bio-CCS applications, reaching very strict overall targets may become costly for the economy.
- Major bottlenecks for CCS and Bio-CCS in Finland:
 - No fiscal incentive for negative emissions
 - "Need" for negative emissions comes rather "late" in scenarios
 - No storage and existing transport infrastructure; Finnish actors hesitant in taking leading role



TECHNOLOGY «FOR» BUSINESS

