Using energy systems analysis to compare cross-dimensional performance of biofuel production

Bio4Energy researchers meeting

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Comparing long and short term biofuel production pathways

- Swedish Energy Agency priorities
  - Short-term: refinery based
  - Long-term: gasification and/or biochemical
  - Existing infrastructure vs. efficiency

- Project funded by f3 and Energy Agency
  - Bio4Energy (LTU), IVL, RISE, Preem

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Biofuel production pathways

	Liquefaction – hydrotreatment	**Gasification – catalytic synthesis**
Kraft lignin	**Case 1. MSL-HDO** Lignin separation, depolymerisation, hydrotreatment	**Case 2. BLG** Black liquor gasification, catalytic synthesis
Forest residues	**Case 3.** Forest residues pyrolsysis, oil upgrading a) HDO based, **3a Pyr-HDO** b) FCC based, **3b Pyr-FCC** c) Hydropyrolys, **3c Hydropyr**	**Case 4. BMG** Forest residues gasification, catalytic synthesis
	Gasoline, diesel	**Methanol**

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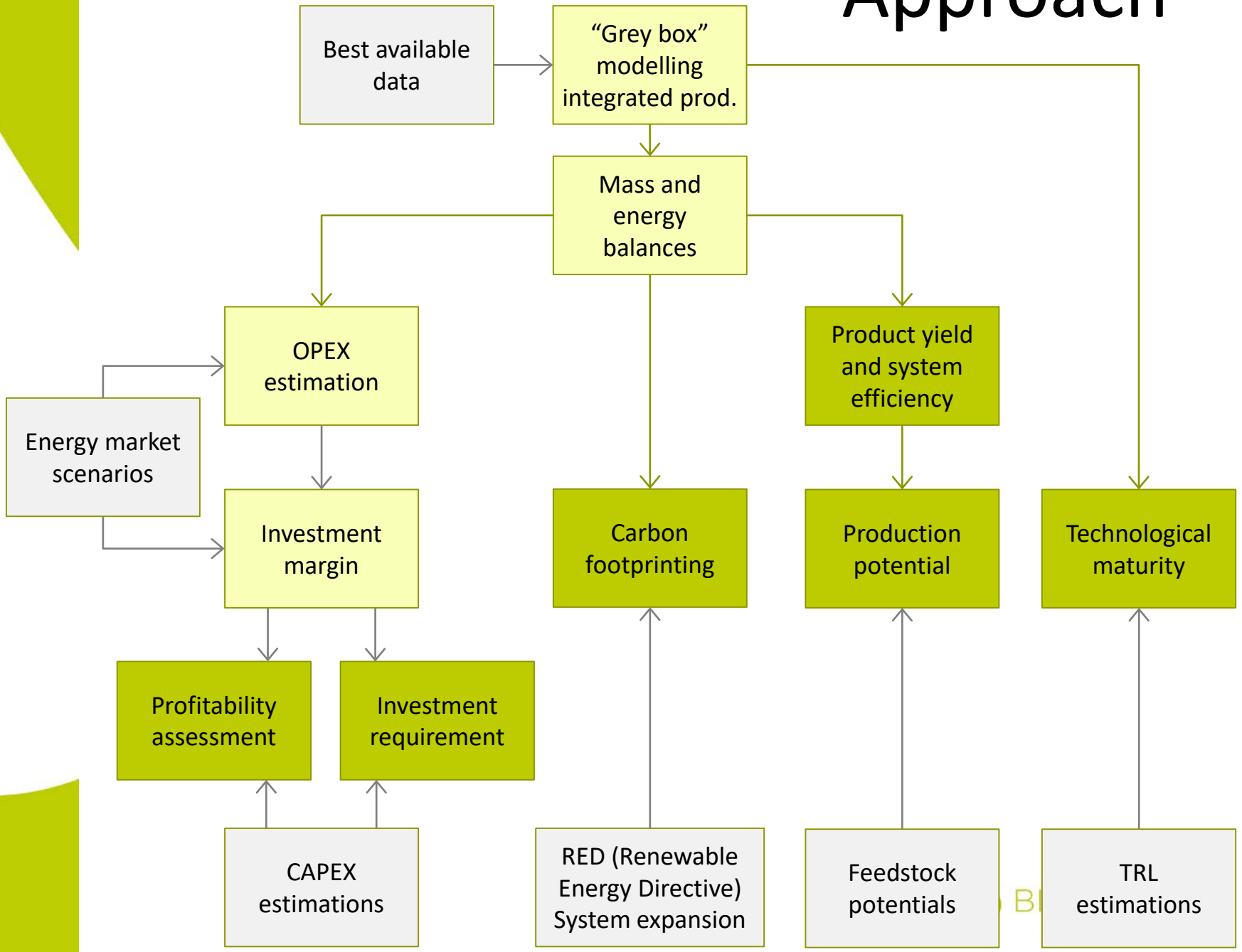
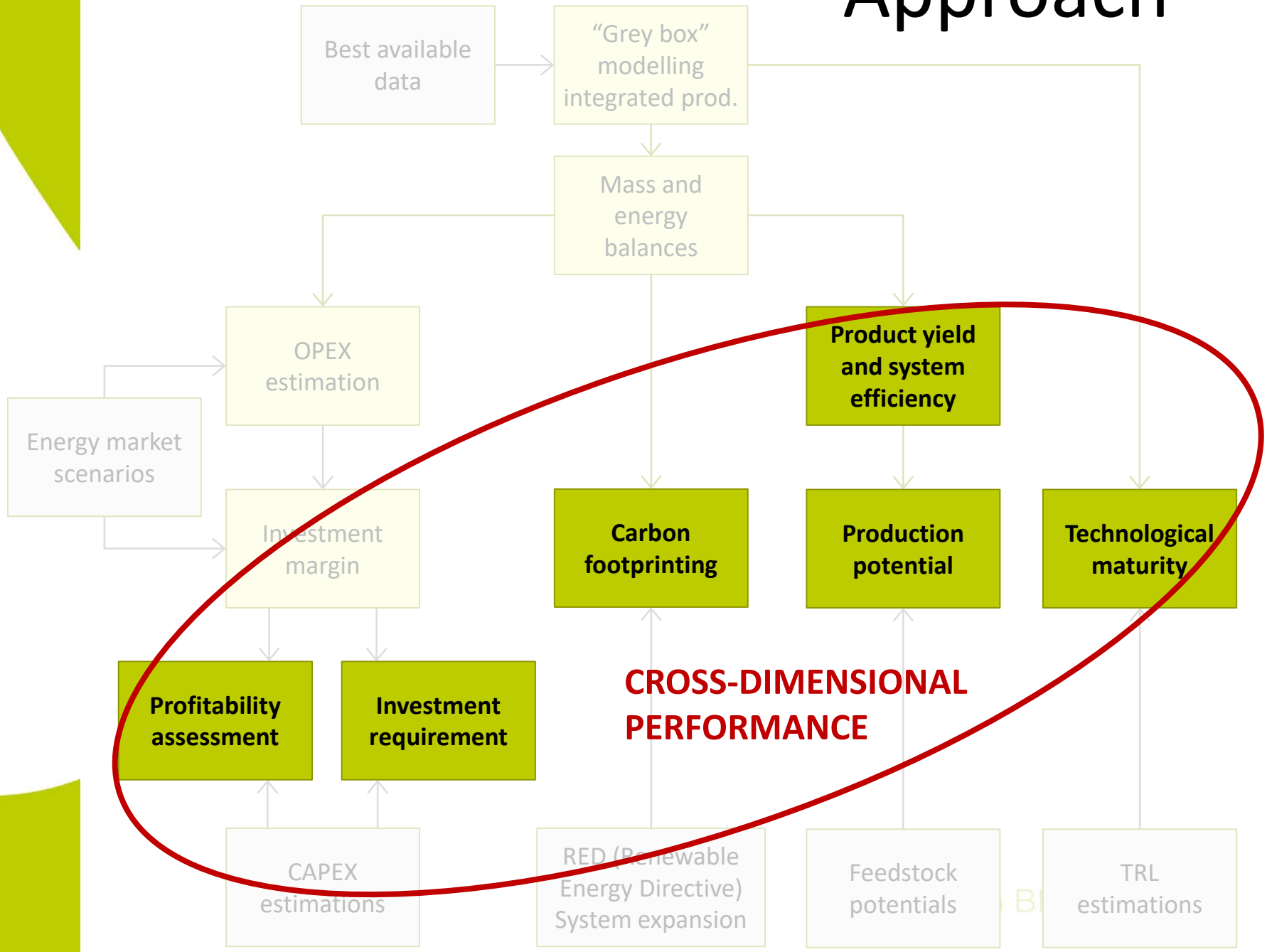
Approach


Best available data
"Grey box" modelling integrated prod.
Mass and energy balances
OPEX estimation
Energy market scenarios
Investment margin
Product yield and system efficiency
Carbon footprinting
Production potential
Technological maturity
Profitability assessment
Investment requirement
CAPEX estimations
RED (Renewable Energy Directive) System expansion
Feedstock potentials
TRL estimations

Approach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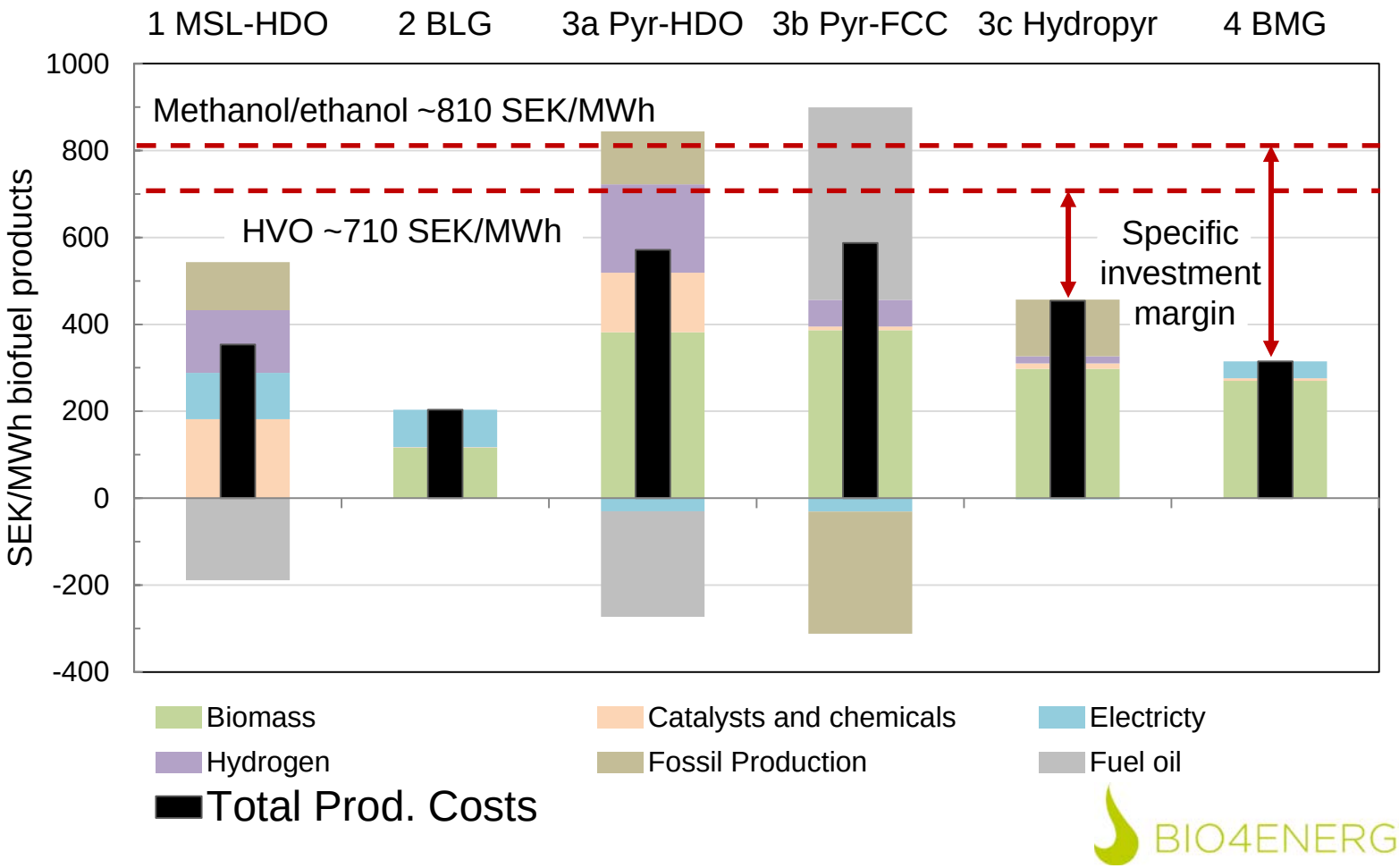
Profitability assessment

1) production cost estimation



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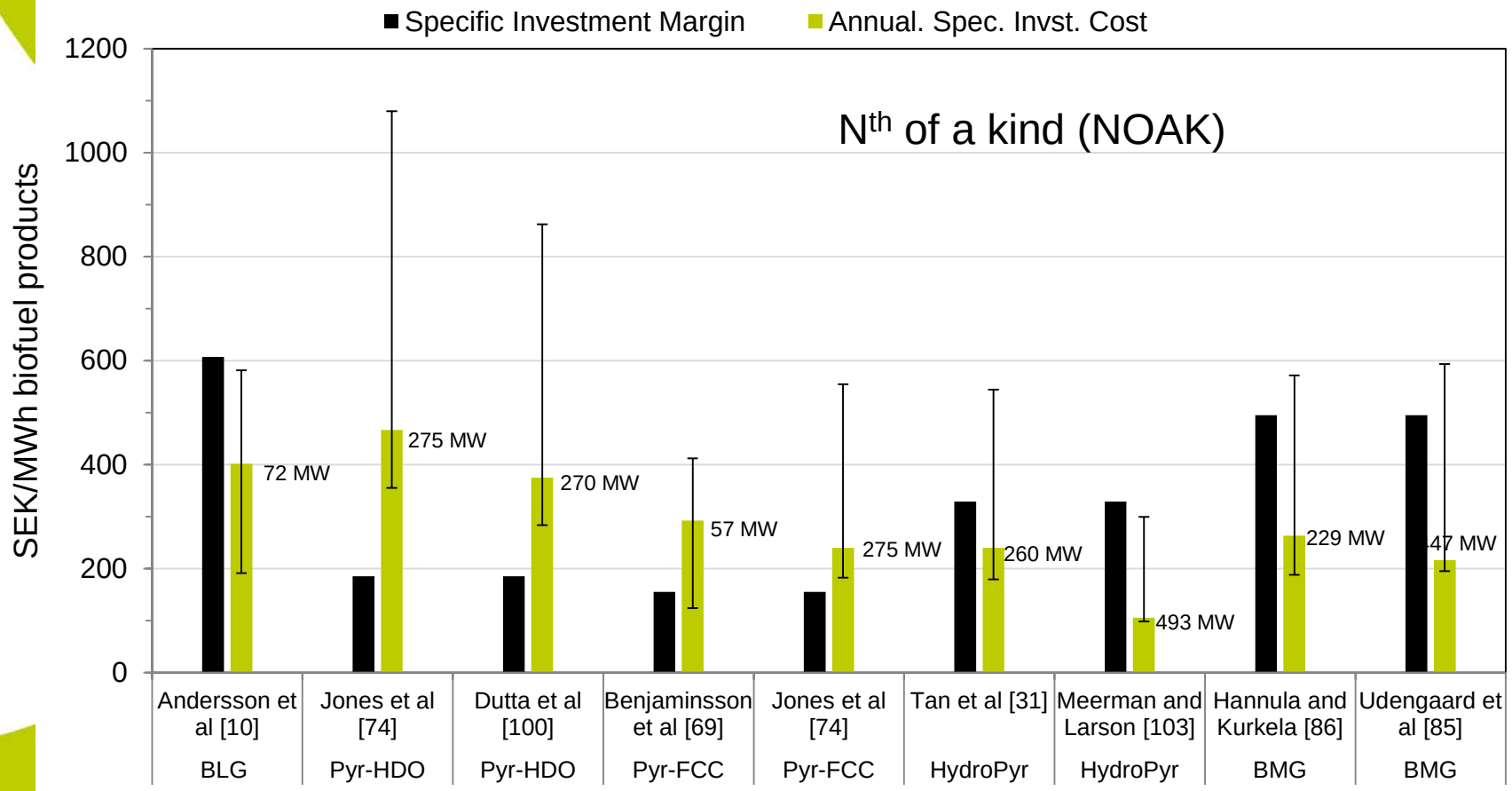
Profitability assessment

2) investment cost estimations



recent CAPEX data from Biozin project (IH2)
~3500 MSEK for 120.000 m^3/y

Profitability assessment

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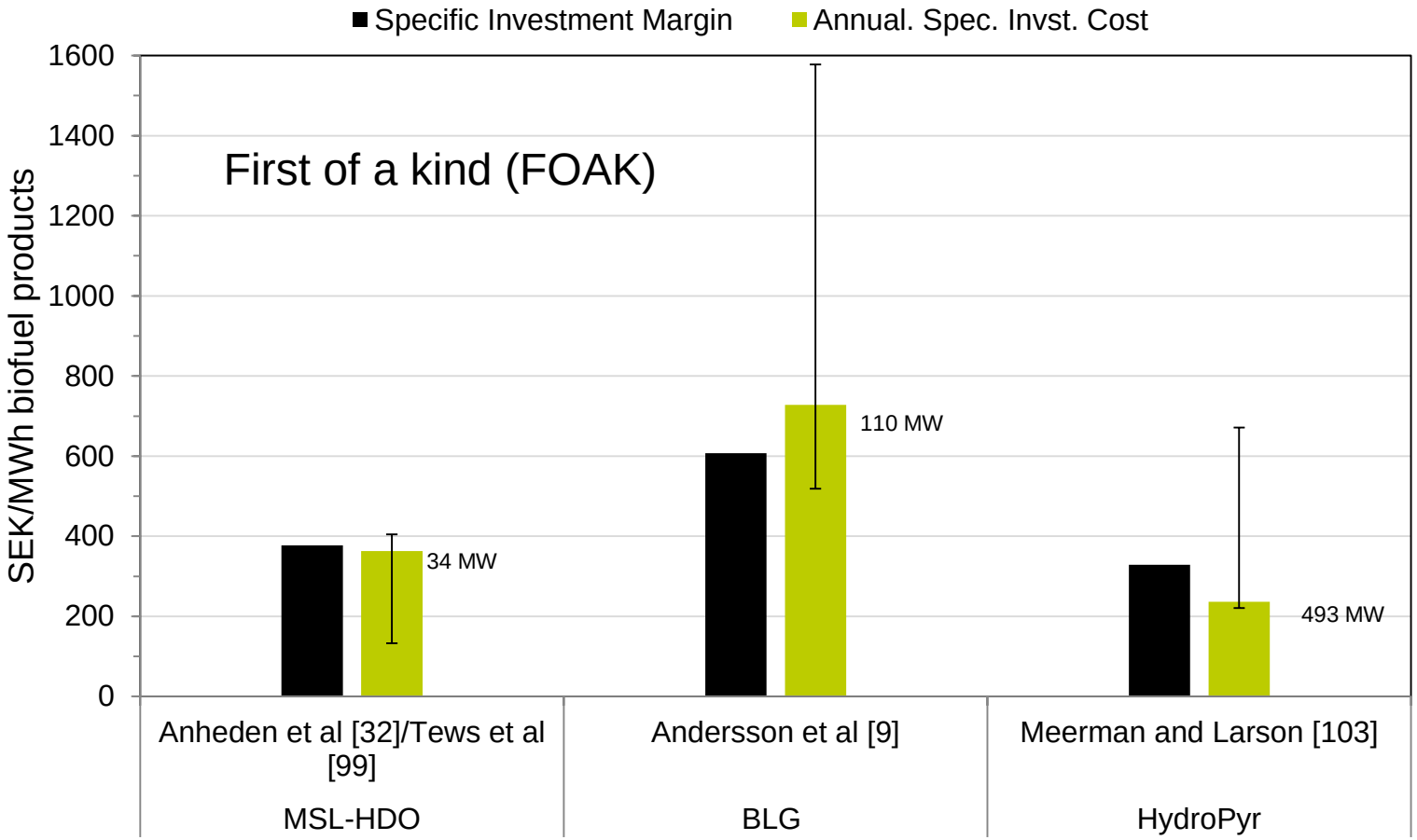

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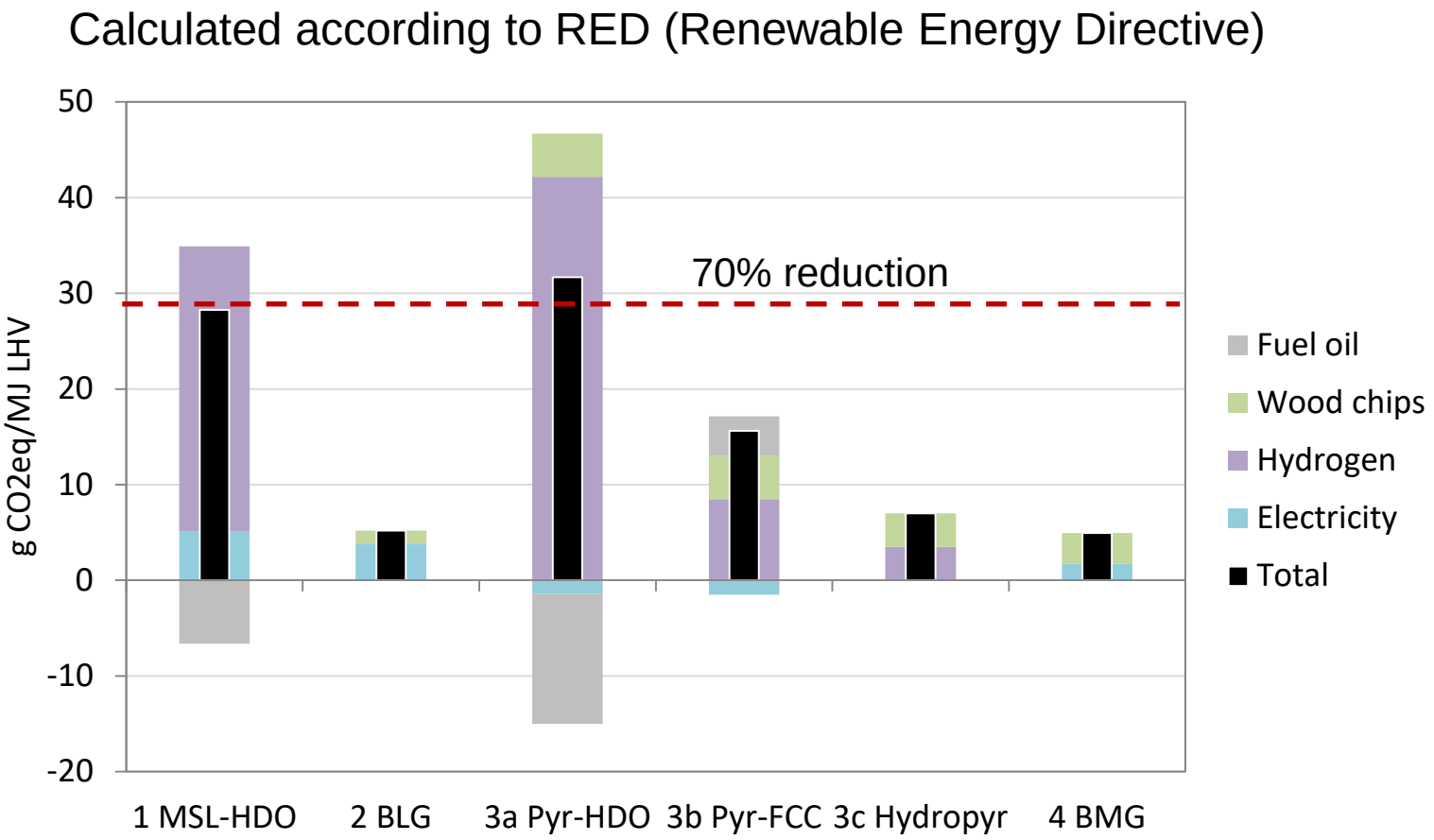
Carbon footprint



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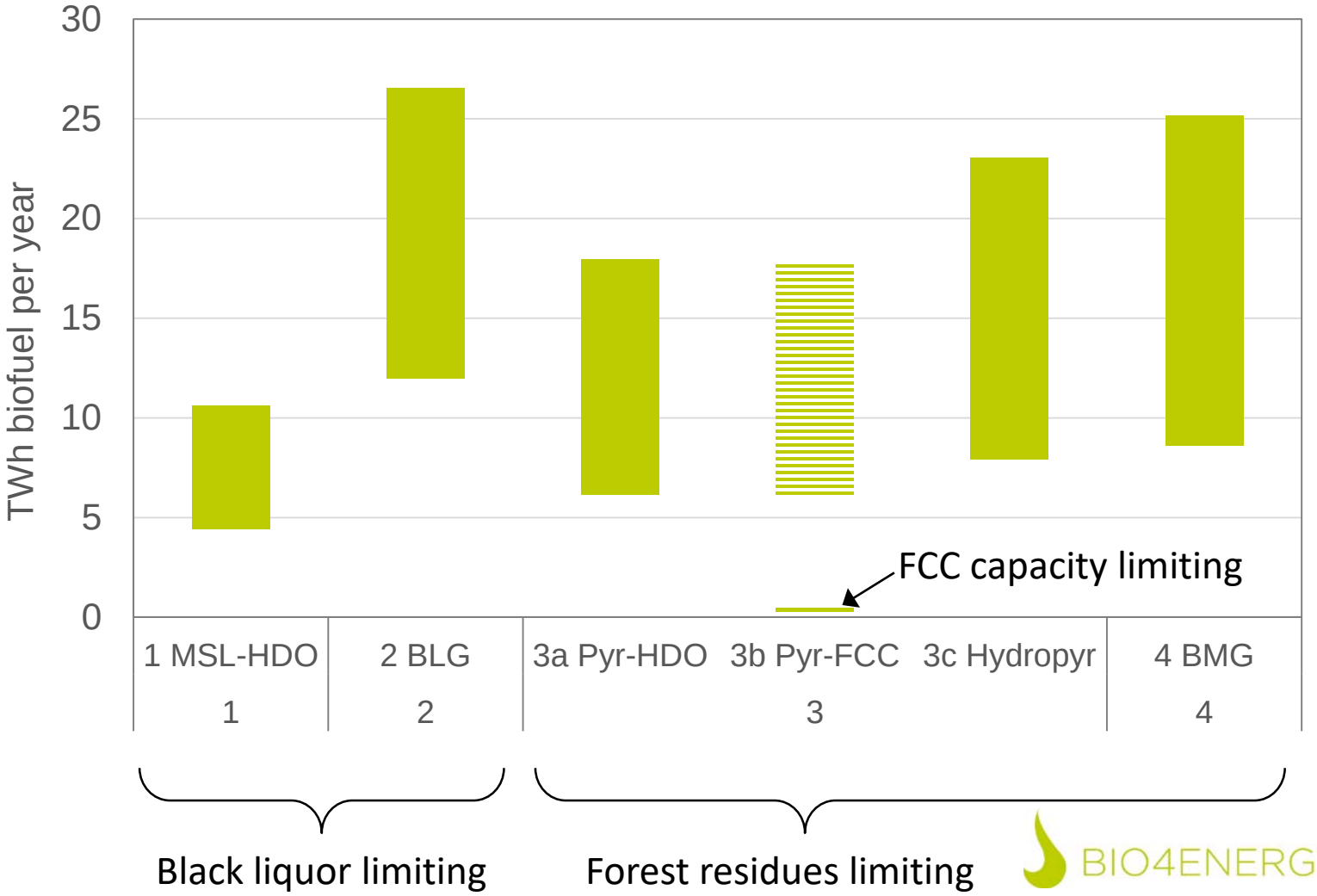
Production potential – in Sweden



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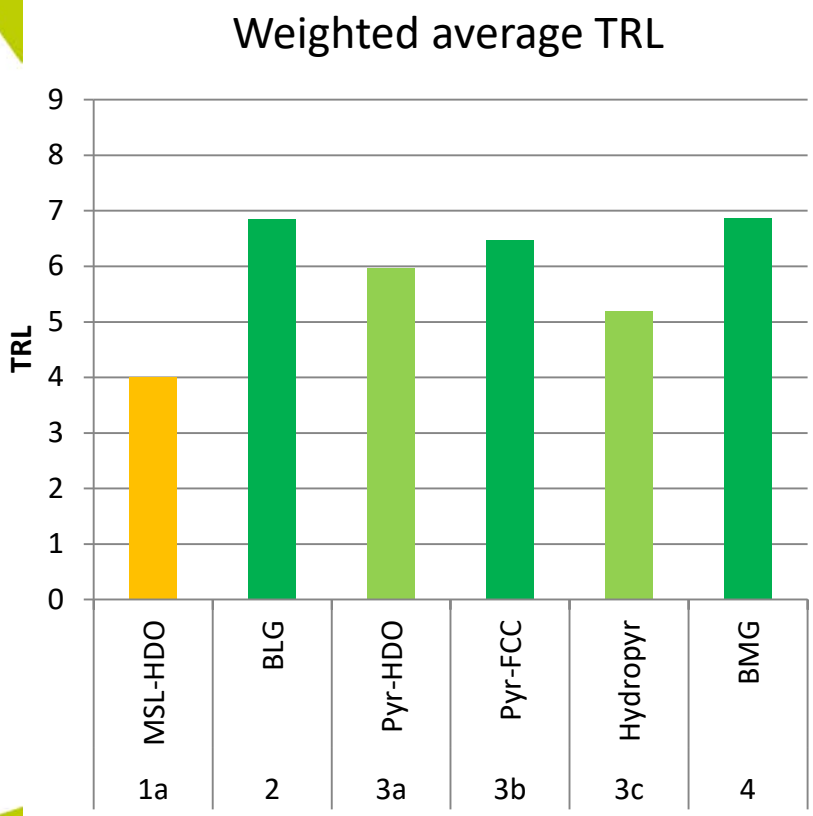
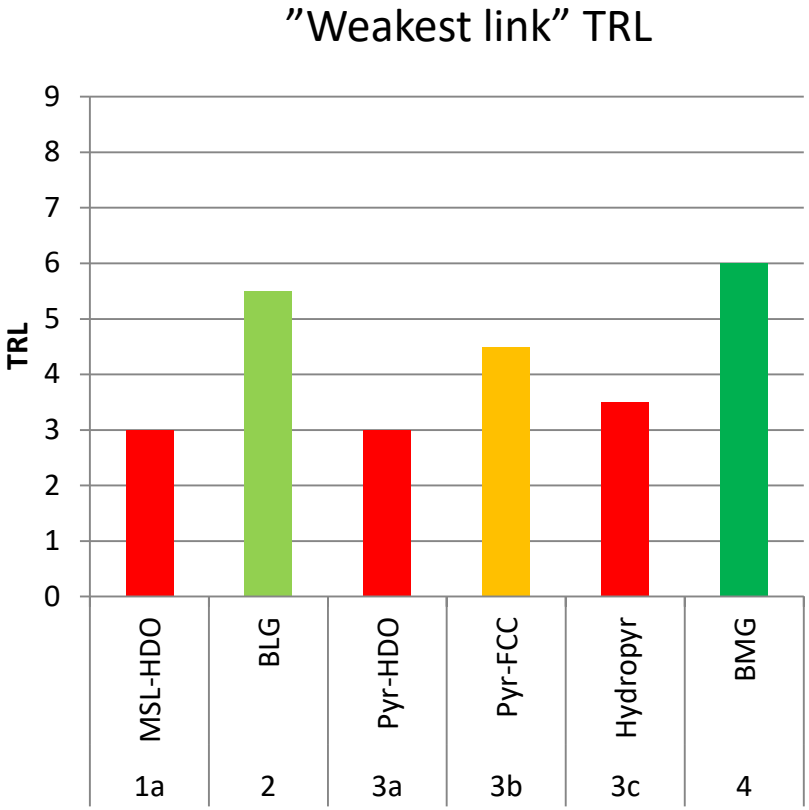
Technology maturity





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Cross-dimensional performance

	Energy efficiency	Profitability	Investment requirem.	Prod. potential	Carbon footprint	Technology maturity
1 MSL-HDO *Lignin depol. + HDO → petrol/diesel*	+	+	+	0	0	-
2 BLG *Black liquor gasification → methanol*	+	+	0/-	+	+	+
3a Pyr-HDO *Fast pyrolysis + HDO → petrol/diesel*	0	-	-	+	-	0
3b Pyr-FCC *Fast pyrolysis + FCC-co-proc. → petrol/diesel*	-	-	+	-	+	+
3c Hydropyr *Hydropyrolysis IH2 → petrol/diesel*	0	+	+	+	+	0
4 BMG *Forest residue gasification → methanol*	0	+	+	+	+	+

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3a Pyr-HDO *Fast pyrolysis + HDO → petrol/diesel*	0	-	-	+	+	0
3b Pyr-FCC *Fast pyrolysis + FCC-co-proc. → petrol/diesel*	-	-	-	+	+	+
3c Hydropyr *Hydropyrolysis IH2 → petrol/diesel*	0	+	+	+	+	0
4 BMG *Forest residue gasification → methanol*	0	+	+	+	+	+

ONGOING PROJECT

f3/EM

Bio4Energy/LTU, RISE, Södra Cell, Smurfit Kappa, SunCarbon, Preem

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Renewable fuels and systems – Program conference

”Flera filer mot framtidens drivmedel”

- Energimyndigheten + f3
- Stockholm, 22 November 2018
- Including ”pitch and match” session

f3 + BIO4ENERGY =

Want to know more?

Jafri, Wetterlund, Anheden, Kulander, Håkansson, Furusjö (2018), Multi-aspect evaluation of integrated forest-based biofuel production pathways: Part 1. Product Yields & Energetic Performance, Energy (accepted)

Jafri, Wetterlund, Anheden, Kulander, Håkansson, Furusjö (2018), Multi-aspect evaluation of integrated forest-based biofuel production pathways: Part 2. Economics, GHG Emissions, Technology Maturity and Production Potentials, Energy (under review)

Furusjö et. al., (2017) Techno-economics of long and short term technology pathways for renewable transportation fuel production – Detailed report. Report No 2018:09, f3 The Swedish Knowledge Centre for Renewable Transportation Fuels, Sweden. Available at www.f3centre.se.

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