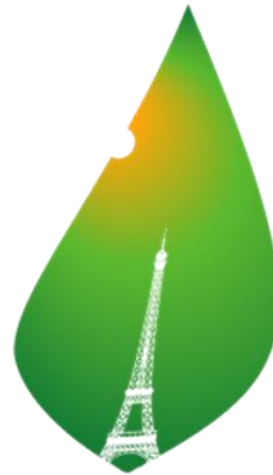
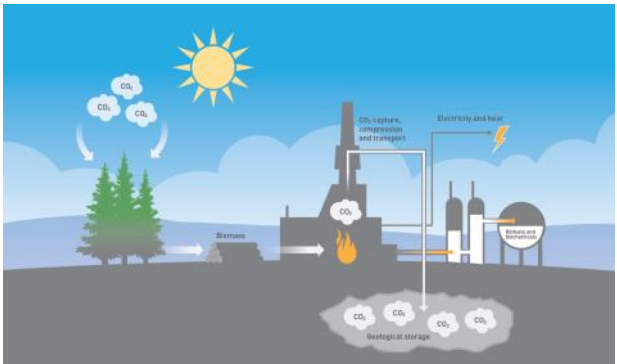


CCS etter Paris – en avgjørende teknologi for å nå 2-gradersmålet



TCM



Ill: Doghouse

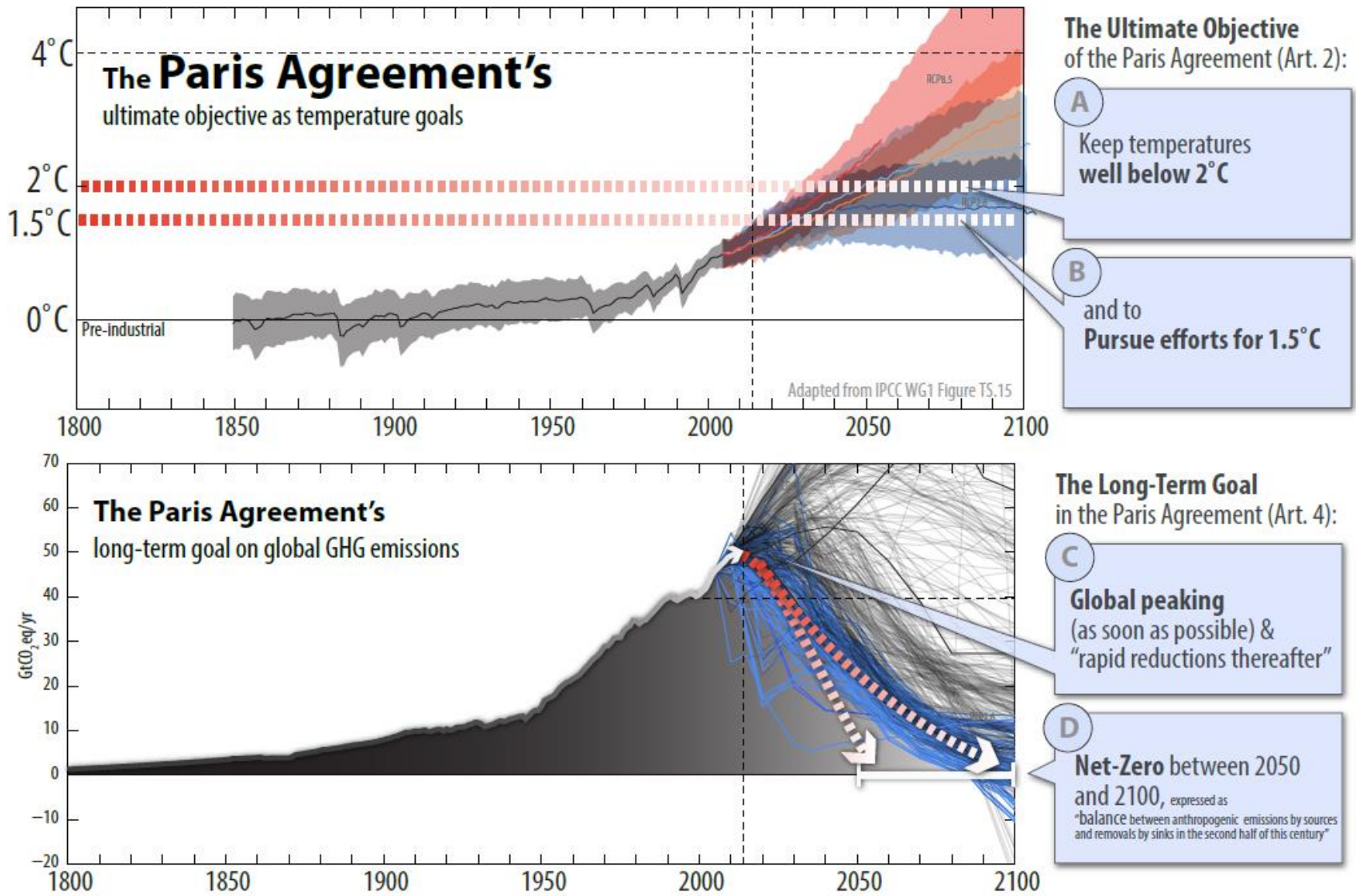
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11



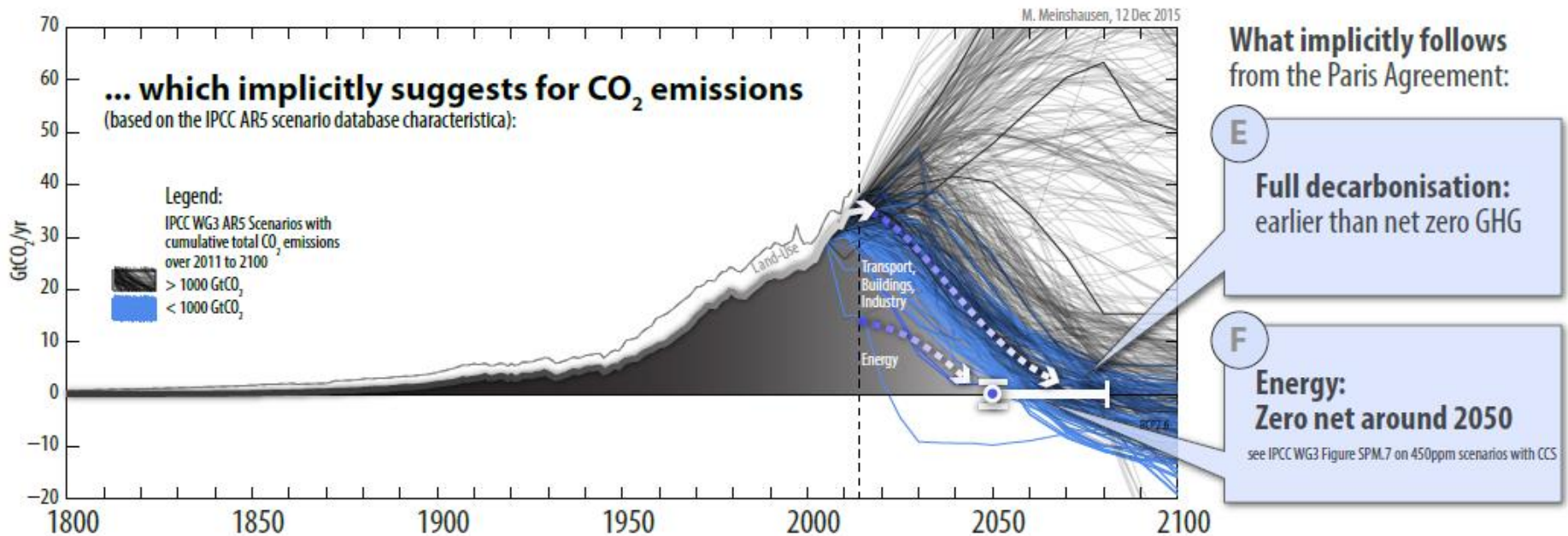
Statoil

Nils A. Røkke, Direktør for Bærekraft SINTEF

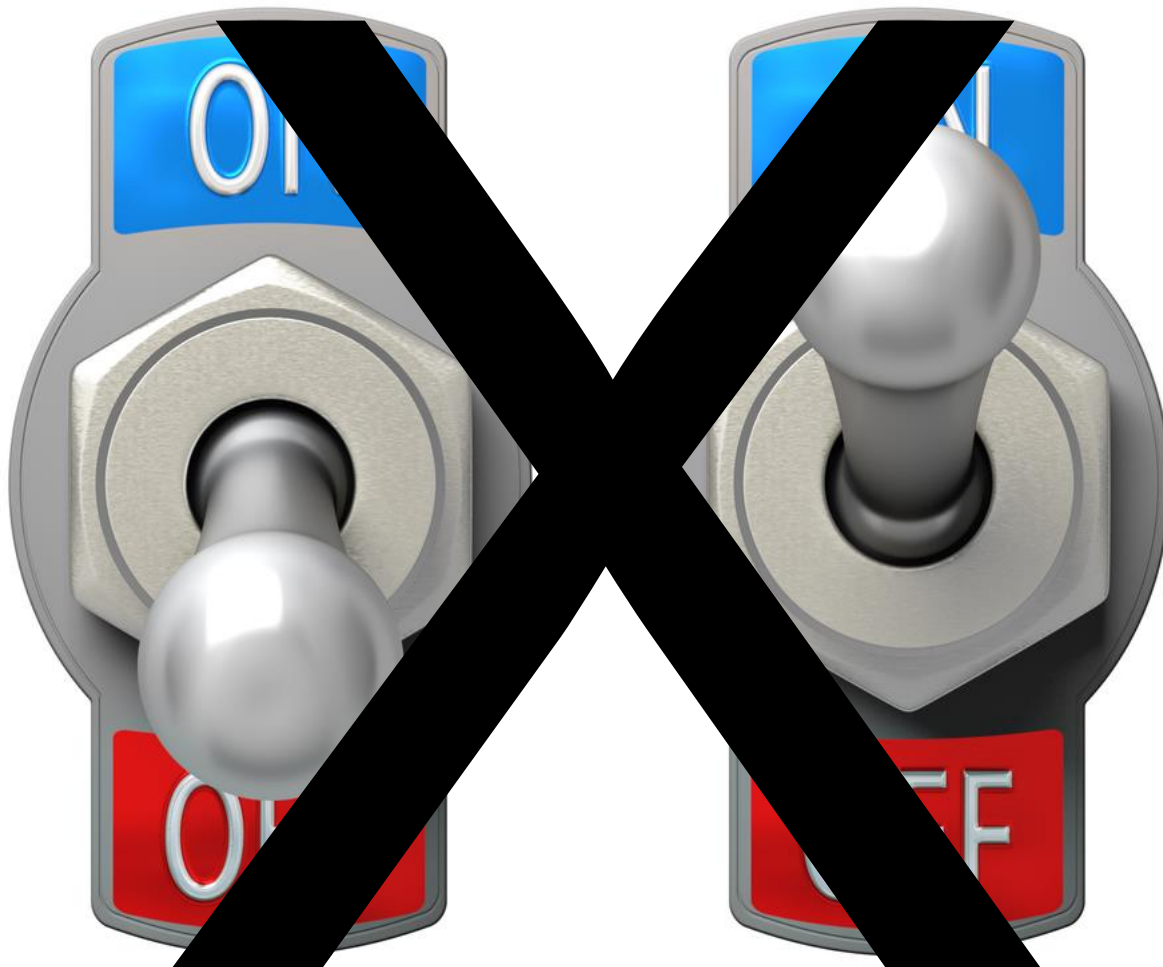
SINTEF CCS Seminar 10 februar 2016



Paris agreement – CCS and Carbon negative solutions

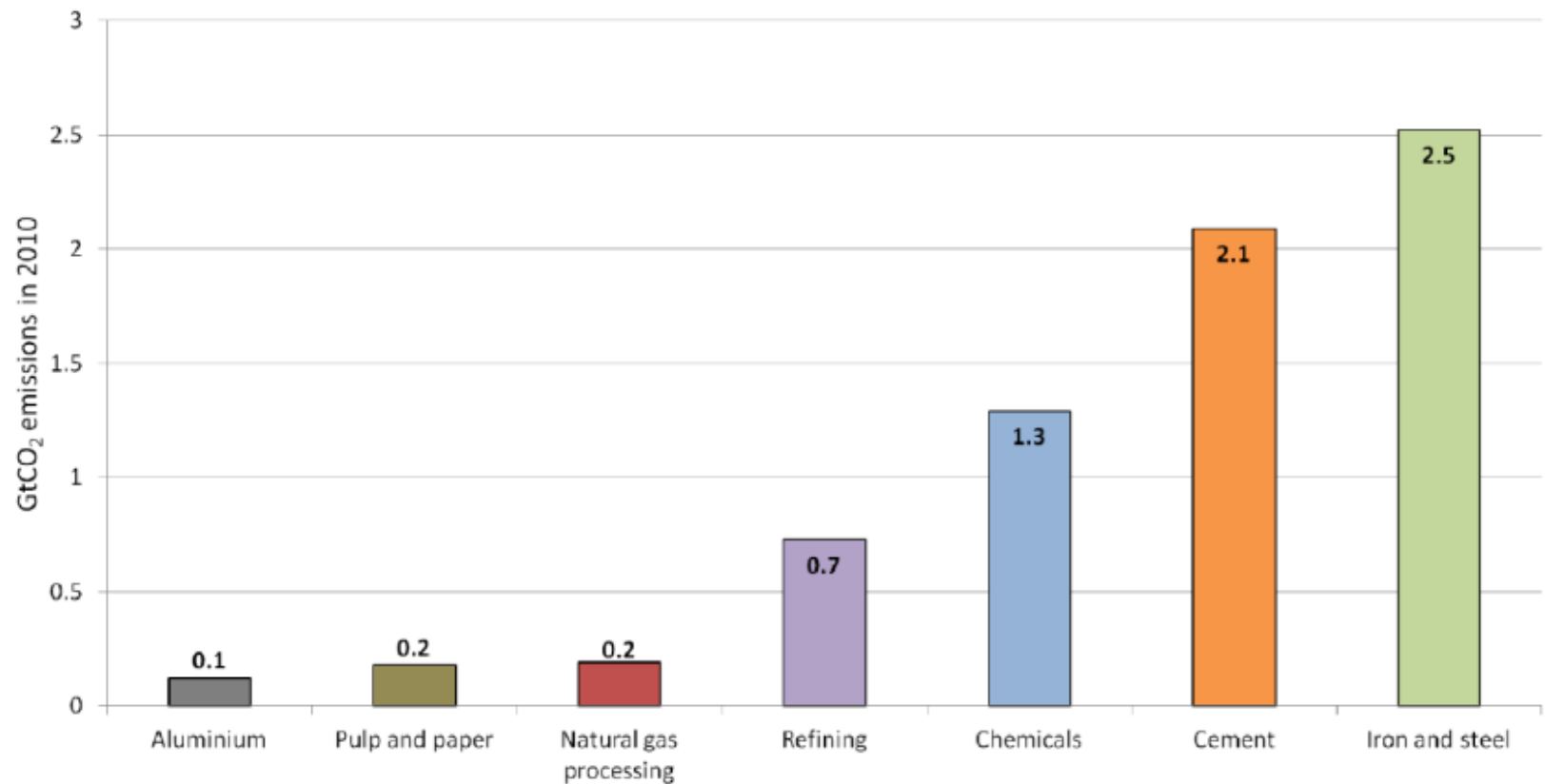


- Full decarbonisation = carbon related emissions- ie CO₂
- Net zero GHG = includes methane and nitrous oxide – in principle these emissions must be stopped or offset by carbon negative solutions
- CCS obviously needed to close the equation towards 2 and 1.5 degC warming also by offering carbon negative solutions



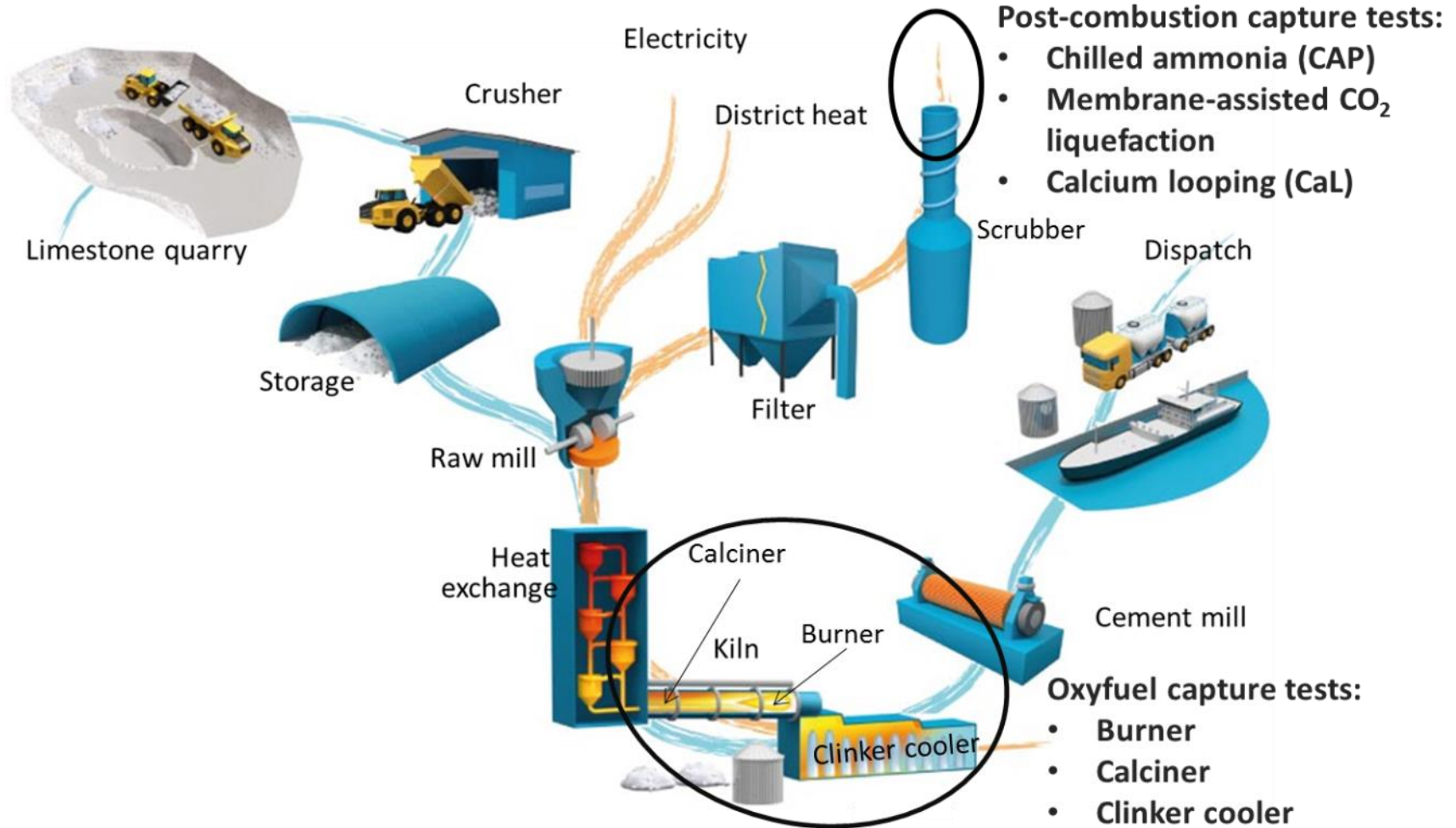
CCS is a technology we simply cannot do without

Figure 1. Global emissions from the seven most CO₂-intense industrial sectors in the IEA *Energy Technology Perspectives* analysis



Lipponen- TCCS-7

Technologies to be tested in CEMCAP, reaching TRL6*

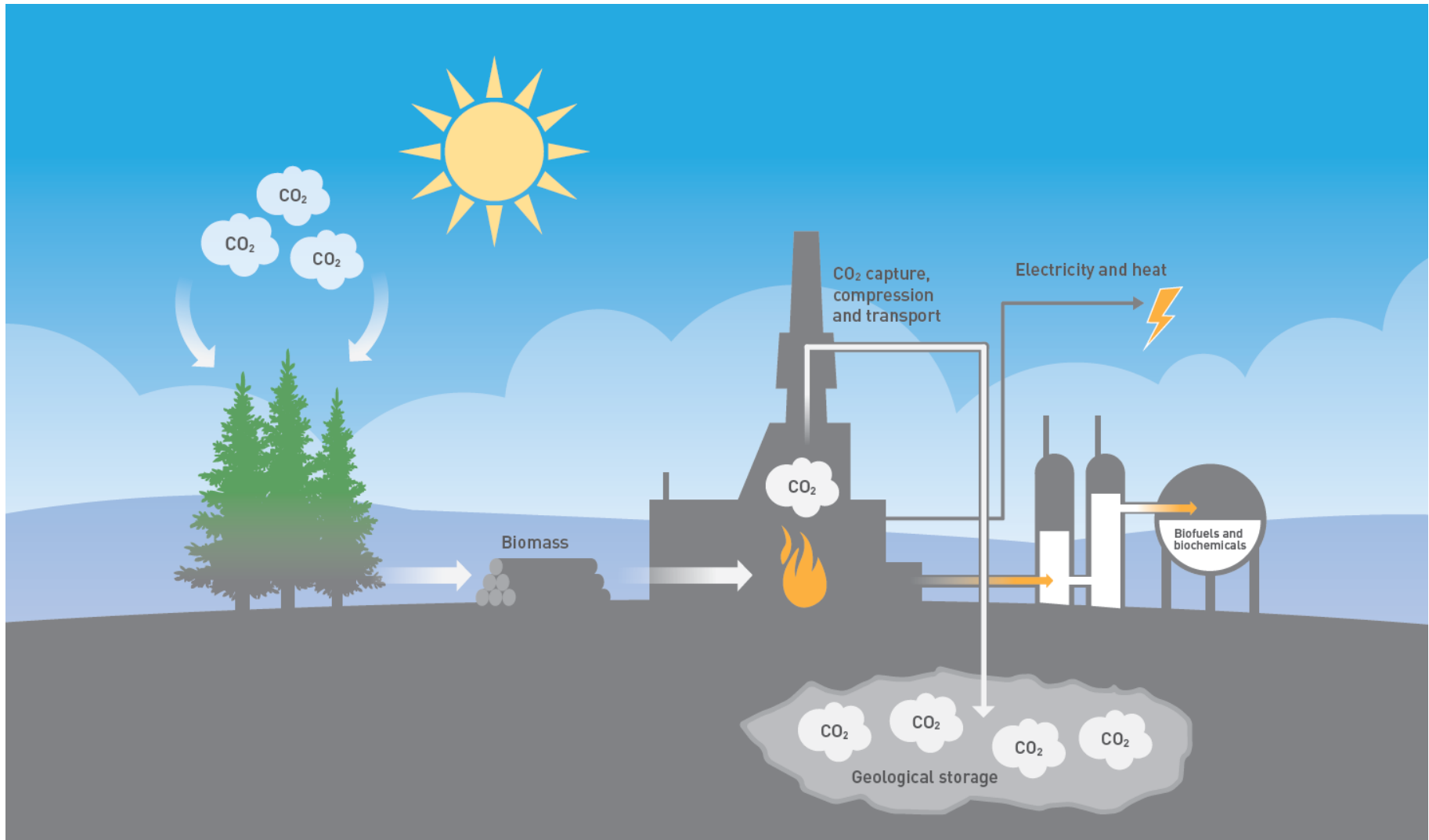


*Technology demonstrated in industrially relevant environment



CEMCAP

CCS anvendt på biomasse- biogen CO₂



Gemini, doghouse

Naturgass til hydrogen med CO₂ lagring



- Behov for hydrogen med lavt karbonavtrykk til fremtidig transportbehov
- Hydrogen til bruk i industri og kraftproduksjon
- Forretningsmulighet for å levere hydrogen basert på naturgassreformering, dvs omdanning til hydrogen og CO₂
- Lagring av CO₂ i Nordsjøen- levere til Europa og flytende H₂ til nye markeder for eksempel i Japan
- Starte med å tilsette hydrogen i gassen til Europa for så å øke andelen
- Stor fleksibilitet til også å føde inn hydrogen fra fornybar energi- for eksempel fra vindkraft

En stor mulighet for å selge miljøvennlige produkter på lang sikt og som integrerer fornybar energi og lav karbon energi fra naturgass

CCS i Norden



CCS er i bruk i de nordiske landene



Sleipner: 1 Mt CO₂/year (Photo: Dag Myrestrand, Statoil)



Snøhvit: 0.9 Mt CO₂/year (Photo: Statoil)



Yara, Porsgrunn: captures and sells 200,000 t CO₂/year to European food & beverage industry (Photo: SINTEF)



(NORCEM Capture Demo Project, large-scale project in planning Photo: NORCEM)

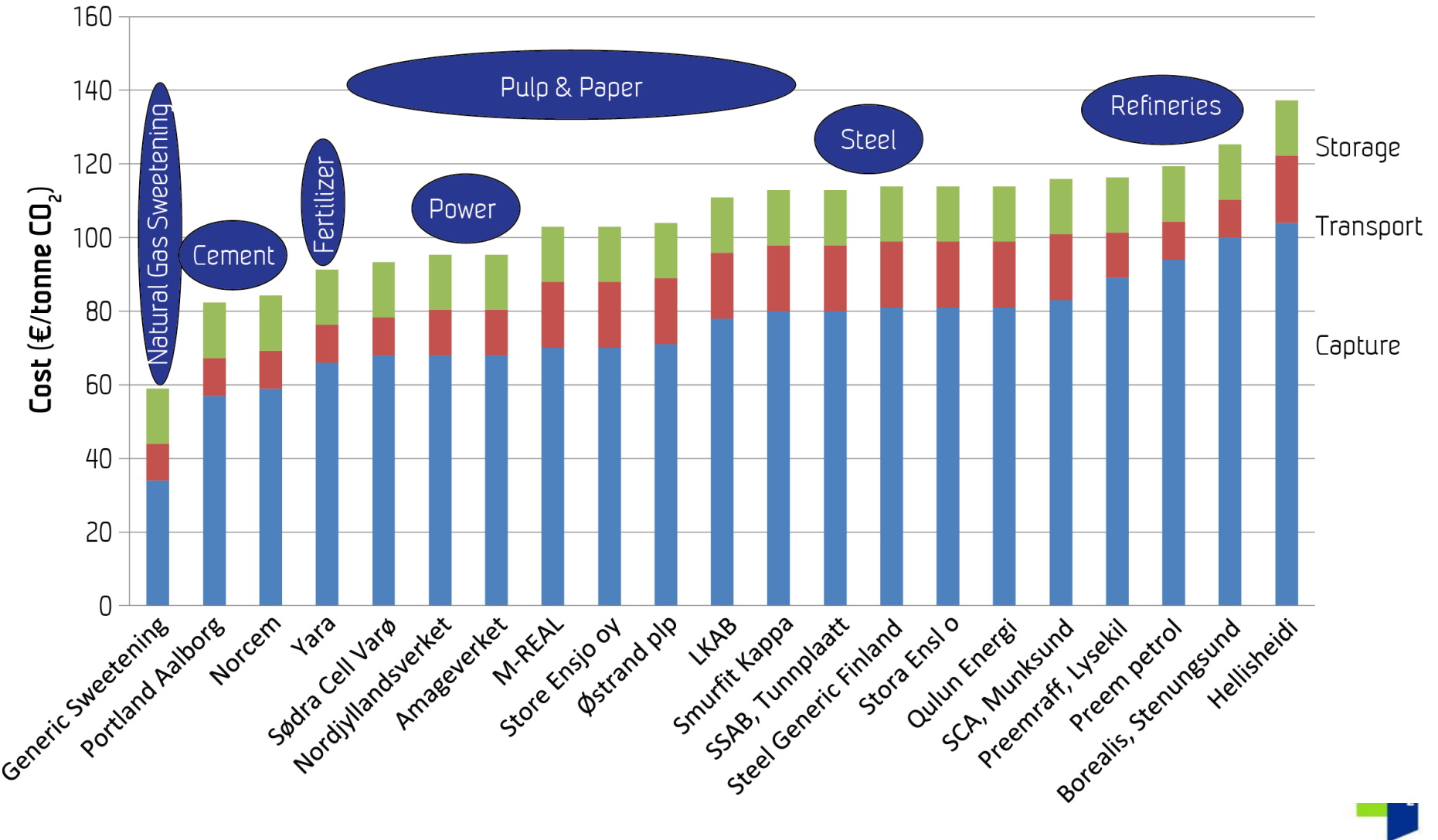


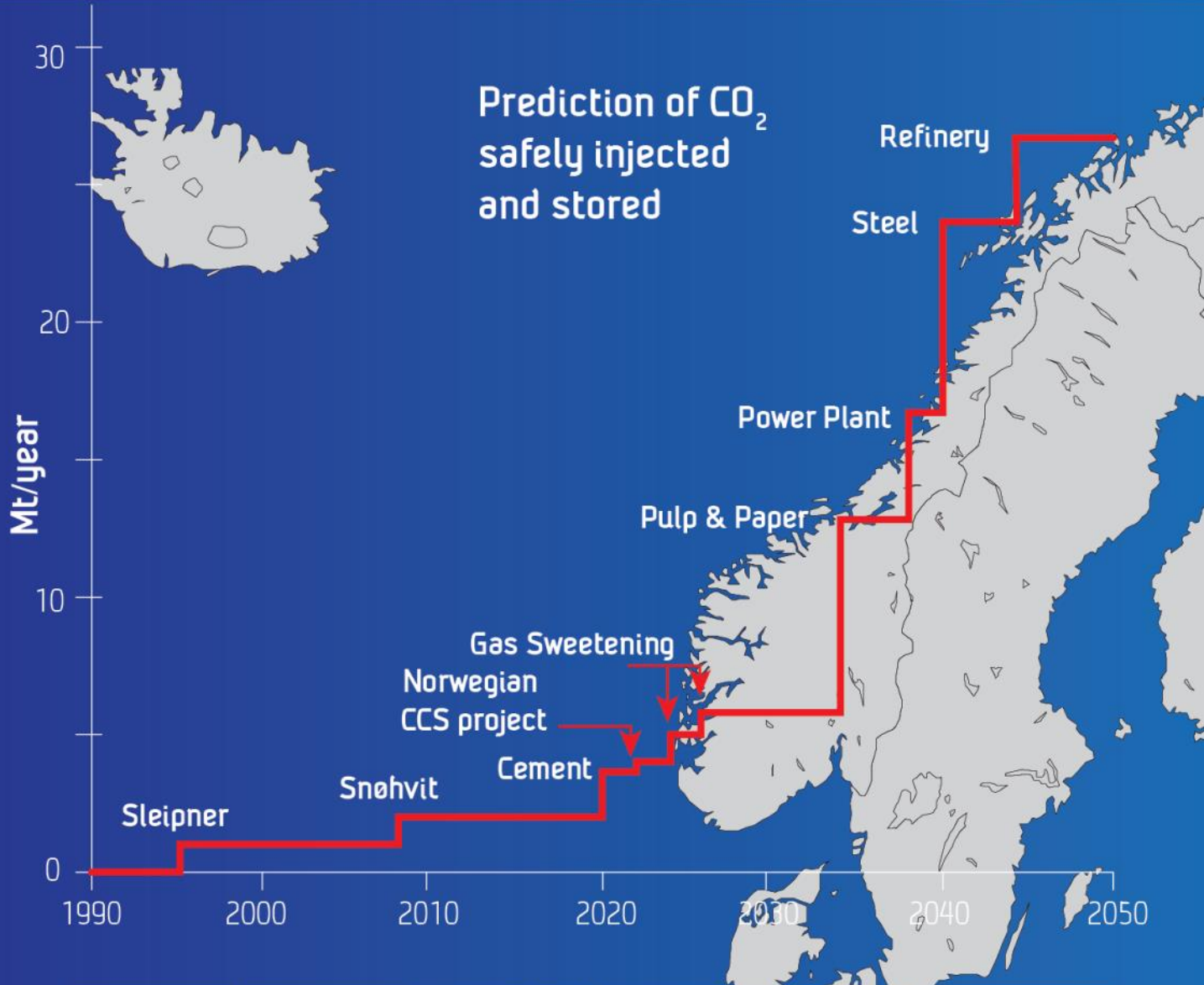
Hellisheidi: Injecting 5000 tonnes/yr in basalt (Photo: Árni Sæberg).

...and more projects in the planning!

Industrial CCS costs are sector dependent

- Nth of a kind Costs





Sleipner A Photo: Harald Pettersen - Statoil

Melkøya - Photo: HELGE HANSEN - Statoil



Oppsummering

- CCS teknologien trengs for å nå globale utslippsmålsettinger
- Veldig lite plass for utslipp fra fossile brensler i fremtiden
- Behov for CCS på industrielle utslipp, biomasse forbrenning og biodrivstoffproduksjon – karbon negative løsninger
- Viktig for kullkraft på global basis, særlig i Asia, usikkert i Europa
- Et visjonært perspektiv for naturgass er reformering av naturgass til hydrogen med lagring av CO₂ og eksport/bruk av hydrogen
- CCS handler om en overgang til lavutslippssamfunnet, det handler om
 - Arbeidsplasser og en robust industrisektor
 - Hegne om verdifulle ressurser på en skånsom måte
 - Bidra til etablering av hydrogensamfunnet i samspill med det helelektriske samfunn

Carbon Capture, Transport and Storage (CCS) in Europe

MAIN CCS STAKEHOLDER GROUPS

The European Commission's Directorate-General (DG) for Research, Energy and for Climate



DG Research
DG Energy
and DG Climate

The EERA CCS Joint Programme (JP)



EERA
CSS JP

Zero Emissions Platform



ZEP

CO₂ Capture, Transport and Storage in the Netherlands



CATO

UKCCS Research Centre



UKCCSRC

COLOUR KEY

- IN OPERATION
- IN PLANNING
- PILOT

The European Network of Excellence on the Geological Storage of CO₂



CO₂ GeoNet

NORDIC CCS Competence Centre



NORDICCS

BIGCCS International Research Centre



BIGCCS

European Carbon Dioxide Capture and Storage Laboratory Infrastructure



ECCSEL

The Bellona Environmental CCS Team



BELLONA

Scottish Carbon Capture & Storage



SCCS

Carbon Capture & Storage Association



CCS^a

CLIMIT
CLIMIT

The European CCS demo project network
CCS NETWORK^{EU}

CCS NETWORK

SELECTED CCS PROJECTS AND TEST FACILITIES IN EUROPE



Developed by SINTEF