CARBON RECYCLING INTERNATIONAL

Commercial scale CO2-to-methanol plant in Norway

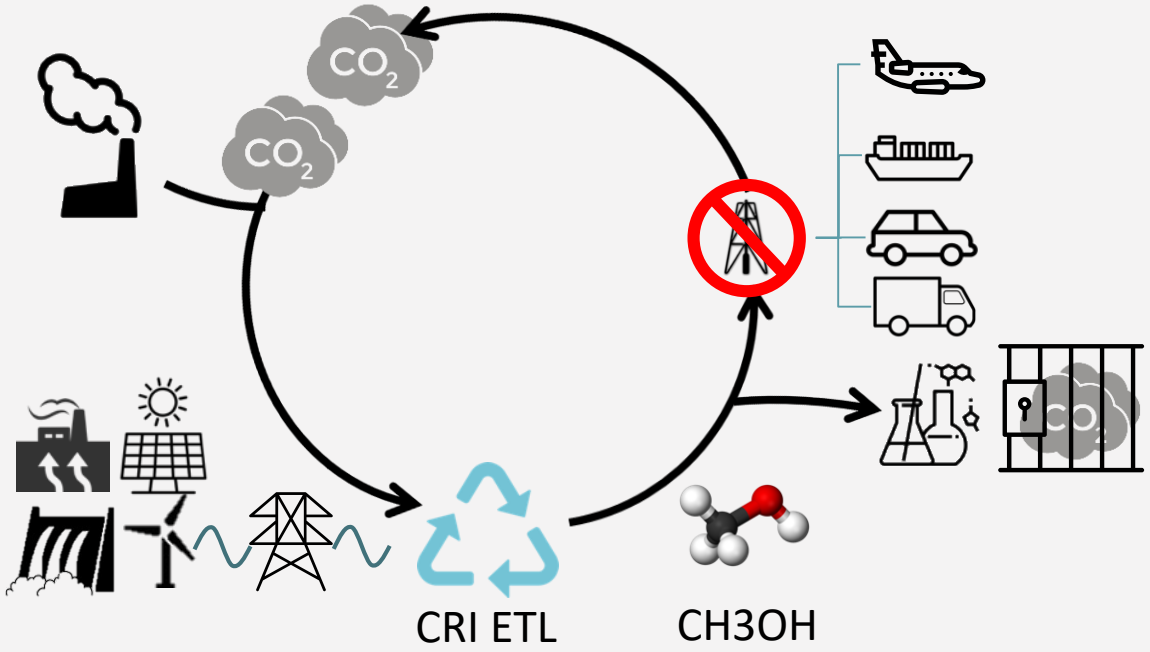
Presentation for CO2 Value EU workshop on Innovation Fund Brussels 2019-09-19

CirclEnergy

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 848757

CRI's Emissions-to-liquids: Direct hydrogenation of CO_2 into methanol

Carbon recycling from renewable energy



Some process advantages

- **Direct and selective:** no reforming or byproduct
- **Low turndown:** flexibility for grid balancing
- **Validated catalyst:** thousands of hrs variable load
- **Low** temp/pressure and **waste heat** integration
- **Safety** for workers and environment

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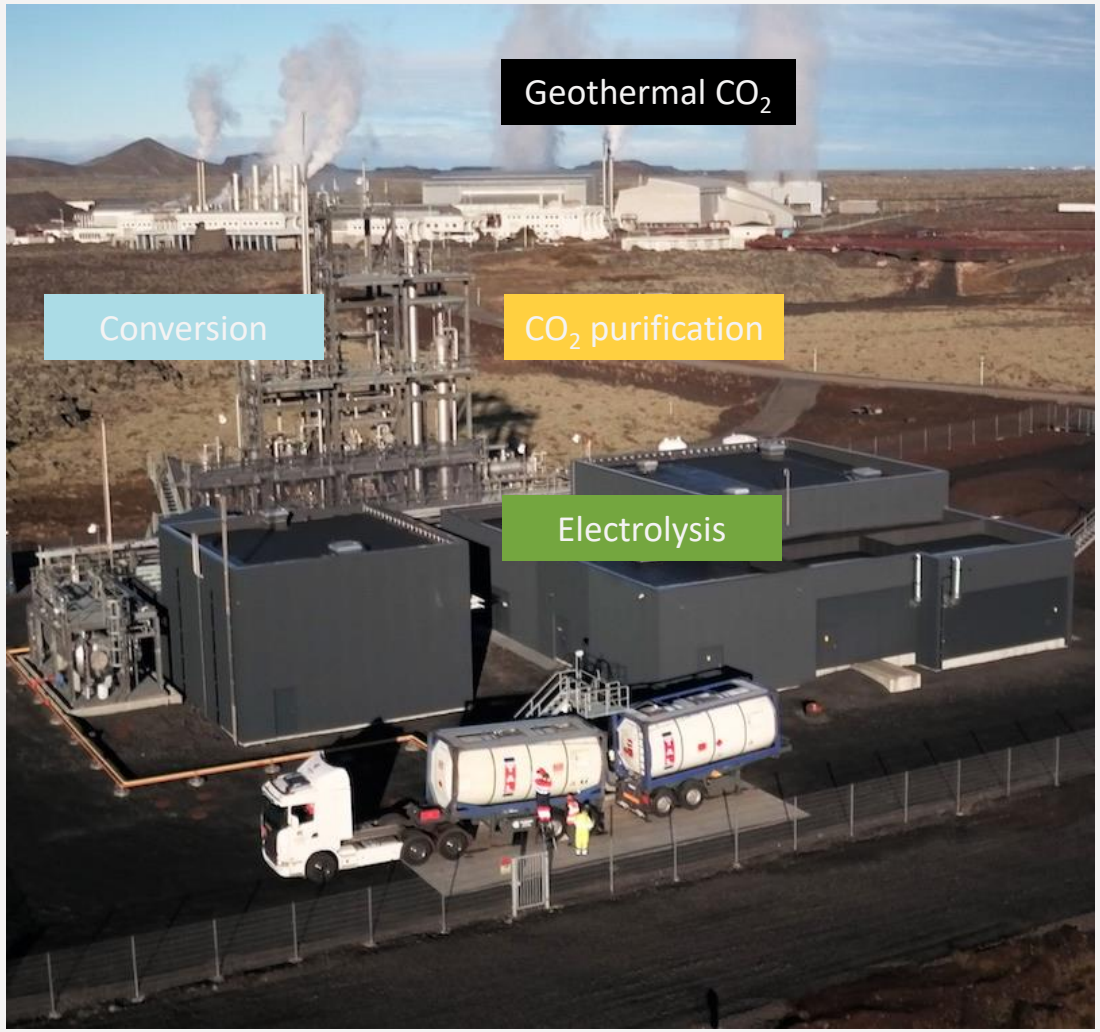
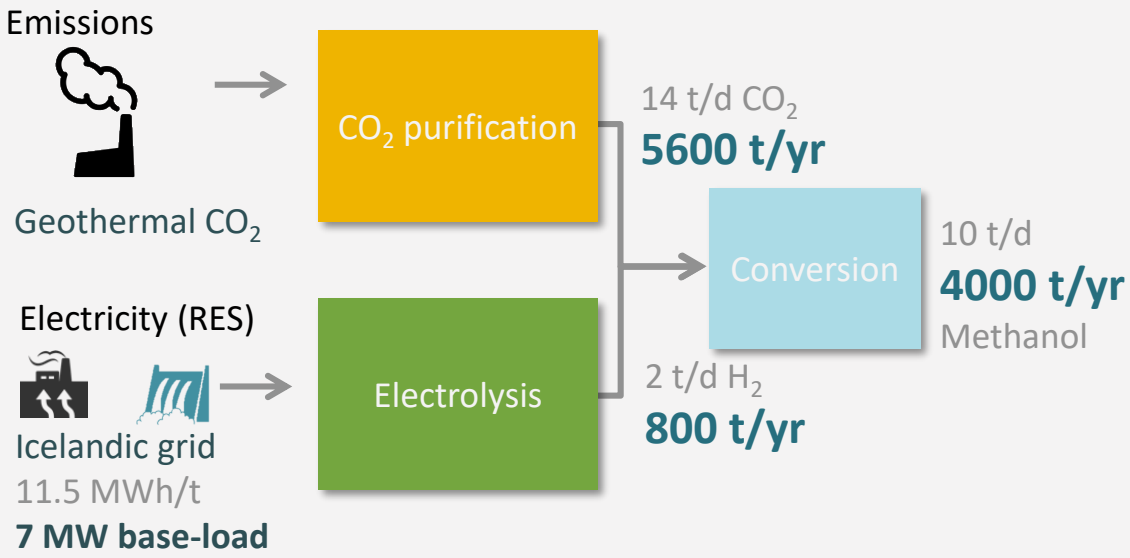
CRI's industrial scale demonstration plant, Svartsengi, Iceland



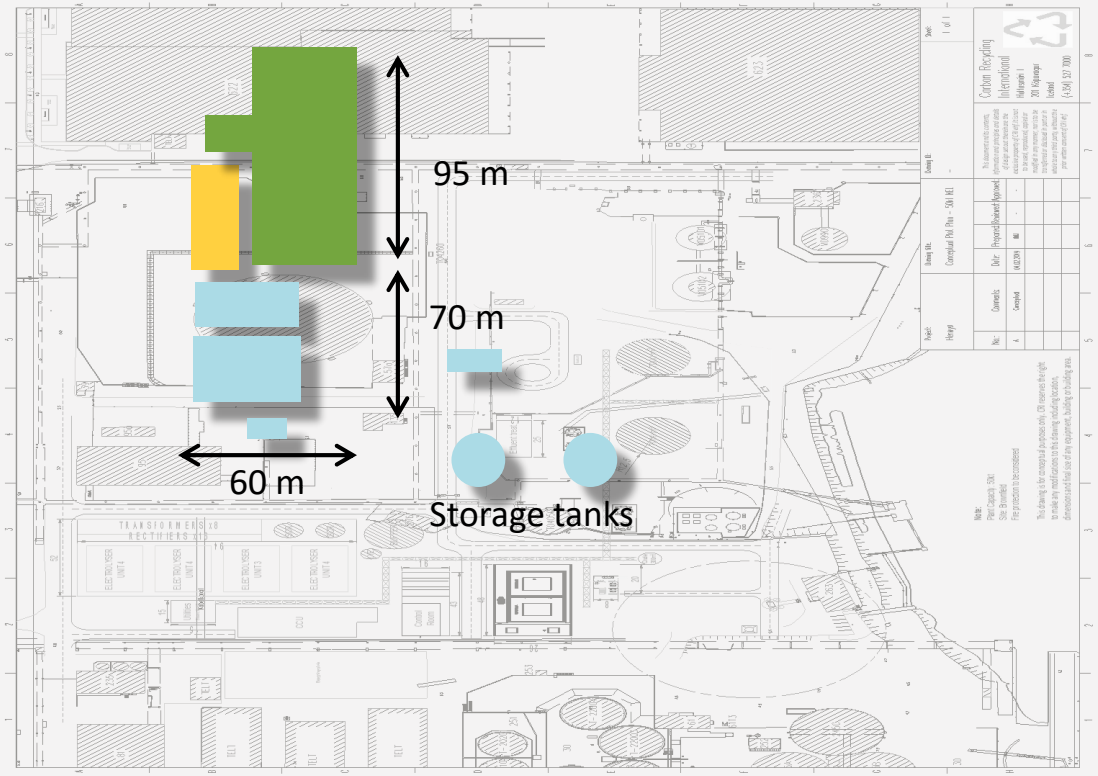
CRI's innovation: Direct hydrogenation of CO_2 at kt scale



First plant to recycle kilotons of flue-gas to produce liquid e-fuel according to RED/FQD for EU market

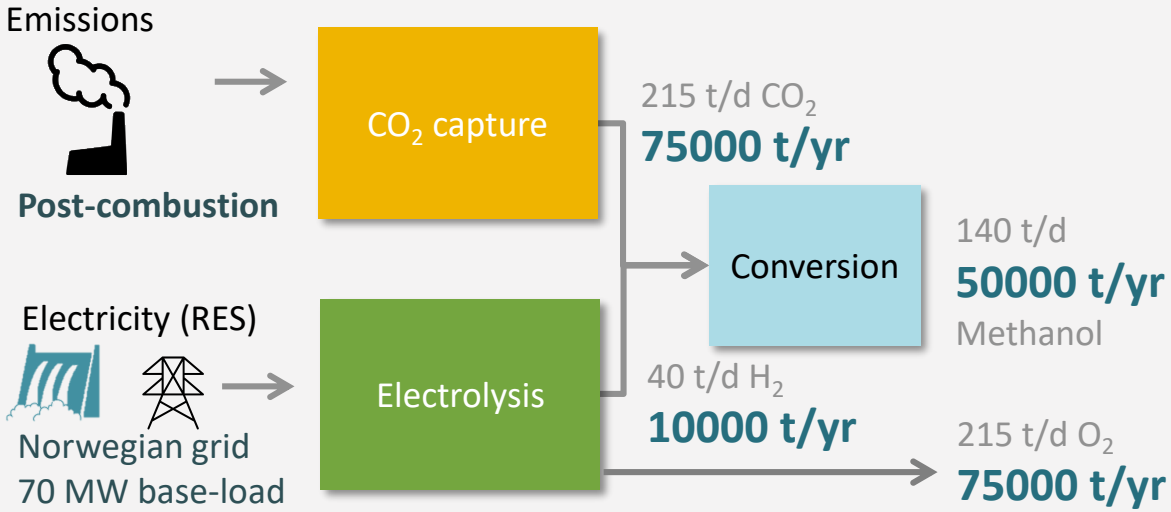
First producer of e-fuel with ISCC Plus certification and verification of sustainability (CO_2 abatement)

Proposed project in Norway



Commercial scale CO2-to-methanol plant using 100% RES

Brown field, 1-2 of several available flue gas sources for CO_2



Entering FEED (Q4)

Timeline: 24-30 mo.*

* After FID

CAPEX: €100 millio

Area: 1 ha.

25 permanent FTE

9/25/2019 *EU Horizon 2020 Research and Innovation Programme under grant agreement No 848757*

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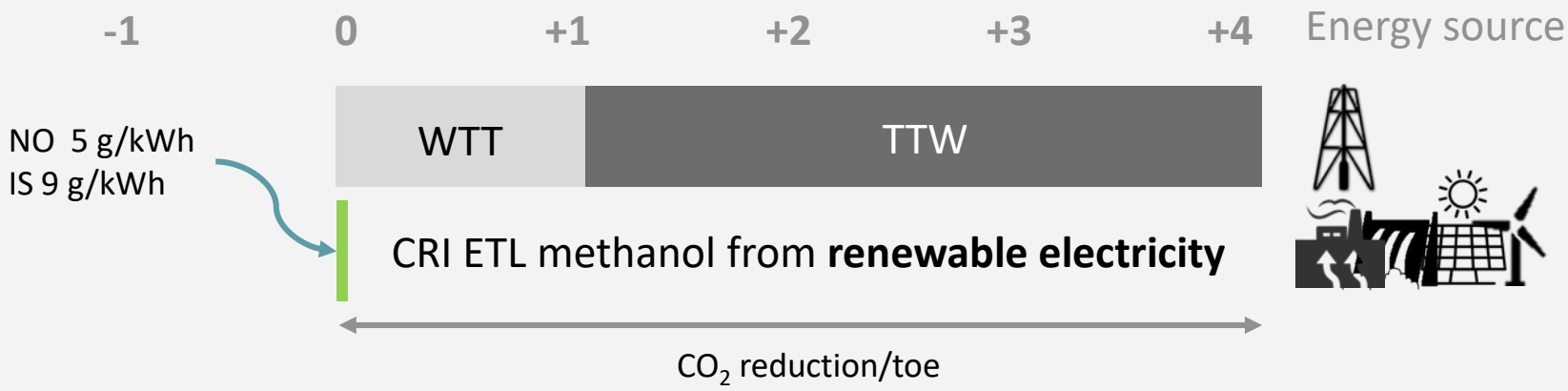
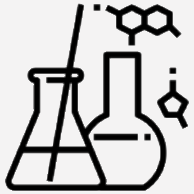
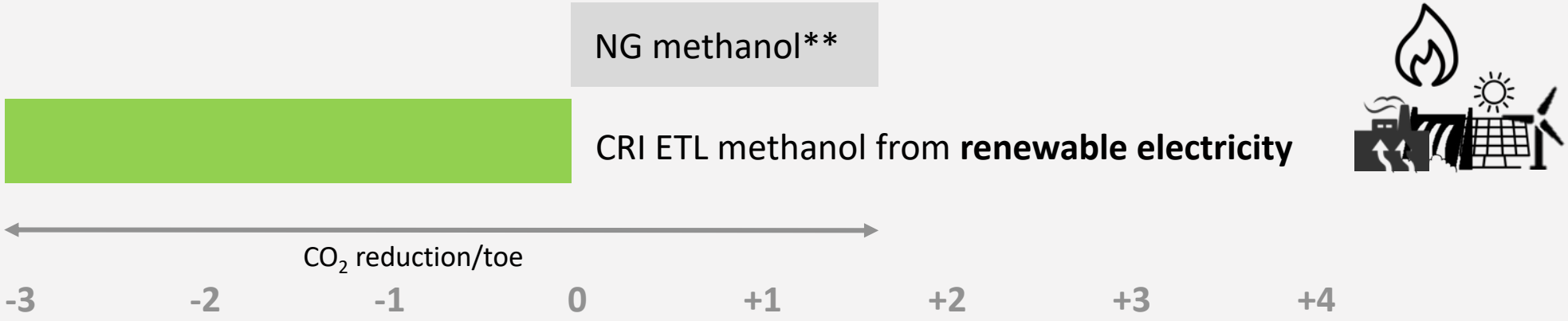
90%-100% reduction of life-cycle CO2 emissions compared to fossil fuel

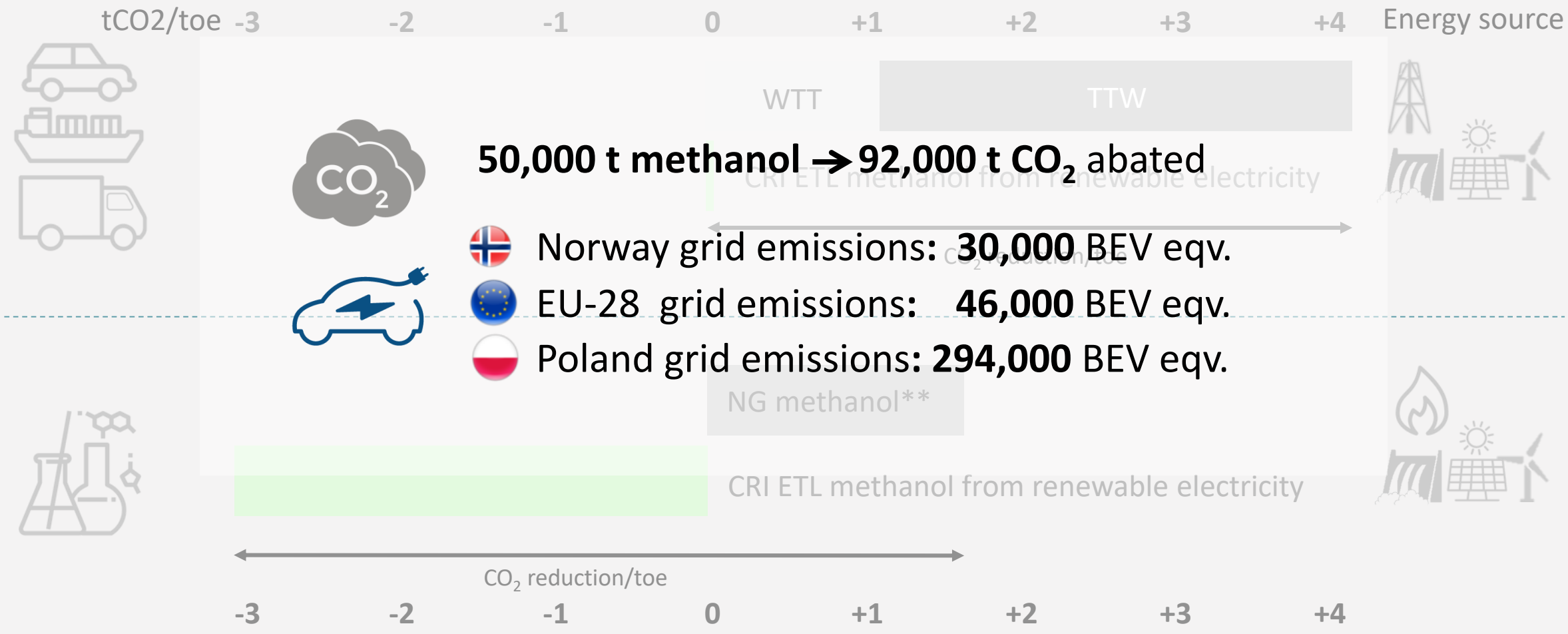






*RED II directive 94 gCO2e/MJ gasoline or diesel; **State-of-the art SME methanol Johnson Matthey Technol. Rev., 2017, 61, (4), 297–307

90%-100% reduction of life-cycle CO2 emissions compared to fossil fuel



50,000 t methanol → 92,000 t CO_2 abated

- Norway grid emissions: **30,000** BEV eqv.
- EU-28 grid emissions: **46,000** BEV eqv.
- Poland grid emissions: **294,000** BEV eqv.

Source: US EPA, Koffi B. et. al. Covenant of Mayors for Climate and Energy (2017) Default emission factors for local emission inventories

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What are near-term offtake markets?

Cars

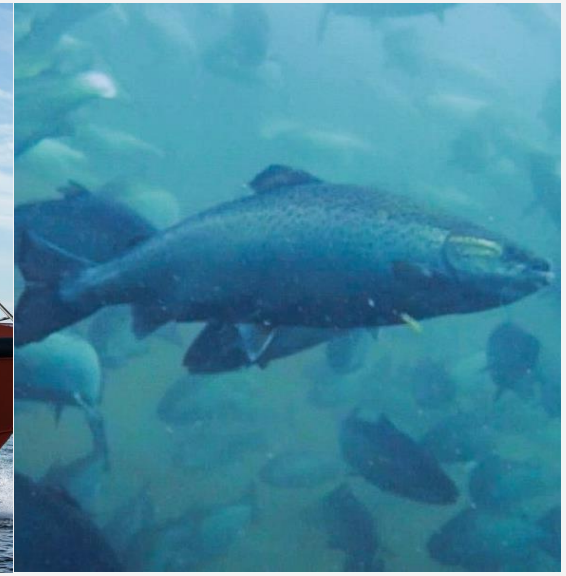
3% blend in standard gasoline (EN228), New gasoline blends (A20%), MTBE, FAME, M100%

Heavy Goods Vehicles

M100%, FAME, UCOME

Ships and barges

M100%, FAME, UCOME



Other

Water denitrification, aquaculture (O_2 byproduct), traditional chemical applications

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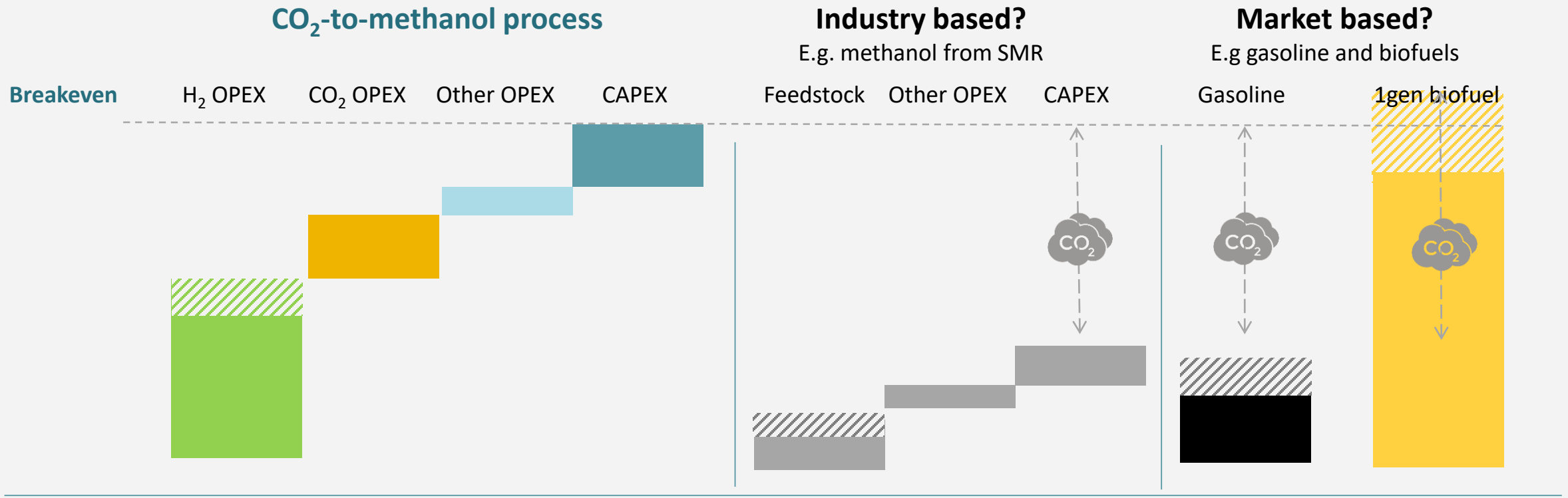
Economics: what is the true abatement cost and value?



Drivers	Cost of **electricity**	Flue gas **source**	Cost of **labor**	Cost of **electrolyzers**	**Local NG** market	**Scale economy** of ≥ 1 MM t/yr	**Global oil** supply/demand	**Lipids/ sugar** supply/demand
Issues	Value of grid stabilization	In who's scope?		No mass production	Cost not transparent	Sustainable tech at lower scale	Volatilty & long run demand	Volatility and ag subsidies

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Thank you

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