

NORDUR: INTERNATIONALE ZUSAMMENARBEIT, PTG & SNG

The Nordur Initiative

HSR: PtG Expertengespräche

12.9.2017: 16.10 – 16.35 pm

Rapperswil

Nordur Power SNG: Power-to-Gas

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- Nordur Power SNG: Power-to-Gas
 - Project Features – Basic Concept
 - Business Approach & Roadmap
 - SNG Green added Value
 - Basic Engineering 40 MW PtG
- Next steps

The Nordur Initiative at a glance

STARTING POSITION & GOALS

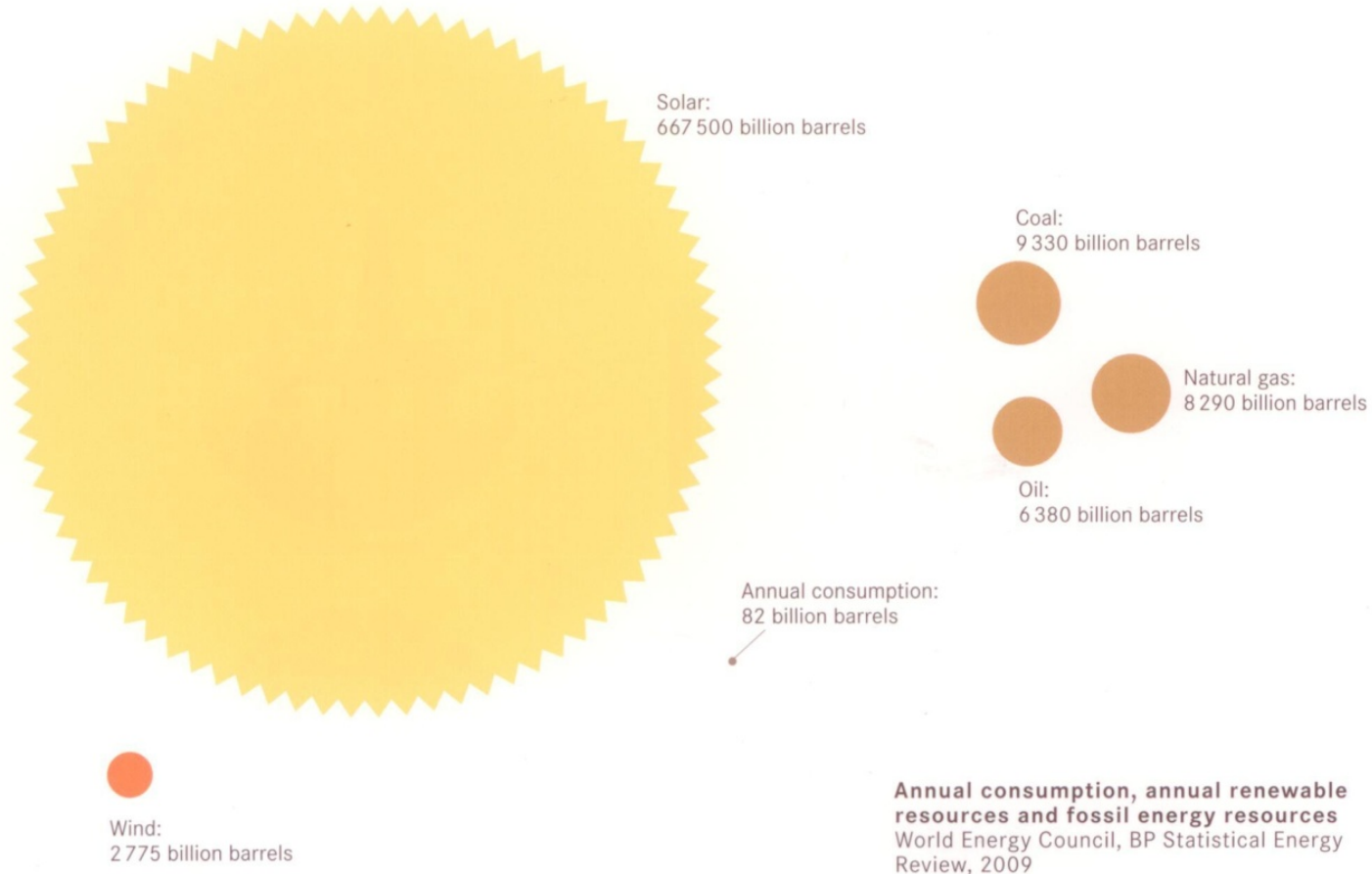
A long-term cooperation between Switzerland, Iceland and Norway in the field of renewable energies.

„Economic Gardening“ in the EFTA region. Another step towards the Global Grid.



The Nordur Initiative at a glance

STARTING POSITION & GOALS



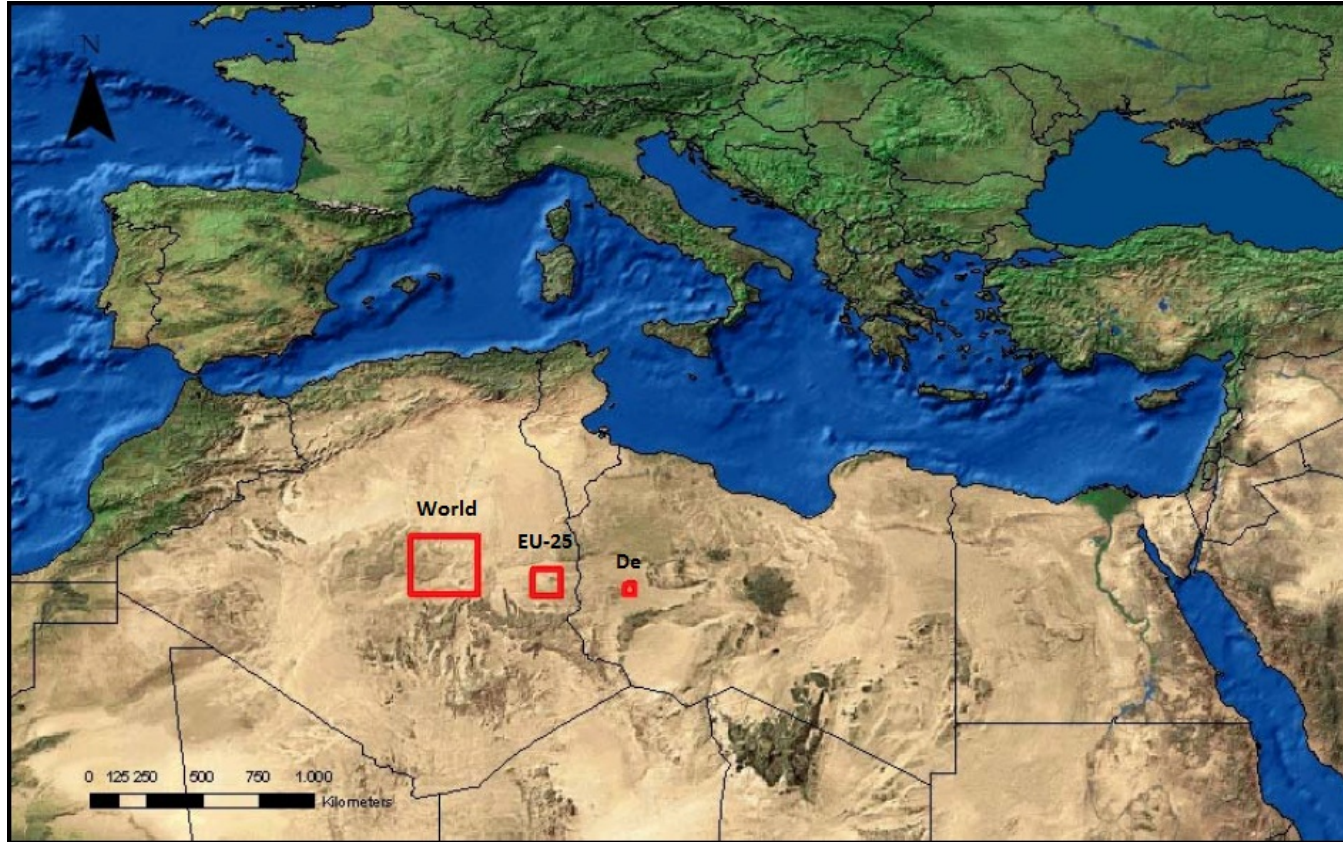
Annual consumption, annual renewable resources and fossil energy resources
World Energy Council, BP Statistical Energy Review, 2009

World's total annual energy consumption, annual renewable resources and fossil energy resources

Graph: Julius Bär, 2011

The Nordur Initiative at a glance

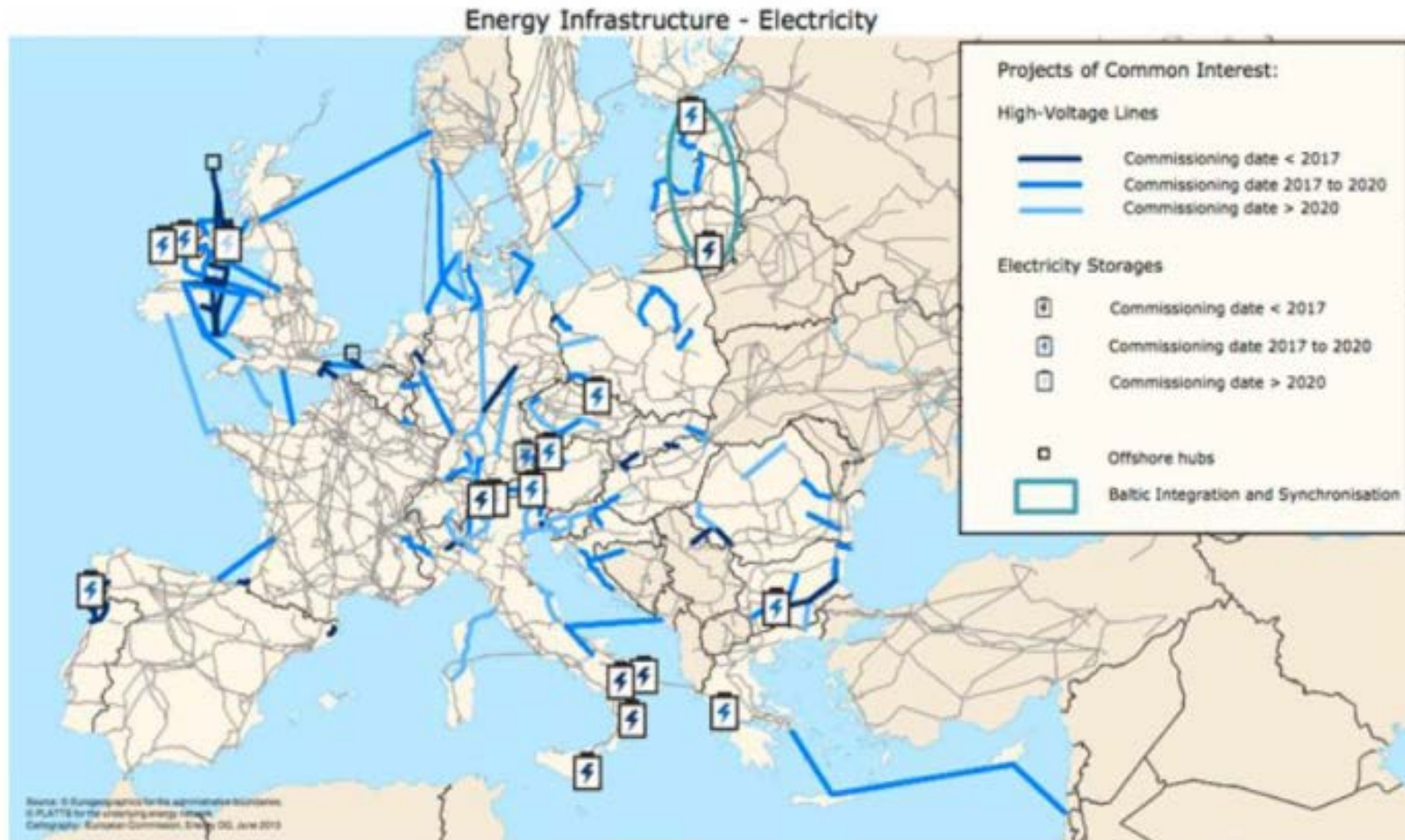
STARTING POSITION & GOALS



In contrast to other global challenges like biodiversity, water, soil, etc. energy itself is available in general.

The Nordur Initiative at a glance

STARTING POSITION & GOALS



*The Global Grid
is not a vision.
It's under construction.*

The Nordur Initiative at a glance

STARTING POSITION & GOALS

- Project portfolio

Nordur Power: HVDC

Nordur Power SNG: P2G

Climate Power: CO₂e neutral energy (RECS & Gold Standard)

R&D / CTI : Trade in geothermal & renewable energy from Iceland (WTI, Bern)

• Today

Short Term

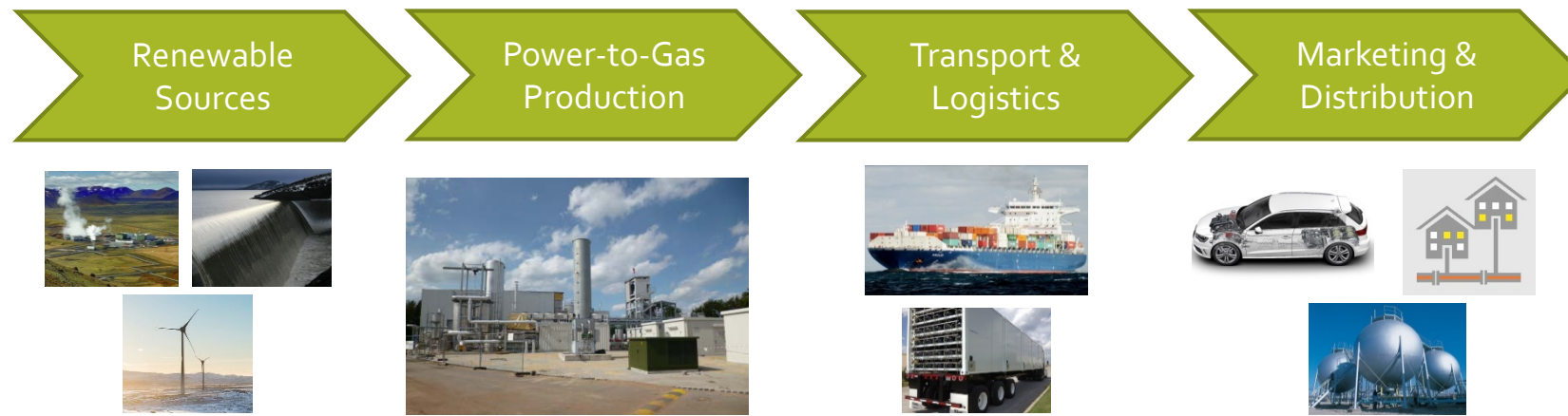
Mid Term

Long Term

Nordur Power SNG: Power-to-Gas

PROJECT FEATURES - BASIC CONCEPT

- The goal of Nordur Power SNG is to create a new product for the Swiss biofuel market by transforming Icelandic abundant renewable electricity into synthetic gases (H₂ / SNG) with following basic concept:
 - ▣ **Production of SNG** in advanced **Power-to-Gas (PtG)** plants located at GPP Hellisheidi, utilizing available **renewable electricity** and **CO₂ from geothermal** or industrial sources.
 - ▣ **Domestic use in Iceland** and transport of the **SNG to Switzerland** either as compressed (**CNG**) or liquefied natural gas (**LNG**).
 - ▣ **Marketing and distribution of SNG**, either via the Swiss gas network or container based, with the objective to substitute fossil fuels and to reduce green house emissions (CO₂e) & NO_x in Switzerland.



Nordur Power SNG: Power-to-Gas

BUSINESS APPROACH & ROADMAP

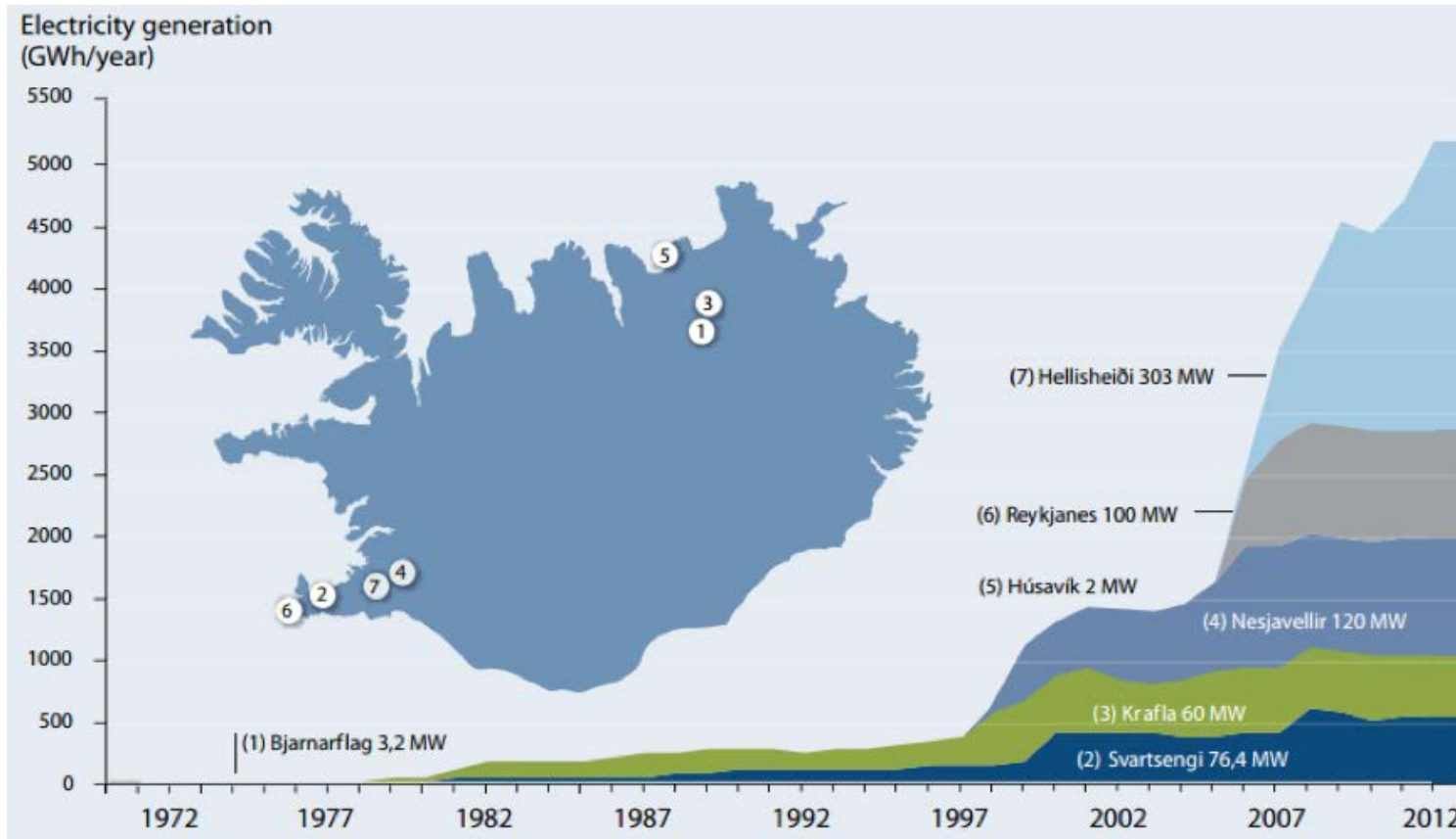


Iceland:

- Isolated grid: Regulating power, balancing energy, spinning-reserves, hydro potentials
- Past: Export of renewable energy with Aluminum
- Today; short- & midterm: Power-to-Gas / SNG / HSNG
- Long-term: HVDC Icelink, Greenland, etc.

Nordur Power SNG: Power-to-Gas

BUSINESS APPROACH & ROADMAP



Nordur Power SNG: Power-to-Gas

BUSINESS APPROACH & ROADMAP

- Let's generate a Win-Win-Win project!
 - Icelandic stakeholders
 - Availability of a new green fuel for the domestic market
 - Recycling of CO₂ from geothermal & other sources
 - Additional gas cleaning & purification
 - Green Economy of Iceland: Largest PtG production site worldwide (approx. 40 MWe)
 - Icelandic Grid: Regulating Power / Balancing Energy / Spinning-Reserves / Hydro potentials
 - Swiss and European stakeholders
 - Show case for international cooperation in renewable energy
 - Market pioneer in green gas & green fuels
 - Marketing
 - Environment
 - Less CO₂
 - Less NO_x
 - Improvement of the P2G technology at industrial scale



MOBIL MIT ERDGASFAHRZEUGEN. SICHER. SAUBER. GÜNSTIG.

ERDGAS 
Natürlich mobil

GÜNSTIG IN DER ANSCHAFFUNG

Die Anschaffungskosten von Erdgas- und Dieselfahrzeugen gleichen sich immer mehr an.

LEISTUNGSSTARK DANK TURBOMOTOR

Erdgasautos stehen herkömmlichen Fahrzeugen in puncto Schnelligkeit und Beschleunigung in Nichts nach.

HOHE REICHWEITE AUCH OHNE BENZINRESERVE

Erdgasautos haben im Erdgasbetrieb Reichweiten von bis zu 570 km, kombiniert mit Benzin sogar bis zu 1.380 km.

Reichweite ERDGAS bis zu

570 km



Reichweite ERDGAS + Benzin bis zu

1.380 km



bis zu
156 PS
bei Pkw

920 x



ERDGAS

7 verschiedene
Hersteller
24 Pkw-
Modelle

MODELLVIELFALT IN ALLEN KLASSEN

Jeder vierte zugelassene Pkw kann mit Erdgasantrieb angeboten werden.



Nordur Power SNG: Power-to-Gas

BUSINESS APPROACH & ROADMAP

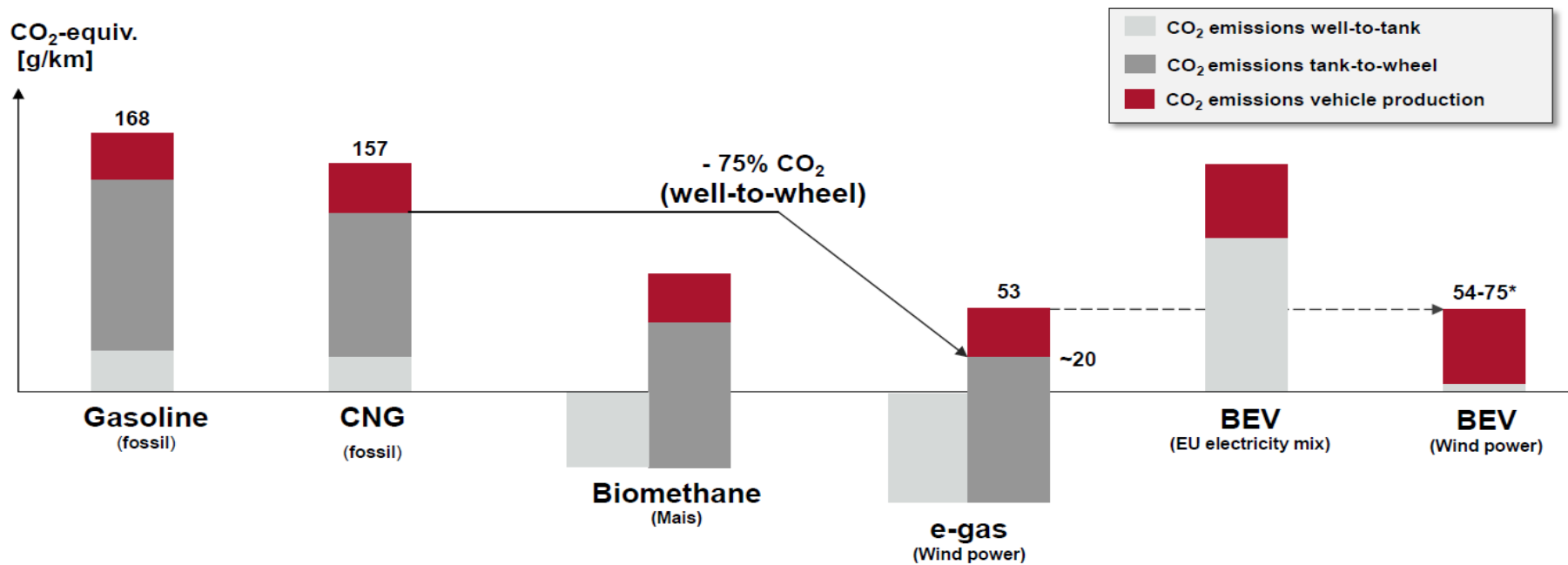


Nordur Power SNG: Power-to-Gas

SNG GREEN ADDED VALUE

A vehicle powered with e-gas is as environmentally friendly as an electrical car powered by wind energy

Example: compact class car with 200 000 km operation

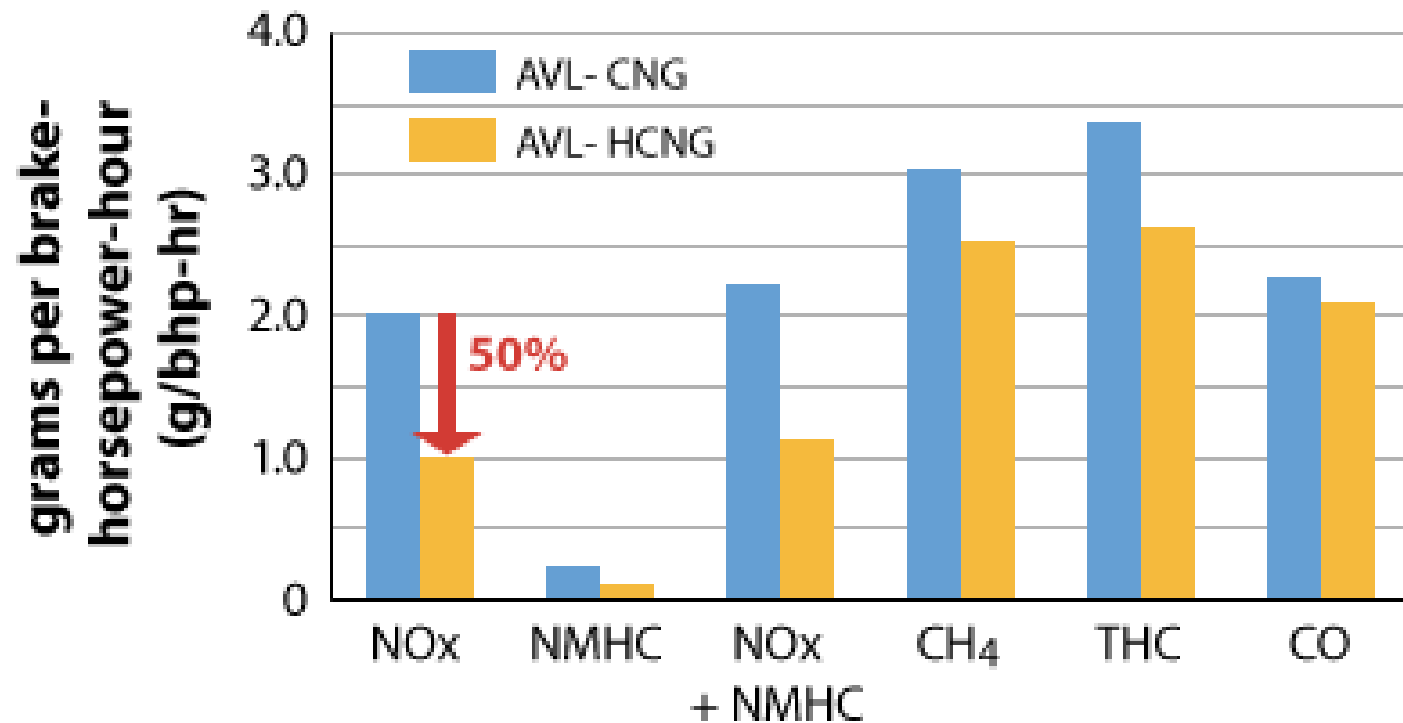


Source: AUDI
* with second battery

Nordur Power SNG: Power-to-Gas

SNG GREEN ADDED VALUE

- HCNG / HSNG und NOx-Emission



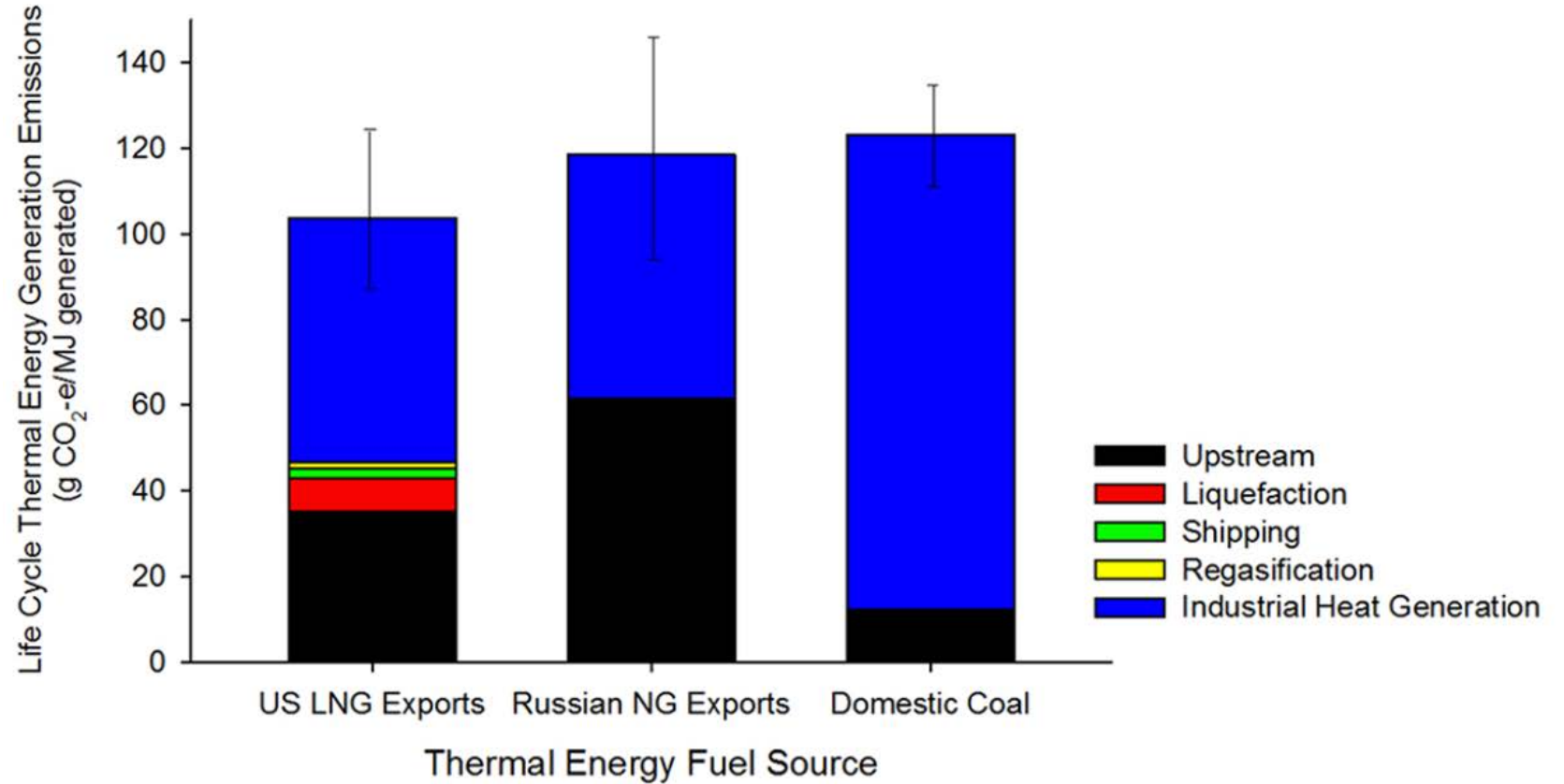
- Wikipedia: HCNG, 3.3.2016

Nordur Power SNG: Power-to-Gas

SNG GREEN ADDED VALUE

American
Chemical Society

ENVIRONMENTAL
Science & Technology

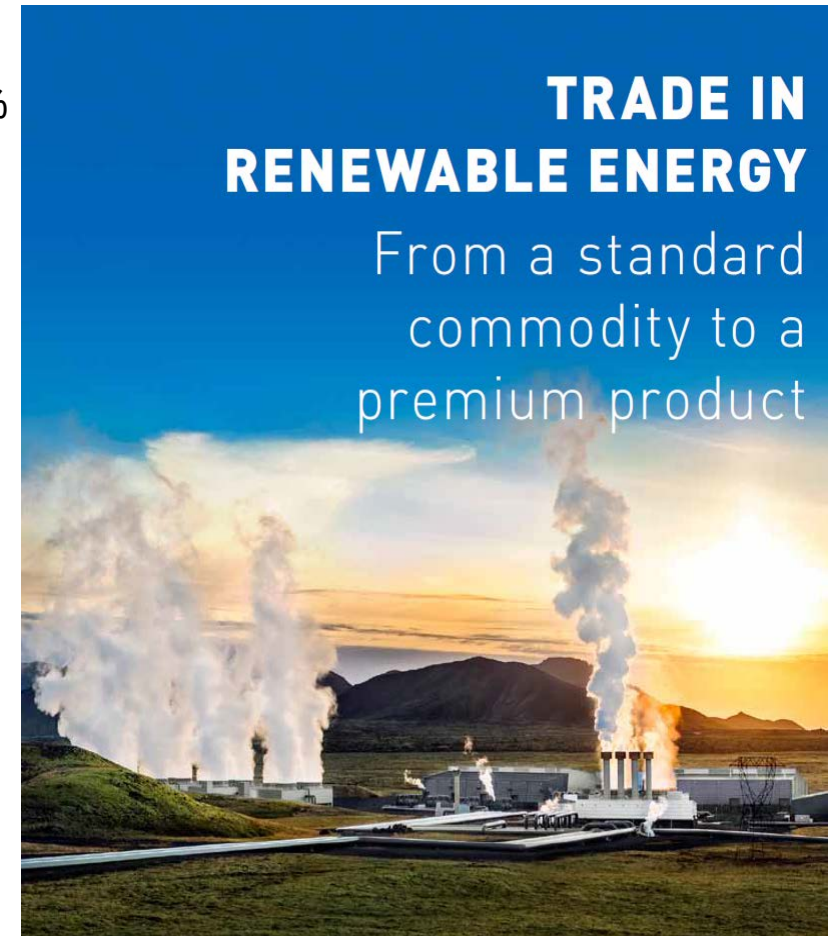


Life Cycle Greenhouse Gas Emissions From U.S. Liquefied Natural Gas Exports: Implications for End Uses

Nordur Power SNG: Power-to-Gas

BASIC ENGINEERING 40 MW PtG

- The industrial park at **Hellisheidi geothermal power plant** (Reykjavik, Iceland) offers access to:
 - Non condensable gases (NCG), such as H₂S and CO₂ gas
 - CO₂ concentration: ~60% (~35% H₂S) reduced by OR to < 1%
 - Construction space / land for PtG-plant (170 x 125m)
 - 303 MW capacity (Electricity 132 kV and 11 kV)
 - Potable cold and hot water (80°C)
 - Steam & brine at 120°C and 180°C
 - Synergies with GTPP for O&M
 - Staff for operation from GTPP
 - 2 harbors (within 30 and 65 km)
 - International airport within 75km

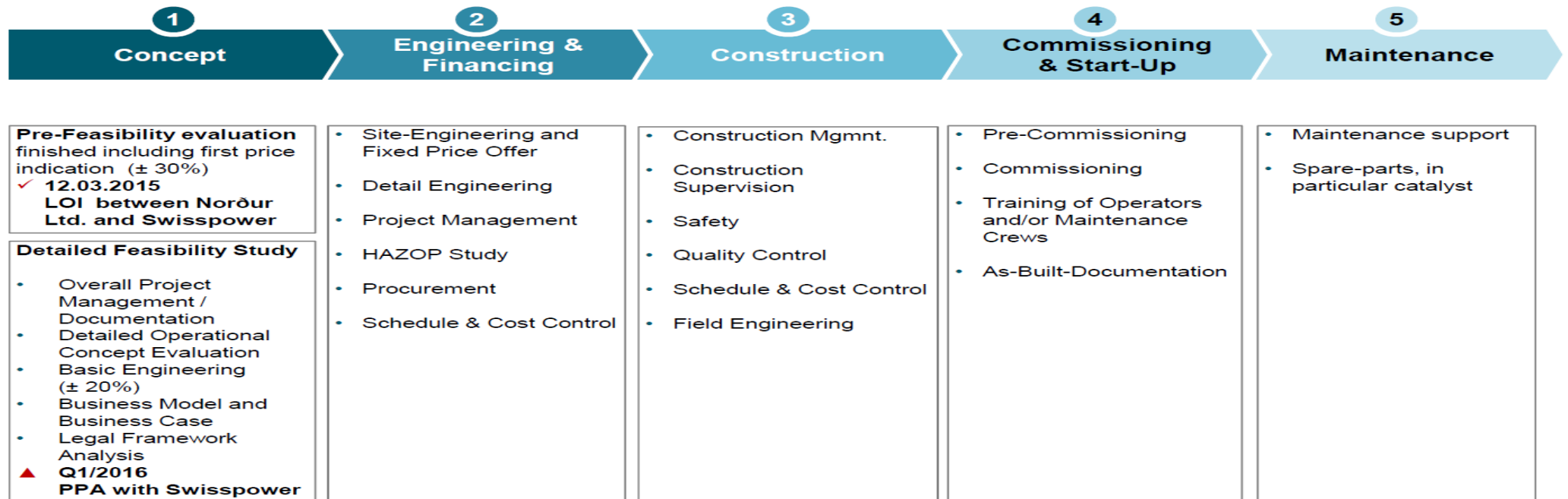


Nordur Power SNG: Power-to-Gas

BASIC ENGINEERING 40 MW PtG

- Nordur Power SNG Roadmap
 - Phase 1 'Proof of Concept': 2015 / 2016
 - Phase 2 Engineering & Financing: 2017 / 2018

Nordur Power P2G / SNG: Roadmap



Nordur Power SNG: Power-to-Gas

BASIC ENGINEERING 40 MW PtG

Basic Engineering & Proof of Concept Study SIPOC-Analysis

Supplier: S1 Reykjavik Energy/ON Power, S2 Etogas, S3 IAV

Input: I1 Location, I2 PPA, I3 CO₂, I4 Water, I5 Heat, I6 HR

Process P2G: P1 Gas purification, P2 Electrolysis, P3 Methanation

Output: O1 H₂, O2 SNG, O3 HSNG, O4 O₂, O5 Heat

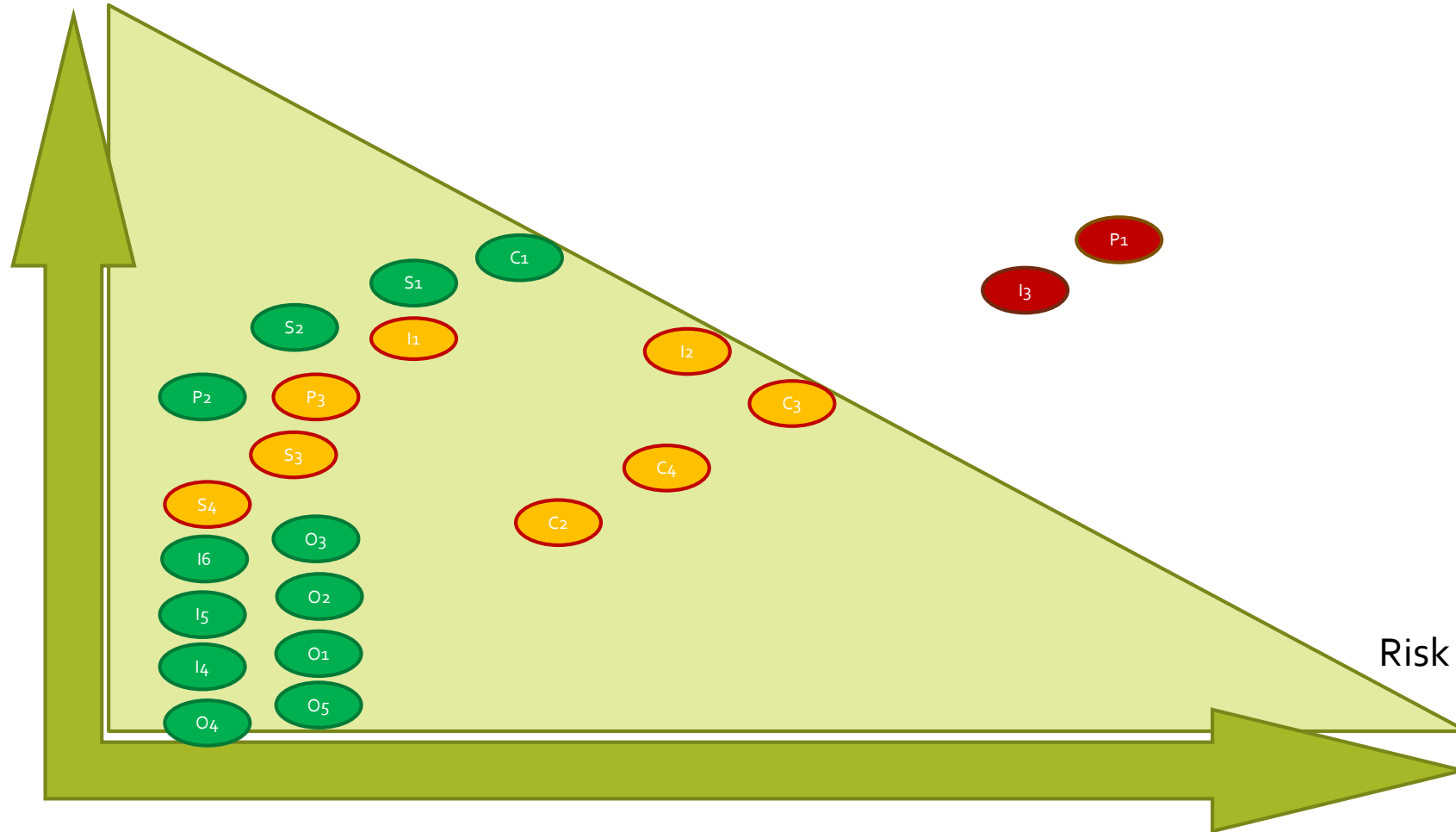
Customer: C1 Erdgas Regio, C2 Swisspower, C3 EU & Iceland & Logistics



Nordur Power SNG: Power-to-Gas

BASIC ENGINEERING 40 MW PtG

Materiality



Level of Assurance

Reasonable (+/- 20 %)

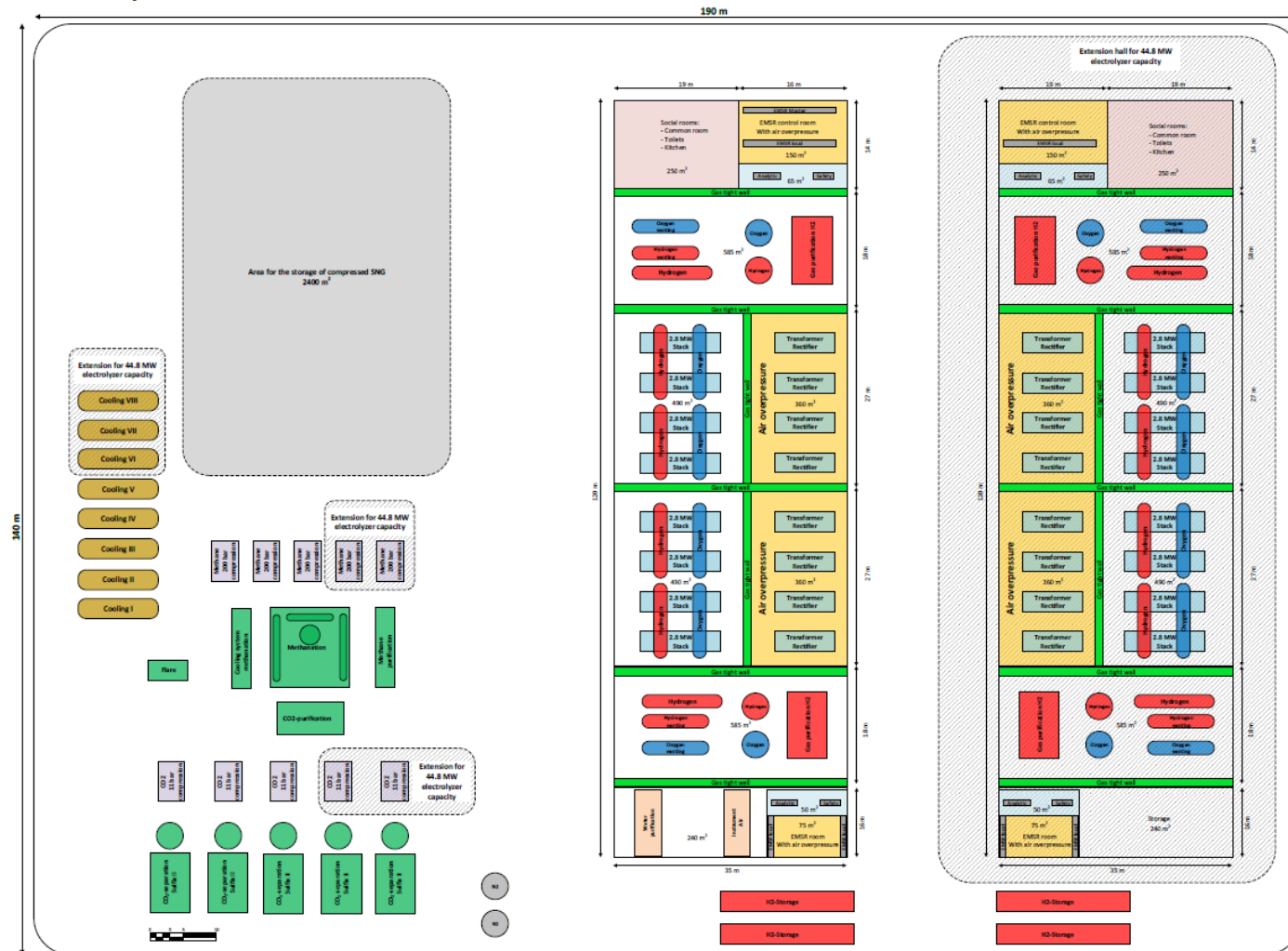
Limited (+/- 30%)

Self Declaration only

Nordur Power SNG: Power-to-Gas

BASIC ENGINEERING 40 MW PtG

Basic Engineering
40 MW PtG PP



Next steps

*Thinking globally –
A basic need of our time*

Thank you for your attention!

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