

Using Biogas in the Production of Liquid Transport Fuels as Hydrogen Source

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Bionova Engineering introduction

Bionova is a clean fuels specialist

Independent consultants since 2001
Expertise in all areas of waste-based
and 1st generation biofuels value chain

We serve industry and public sector

Key markets Finland, Baltics and Russia
Biofuels-related industries, government,
public sector agencies and operators

Consulting and turn-key projects

We do testing, studies and research
We excel in turnkey projects, pilots and
project development

Recent assignments

Find the most efficient
CO₂-reduction tools for a
ministry

Help an oil company to
develop their biofuel
blending strategy

Search for biogas
partners for grid operator

Reduce total transport
harmful consequences
for an European capital

Some of our reference customers

Public sector



Energy efficiency arm
of Ministry of Industry
& Economy



Ministry of Agriculture
and Forestry

City of Vilnius,
Lithuania



Transportation



Itella (formerly
Postal Service)

The bus company of
city of Tampere

The vehicle fleet of
city of Tampere

Industry



World's largest
oil company



Leading biodiesel
and oil refiner



Leading Nordic
contractor



Finnish gas grid
operator

Waste management

Wastewater management

Public sector agencies

Using biogas to produce hydrogen in the production of liquid fuels

- Some challenges
- Using biogas at the oil refinery
- The context and benefits of the solution
- Case study from a Finnish refinery
- Further issues

Some challenges

Situation

Less sulphur in liquid fuels

Europe is pushing low sulphur fuels with tax breaks and standards

CBG is good for environment

Biogas is arguably the best fuel considering CO₂ and harmful emissions balance

Small scale plants flourish

Farm-size biogas plants have broken through in several European countries

Problem

More energy used at refineries

Sulphur down to 10 ppm at EU-15 level would increase CO₂-emissions by 4,6Mt per annum ¹⁾

Parallel infrastructure is issue

Gas fuelling infrastructure and gas vehicle fleets add extra costs and complexity

... in countries with state-subsidized programs,
but are extinct in other countries

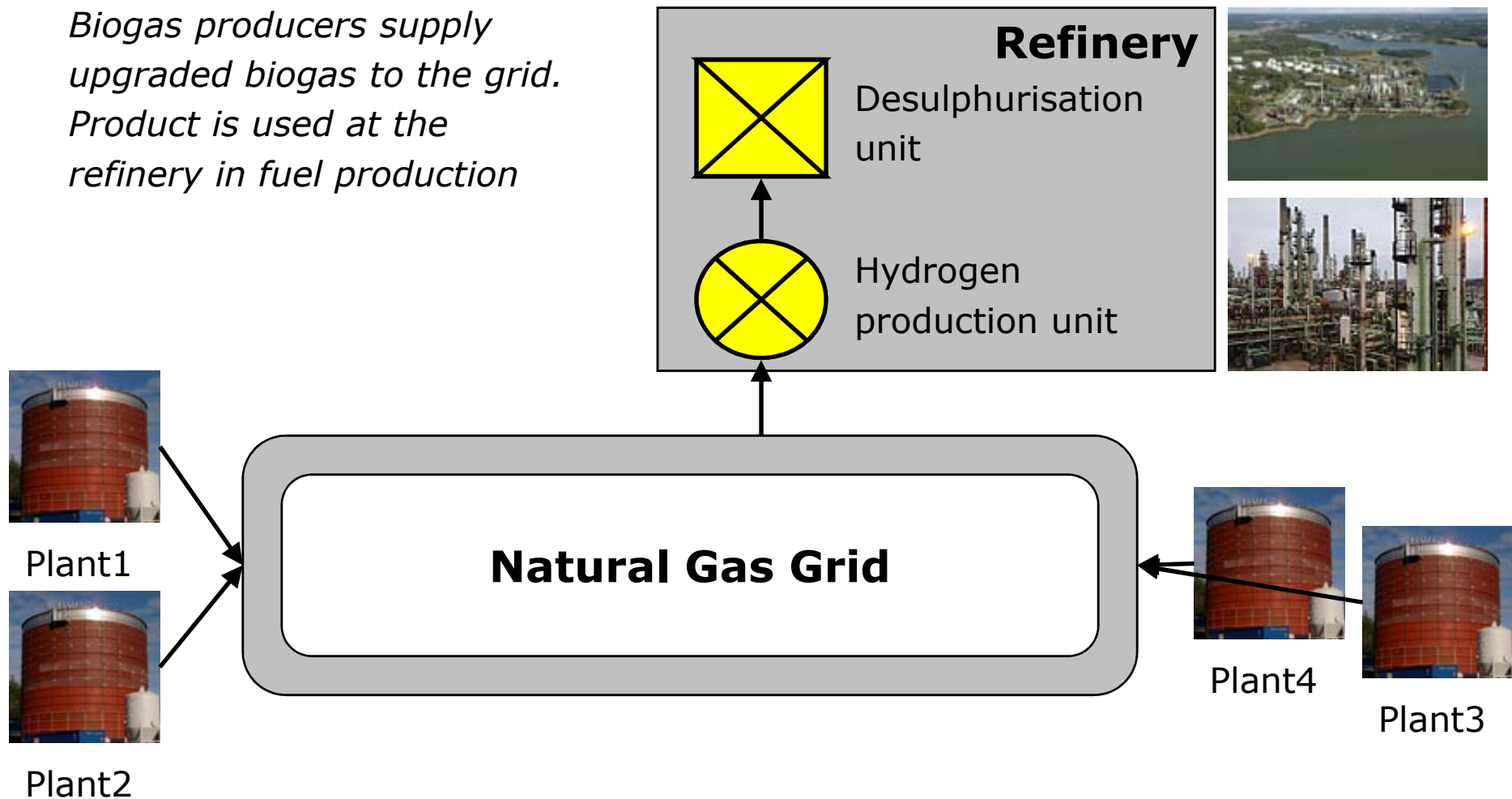
1) Concawe on ULS fuels

Using biogas at an oil refinery

- Modern refineries use substantial amounts of natural gas for amongst others hydrogen production
 - Hydrogen is used for hydrocracking the crude oil to remove sulphides
- The refinery can take upgraded biogas to substitute natural gas 1-to-1
 - The biogas needs to be upgraded and delivered to the grid
 - Gas is used by the oil refinery on a equal volume book-keeping basis
- (Small) biogas producers can sell their product to an oil refinery via long-term agreements (10-20 years)
 - This enables investment viability even without long-term governmental committment to support the industry
- Overall infrastructure costs are significantly reduced for biogas use
 - No expensive bi-fuel cars or filling stations are required

Using biogas at refinery- illustration

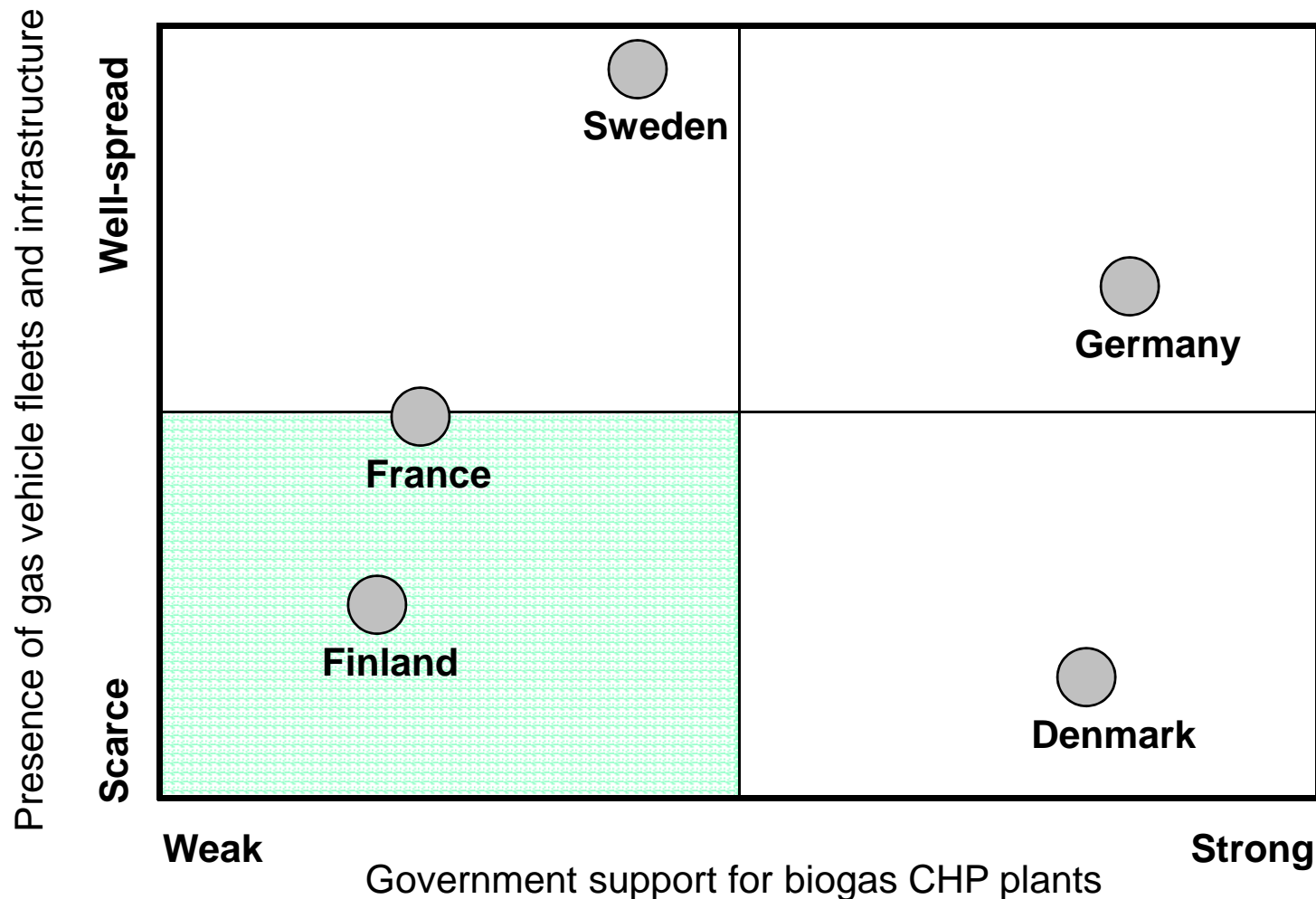
Biogas producers supply upgraded biogas to the grid. Product is used at the refinery in fuel production



Images: Bionova Engineering, Neste Oil

The context – when is this suitable?

Pre-condition: well-developed gas grid must exist



Benefits of the solution

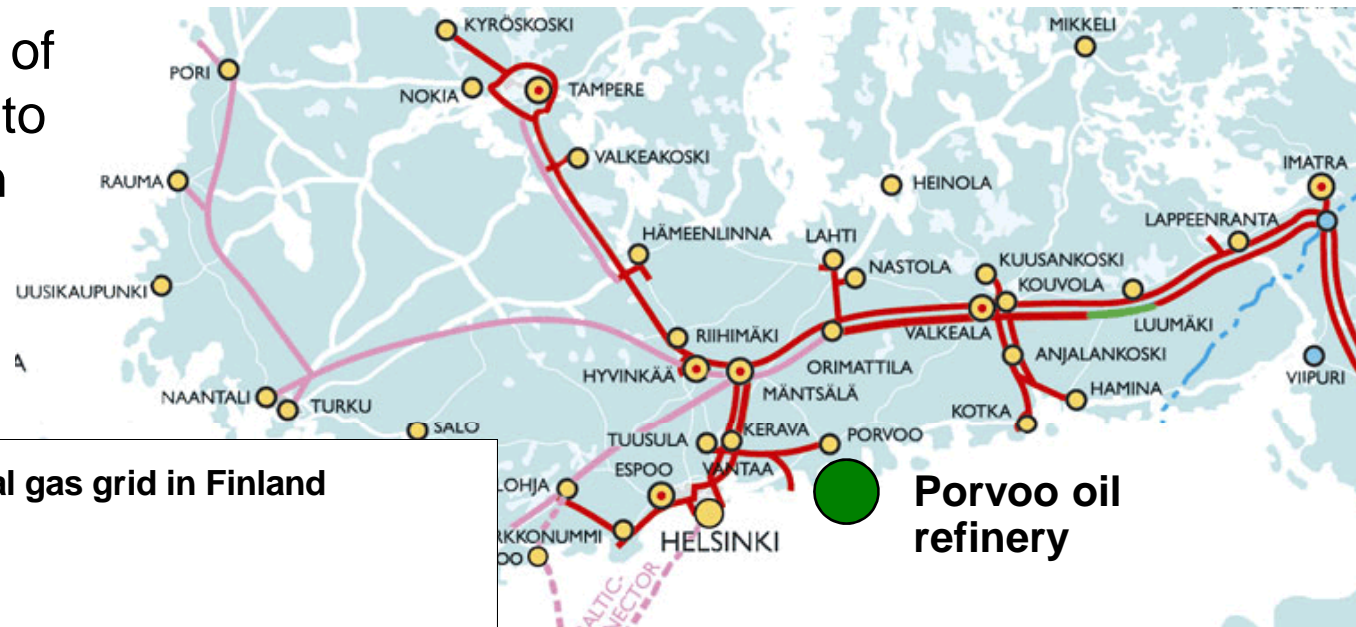
- Reduced investment – comparable investment in medium size plant
 - CHP production scenario : CAPEX 100
 - Gas pumped to grid scenario: CAPEX 140
 - Gas upgraded and tanked: CAPEX 205
 - This does not consider the higher cost of actual vehicles

- Additional benefits:
 - Energy industry is governed by Kyoto Protocol and may utilise the biogas for acquiring additional quotas, unlike farming industry
 - The biogas may be additional biocomponent towards commission targets
 - The biogas does not need to be "pure" – it needs to be as good as the natural gas in the country/area in question

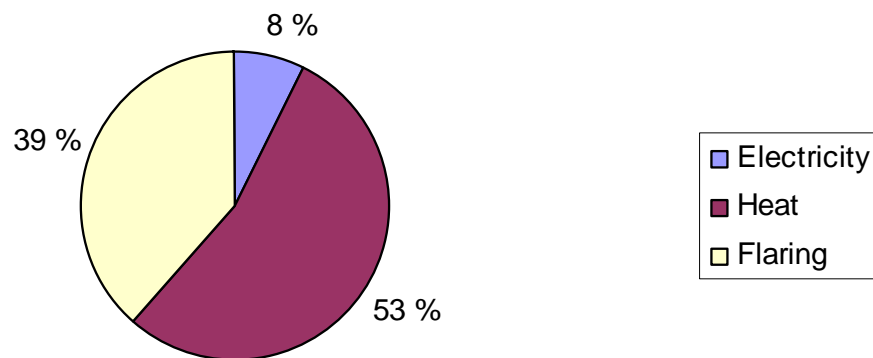
- The refinery can offer a competitive price for the refined biogas, depending on the final political handling of the "bio-component"

Case study: Finnish Refinery 1/2

Current production of (raw) biogas close to grid is ca 95 million Nm³ p.a. Potential for more exists



Use of biogas within natural gas grid in Finland



Natural gas consumption at the refinery is ca 900 million Nm³ per annum (20% of Finnish total use)

With the kind permission of our partner

Case study: Finnish Refinery 2/2

- Bionova Engineering completed a study at the request of its partner to determine the profitability and opportunity size for biogas upgrading
- Key findings:
 - Selling to gas grid can be profitable starting at 1MNm³ upgraded gas p.a.
 - At large scale (3MNm³) the selling to gas grid can become actually so effective that it is better to switch from existing CHP equipment
 - Besides existing plants, several new plants could be created for supplying the upgraded biogas to the grid
- Most recent status:
 - Since completion of this study, Finnish government has announced plans to allocate a subsidy for biogas CHP. Plan is in under finalisation now.

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Further issues

- To set up a gas grid ecosystem several steps are needed
- Build up a cooperation framework contract allowing anyone to build the plants and plug into the gas grid
- Ensure stability of the political environment
 - see CHP subsidy in Finland
- Ensure the use of biogas in production is recognized as biofuel contribution by the policymakers



**Thank you for your
attention!**

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