



RENEW

Renewable Fuels for Advanced Powertrains
IP-502705

The Chemrec BLGMF Process (Black Liquor Gasification to Motor Fuels) Status, Progress and Future Prospects

Ingvar Landälv, VP Technology, Chemrec AB

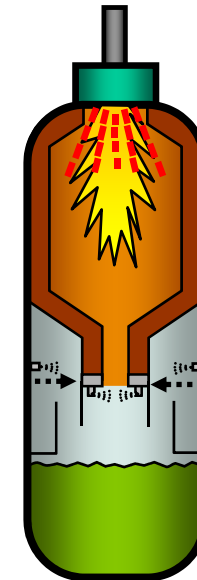
Project supported by European Commission under FP6

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Black liquor Uniquely Suitable for Gasification



- **Liquid**
 - *Easy to feed to a pressurized gasifier*
 - *Can be atomized to fine droplets*
 - *Rapid gasification rates*
- **Highly reactive (high Na/K content)**
 - *Full carbon conversion at ~1000 deg C*
 - *No tar formation*
 - *Low methane formation*
- **Available in large quantities**
 - *About 270 MW of black liquor is generated at an average sized pulp mill (~ 400 000 tons of pulp per year)*





STATUS CHEMREC'S DEVELOPMENT PLANT DP-1

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Development Plant in Piteå



2004
Ordering critical components June
Financing completed Sept
Start of mechanical erection Oct

2005
Mechanical completion May
Commissioning May-Sept
Start of operation Sept 30
Test runs & debugging Oct-Dec

2006
Test runs & debugging Jan-Mar
Burner optimization Apr-May
Longest run 13 days Sept

2007
Longest run 22 days Aug

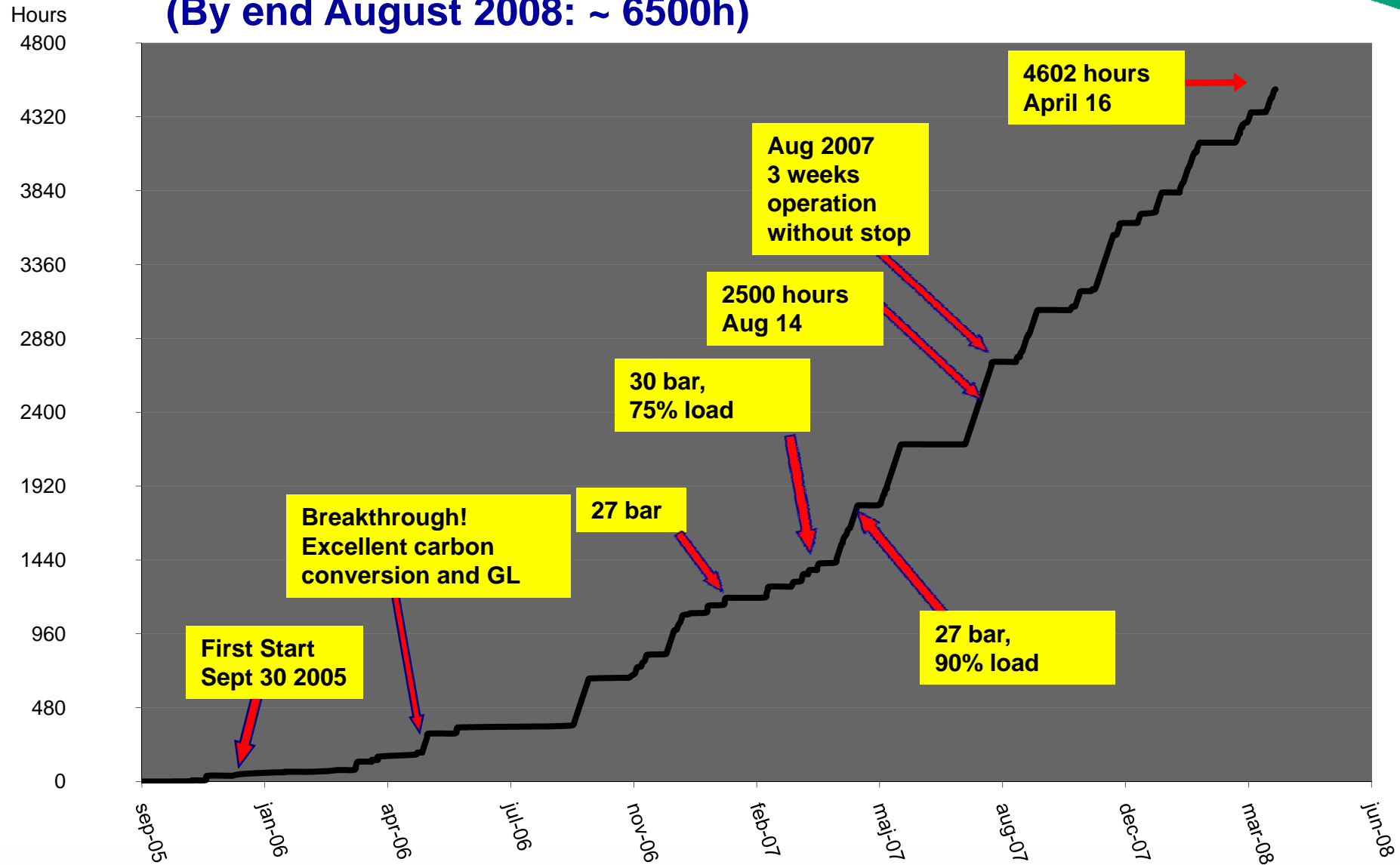
2008
Start Continuous operation with 5 shifts May

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DP-1 Accumulated Operating Hours



(By end August 2008: ~ 6500h)





THE BioDME PROJECT WITHIN FP 7

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Overall Scope and Objective

Demonstration of an environmentally optimised future bio-fuel for road transport covering the full chain from production of fuel from biomass to the utilisation in vehicles

Starting date:	1 September 2008
Total budget:	28.4 M€
Duration:	48 months
EU funding:	8.2 M€
Coordinator:	AB Volvo

BioDME Consortium



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DELPHI

ETC

HALDOR TOPSOE



CATALYSING YOUR BUSINESS

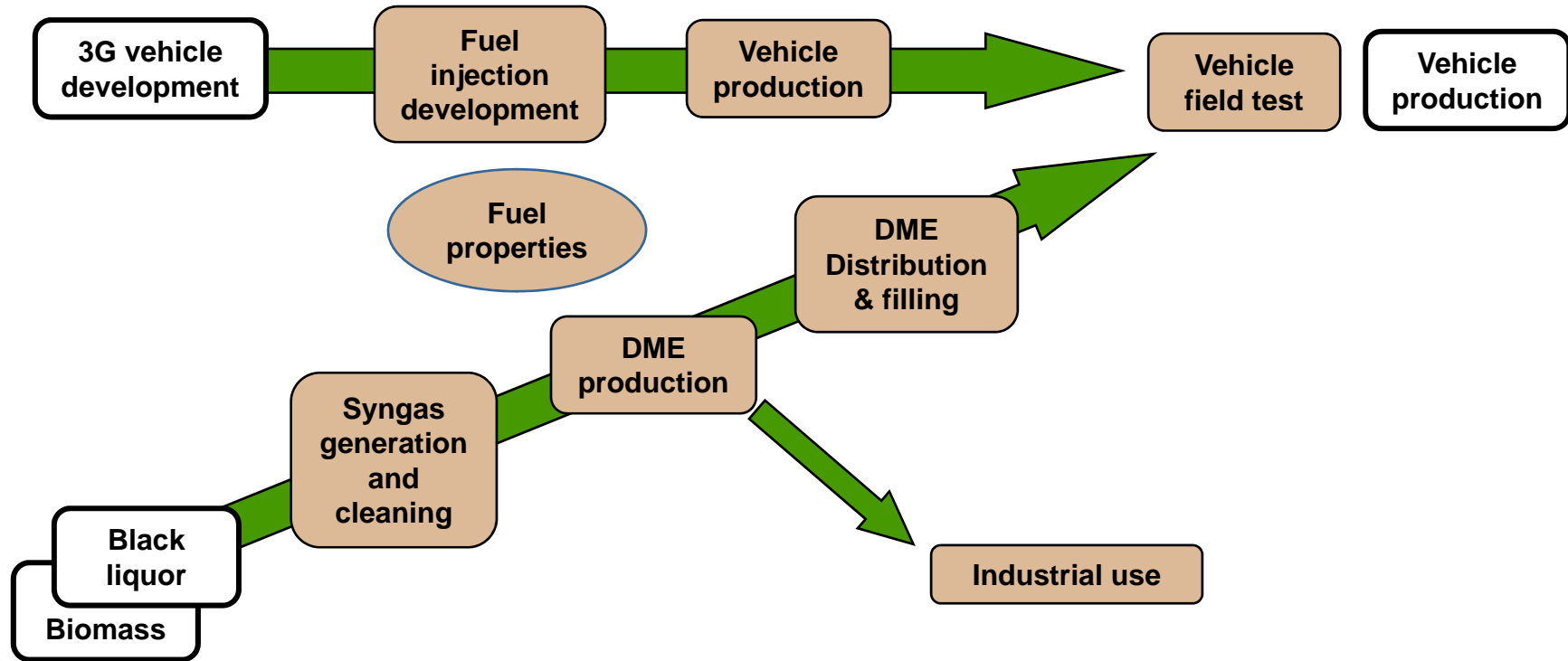


VOLVO

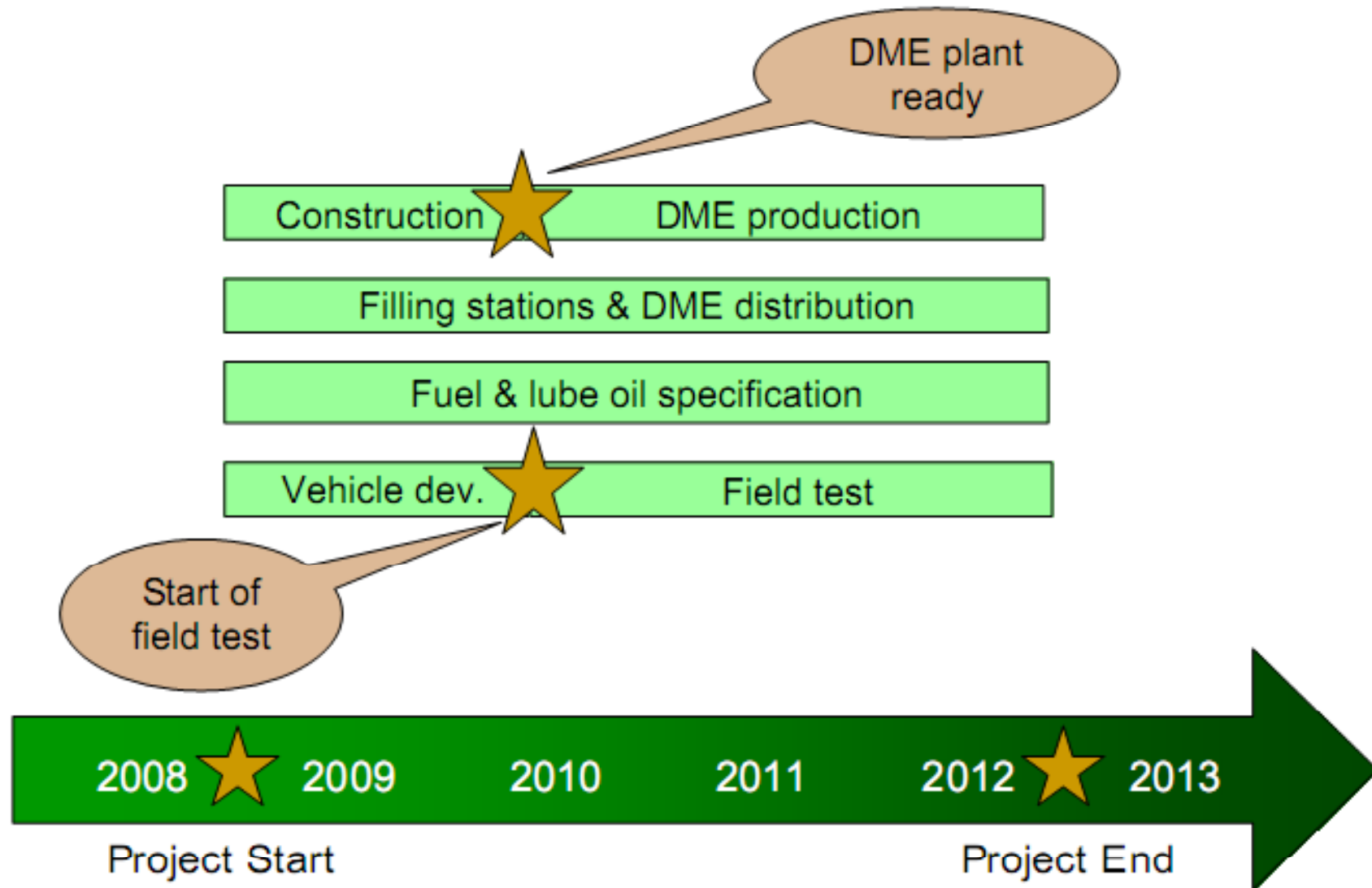
TOTAL

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Overall Scope



BioDME Project Time Schedule

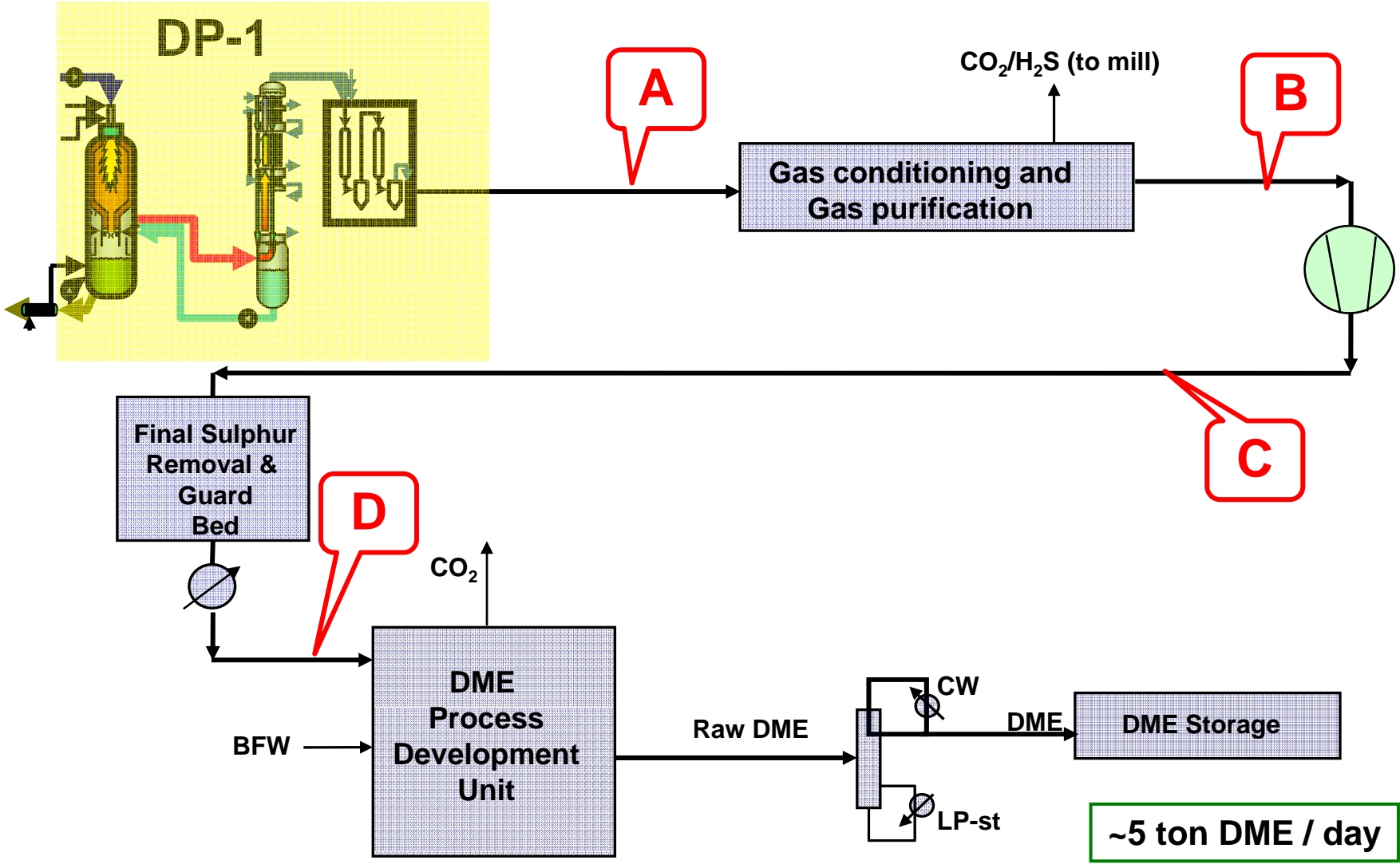


Overall Work Scope of BioDME

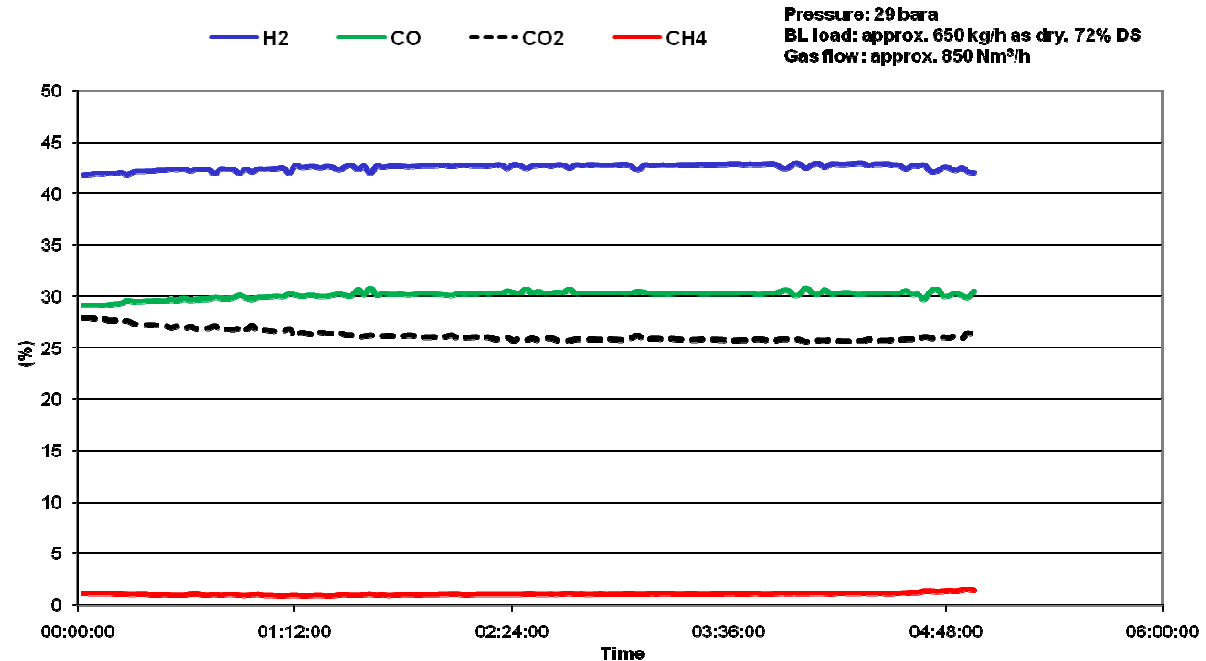


WP	Work Page (WP) Topics	Responsible partner
1	Basic engineering of process plant	Chemrec
2	Development and EPC of new process plants	Chemrec
3	Production of DME	Chemrec
4	Fuel distribution	Preem
5	Fuel and lube oil specification	Total
6	Fuel injection equipment	Delfi
7	Vehicle procurement	Volvo
8	Vehicle field test	Volvo
9	Industrial use of DME	Chemrec
10	Evaluation and Dissemination	All
11	Project management	Volvo
12	Experiments and sampling in BioDME plant	ETC

BioDME Pilot downstream Chemrec's DP-1 plant



Raw Syngas Quality



- **50-70 ppm benzene**
- **< 5ppm naphthalene**
- **Zero or close to zero higher tars**
- **Very little fouling in heat exchangers**
- **Particulates "non-detectable"**

Gas Conditioning and Cleaning in the BioDME Project



Point	Variable	To be accomplished	Comment
B	Gas composition	H ₂ /CO adjustment ~ 2% CO ₂ < 30 ppm sulphur components	Main cleaning
C	Gas pressure	> 100 bar	
D	Gas composition	< 0.1 ppm sulphur	Final polish

Overall Work Schedule for the BioDME Pilot



Work Package	Description	Time
WP1	Basic Engineering Cost estimate Permitting	Sept. 2008 – Feb. 2009
WP2	Engineering Procurement Construction Commissioning	March 2009 – Feb. 2010
WP3	Operation	March 2010 – Aug. 2012

Illustration of the BioDME pilot



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THE BLGMF CONCEPT IN AN INTERNATIONAL COMPARISON

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Well to Wheel GHG versus total energy use

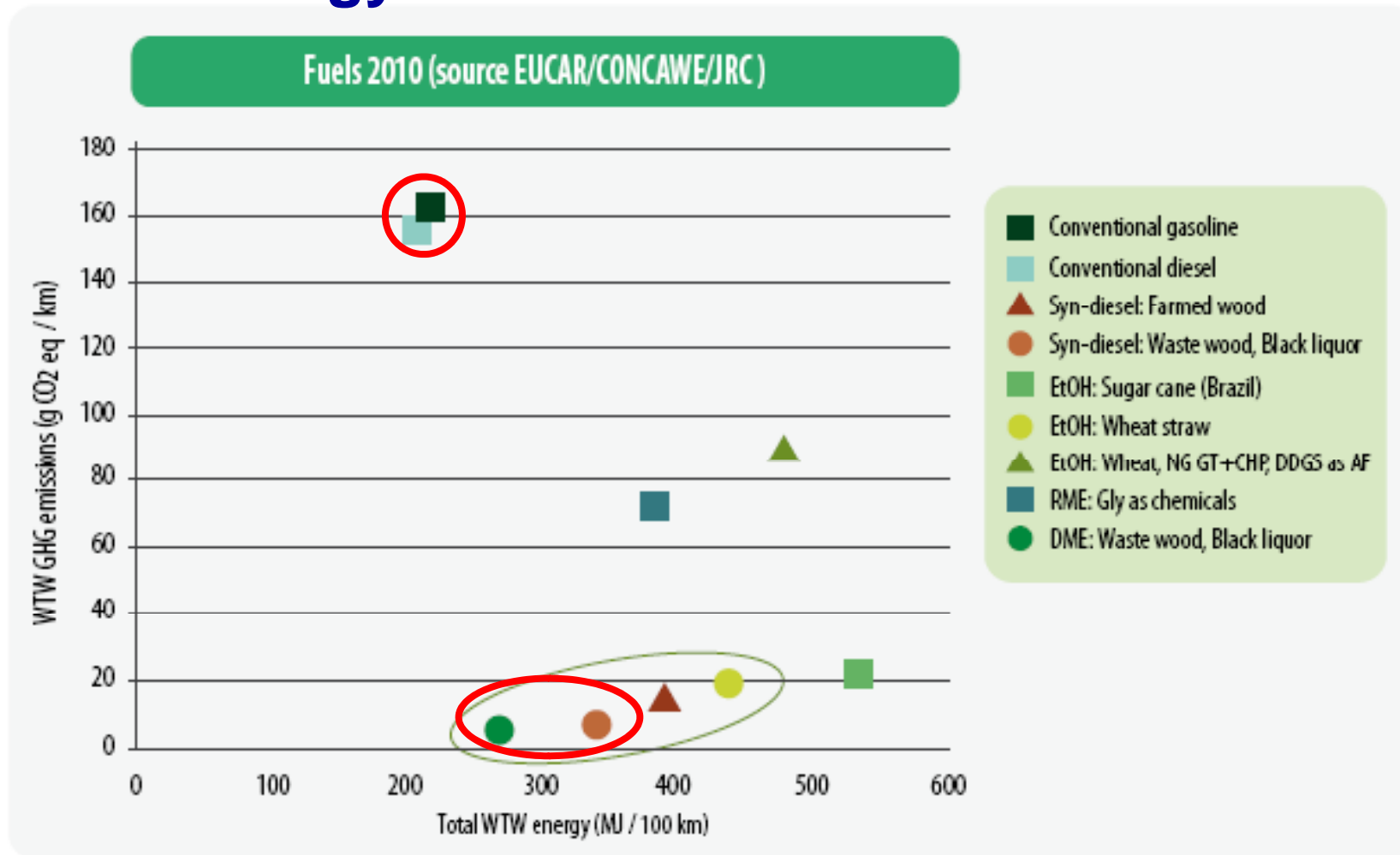


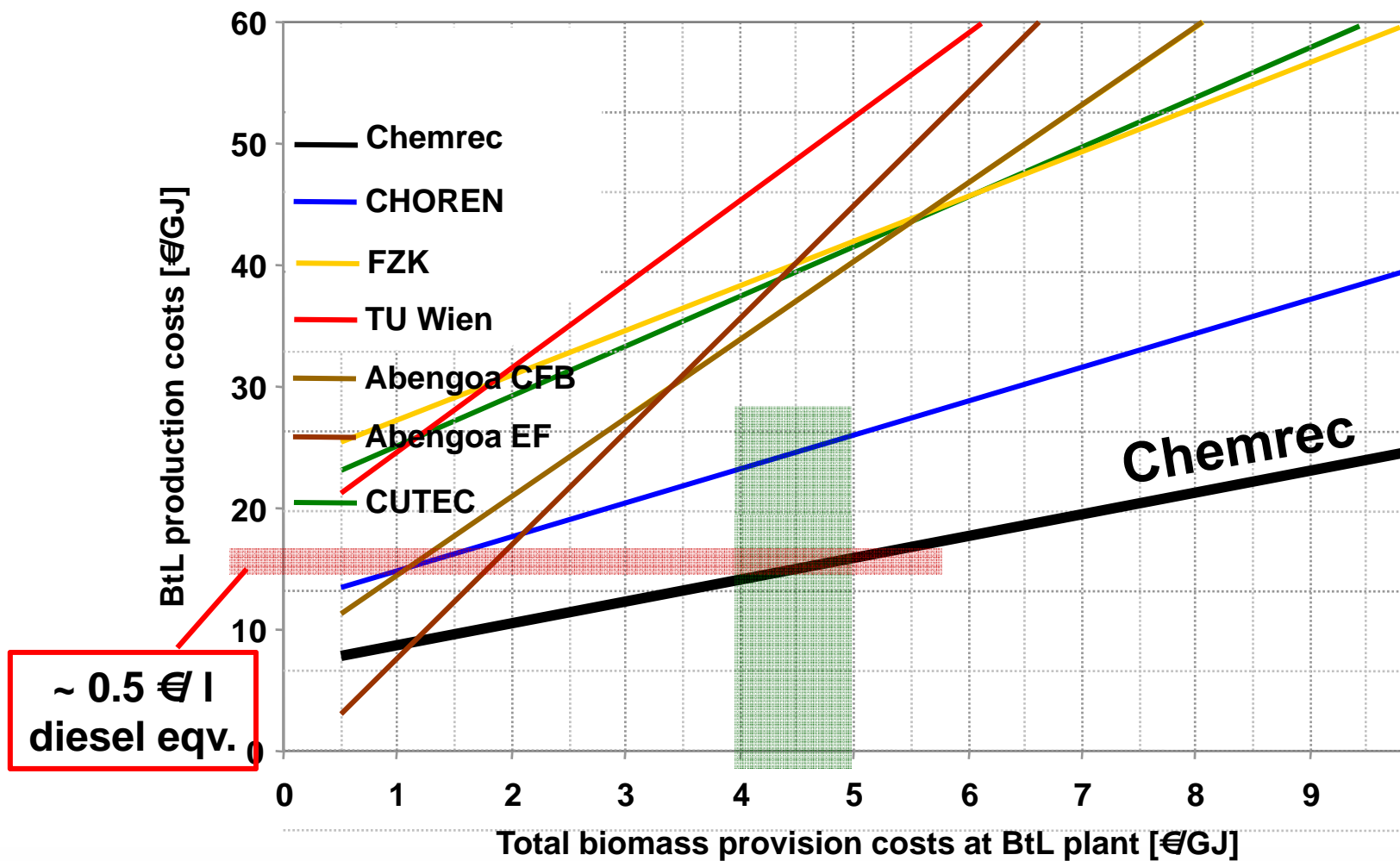
Figure 1.5. Well-to-wheel greenhouse gas emissions (in CO₂-equivalents/km) versus total energy use for running a mid-size car over a distance of 100 km

Source: European Biofuels Technology Platform, Jan 2008

Biofuels Production Cost as function of Biomass Price

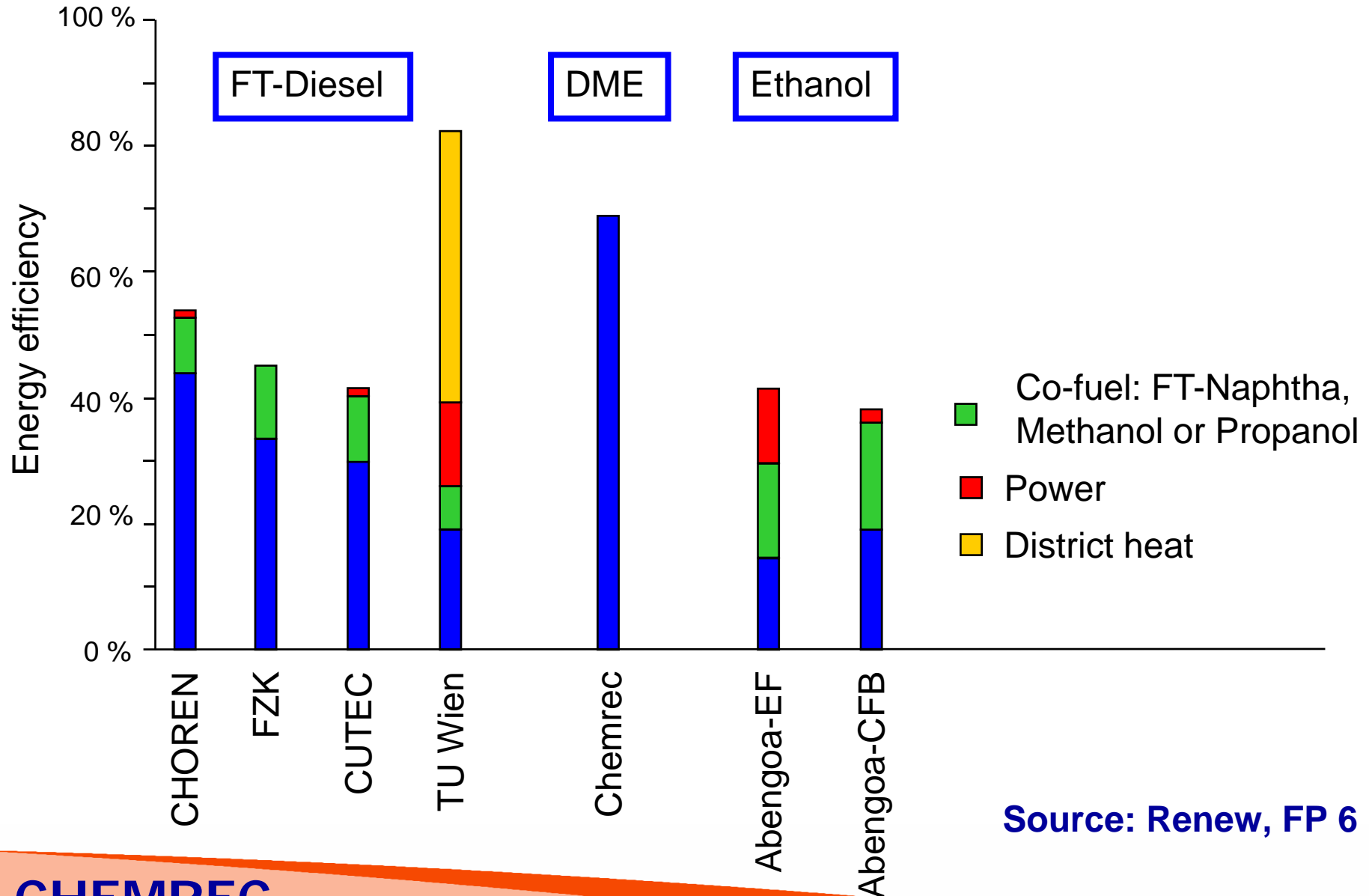


Source: Renew, FP 6



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Energy Efficiency for different Conversion Routes



Source: Renew, FP 6

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The Princeton Study

Dec. 2006



A Cost-Benefit Assessment of Gasification-Based Biorefining in the Kraft Pulp and Paper Industry

Volume 1 Main Report

FINAL REPORT

Under contract DE-FC26-04NT42260 with the U.S. Department of Energy
and with cost-sharing by the American Forest and Paper Association

21 December 2006

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Effective Capital Investment Intensity

\$(/bbl per day) vs bbl per day diesel equiv.

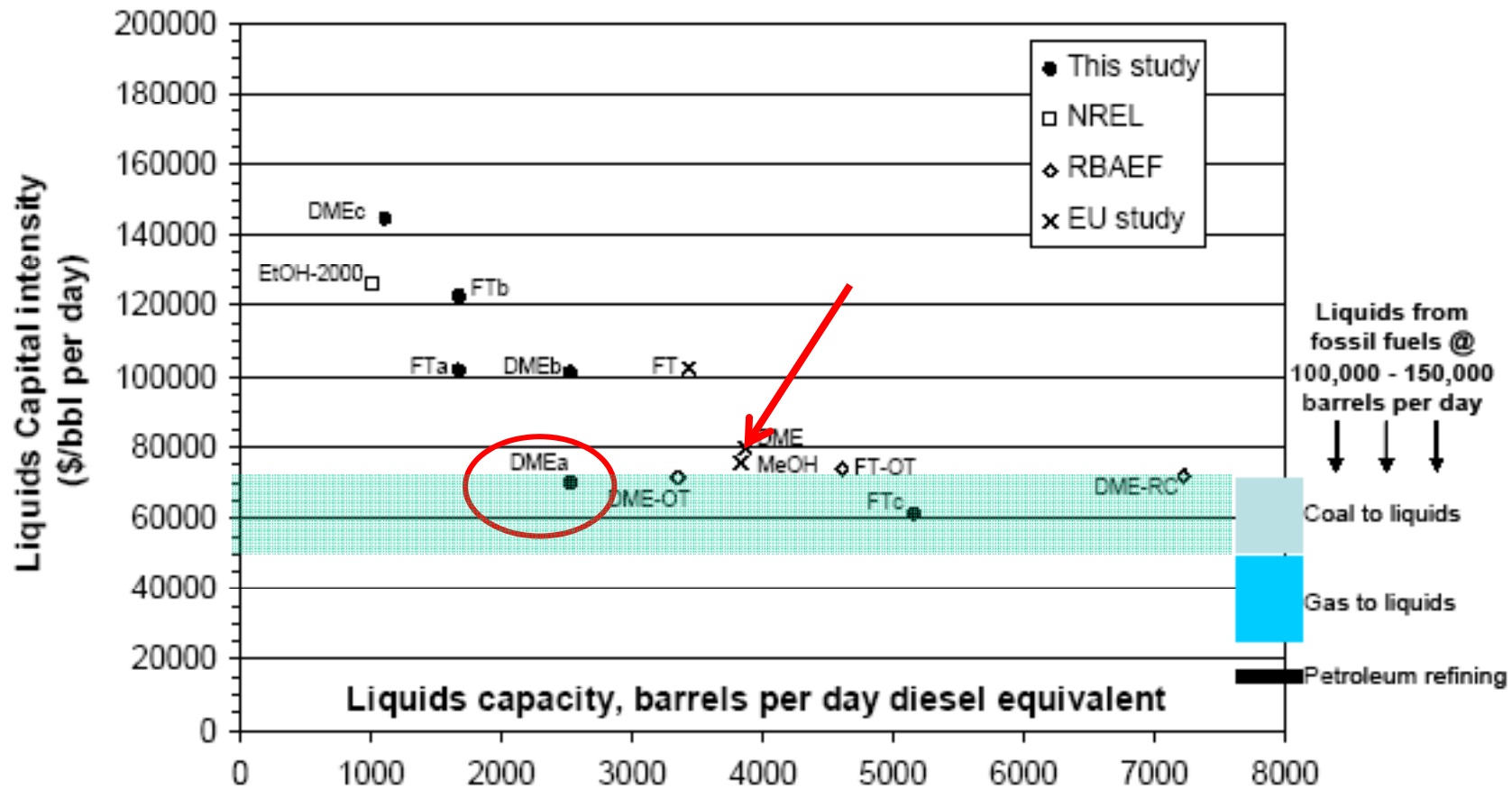


Figure 44. Effective capital investment intensity (2005\$ per barrel diesel-equivalent per day) for liquid fuels production as a function of liquids production capacity. See text for assumptions.

Source: Princeton University



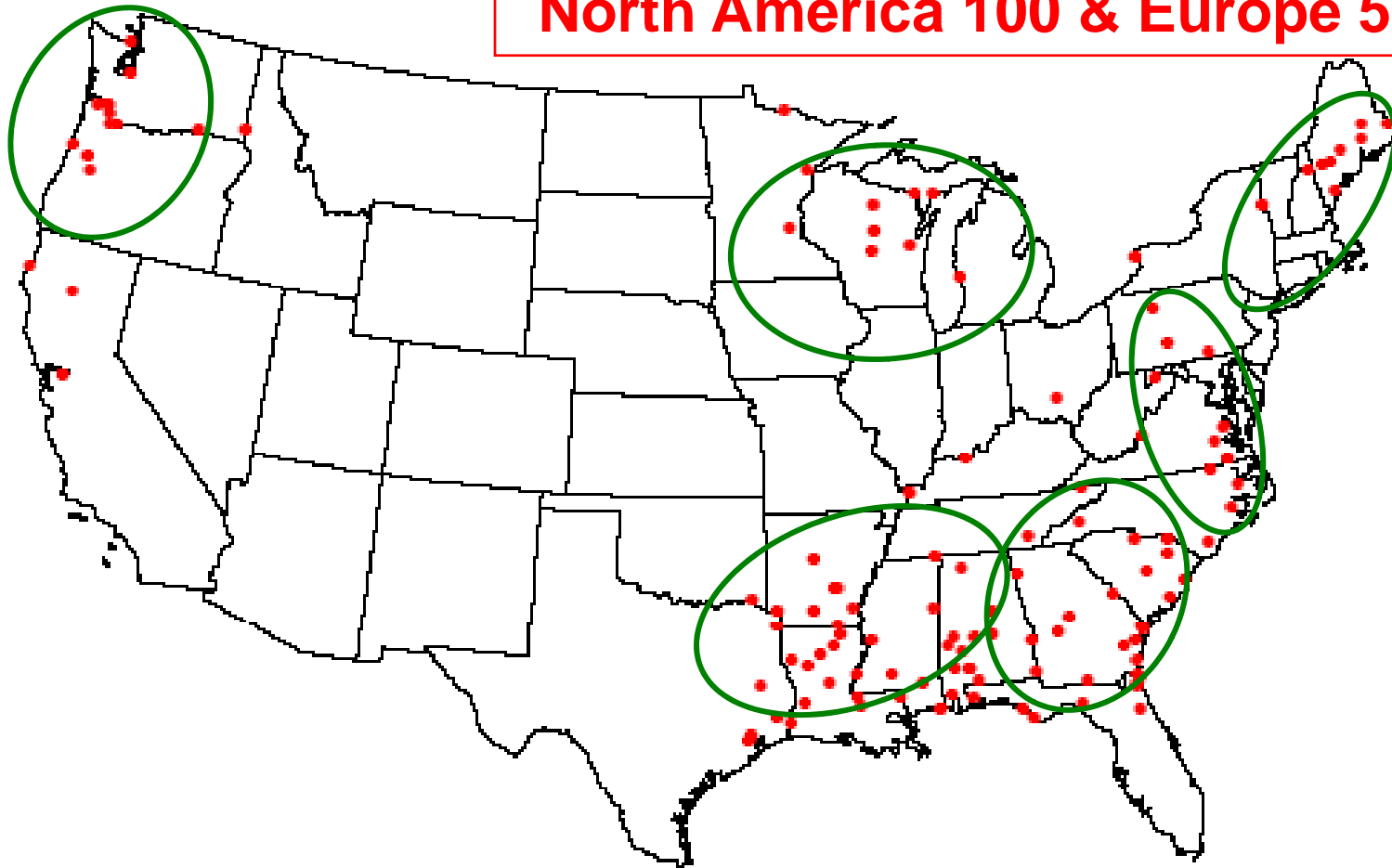
MARKET ILLUSTRATION

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Location of US Pulp Mills.



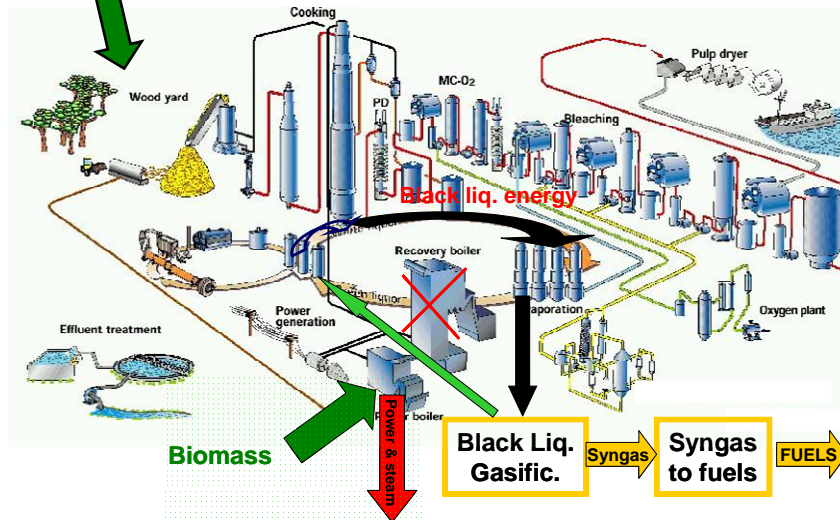
Potential number of large plants:
North America 100 & Europe 50



Impact of an average sized pulp mill converted to a Biorefinery



Pulp Wood



Pulp
400 000 t pulp / y

Renewable Fuels
115 000 t of
Diesel/gasoline
Equivalents *)

Renewable waste streams

Biomass Corresponding to
350 000 t dry biomass / y



Enough for
3000 – 4500
Heavy Duty
Vehicles

*) As DME or Methanol

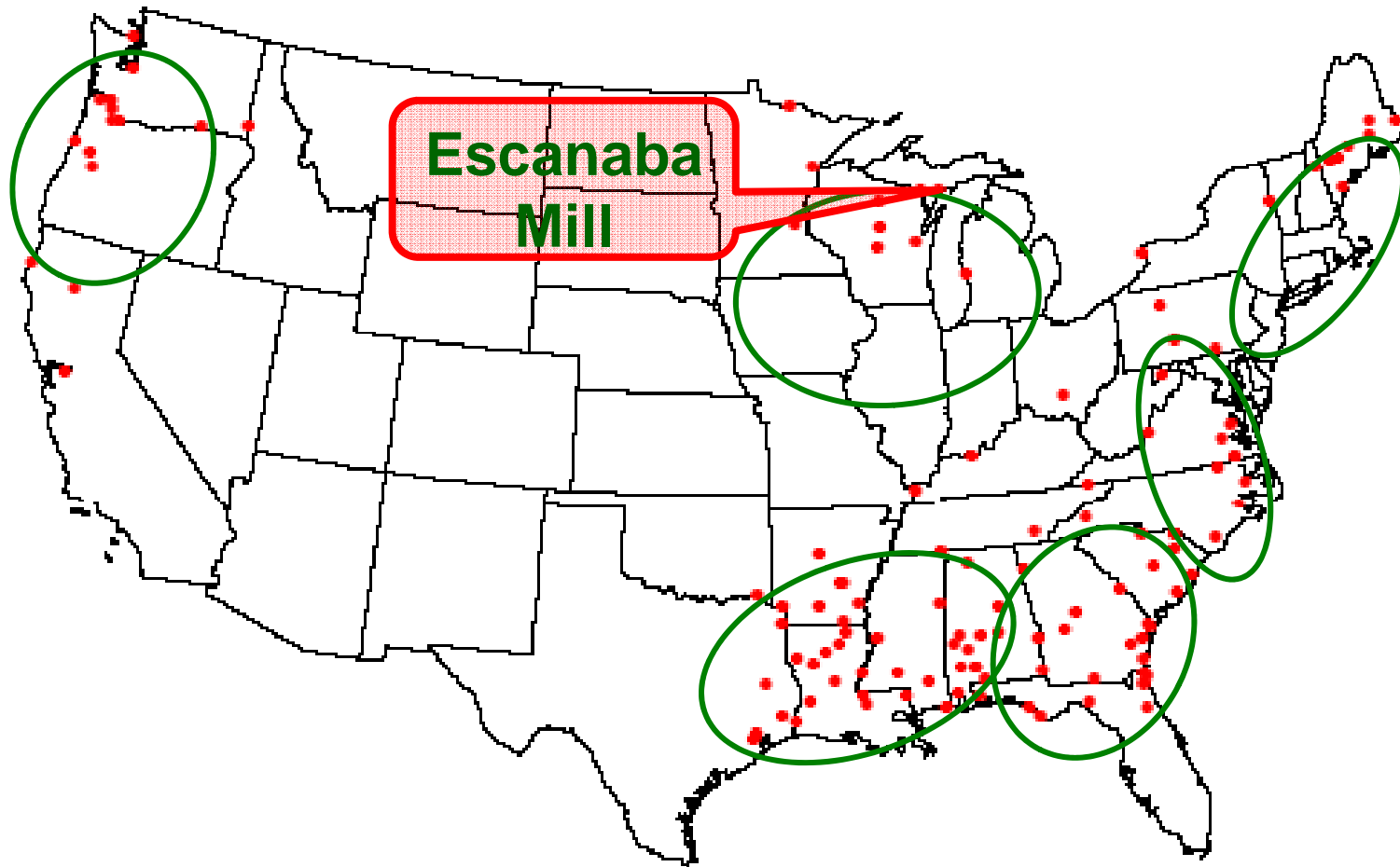


NEXT STEP

DEMONSTRATIONS

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Location of the NewPage Escanaba Mill



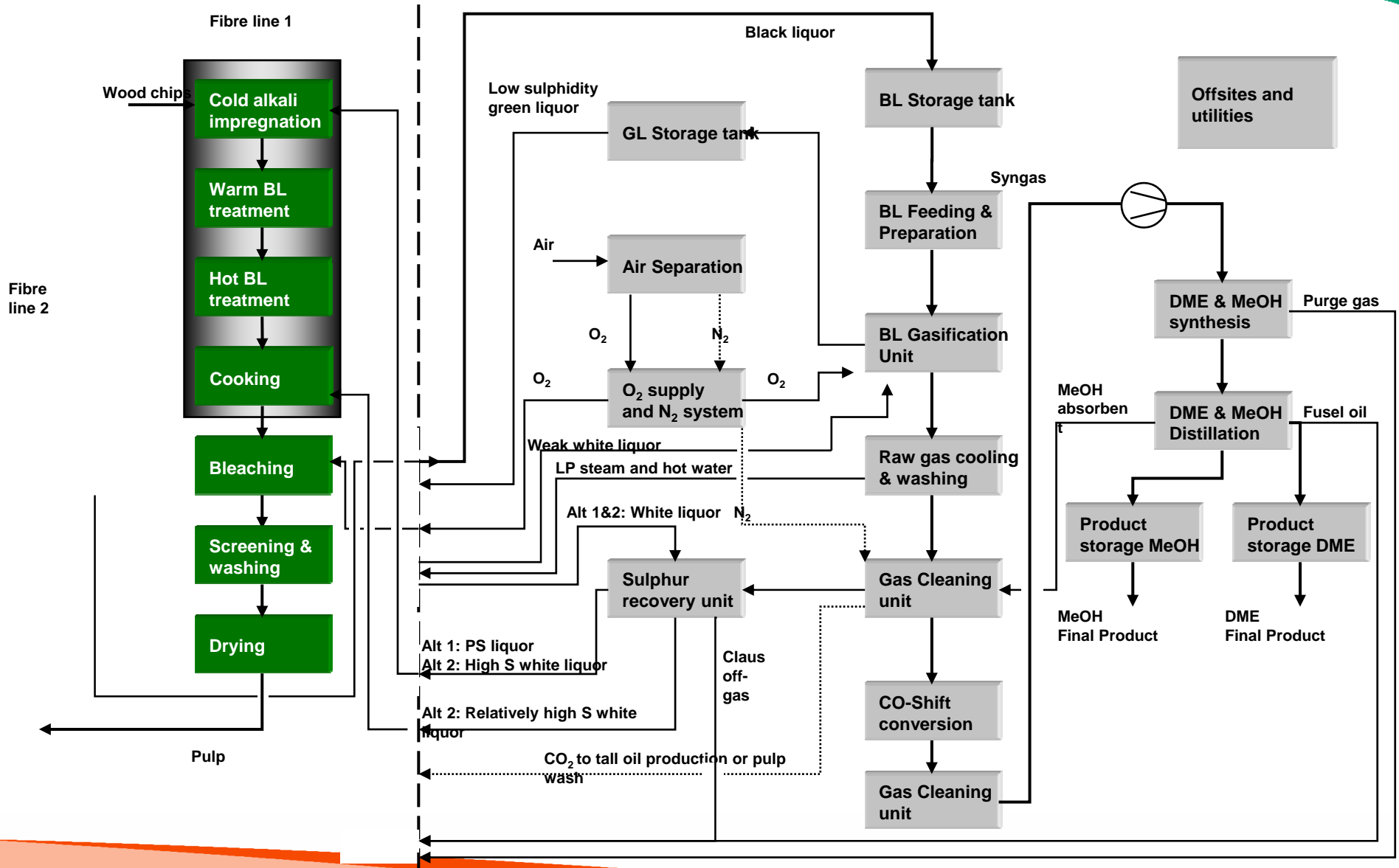
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NewPage - Escanaba Mill Location for US Demonstration

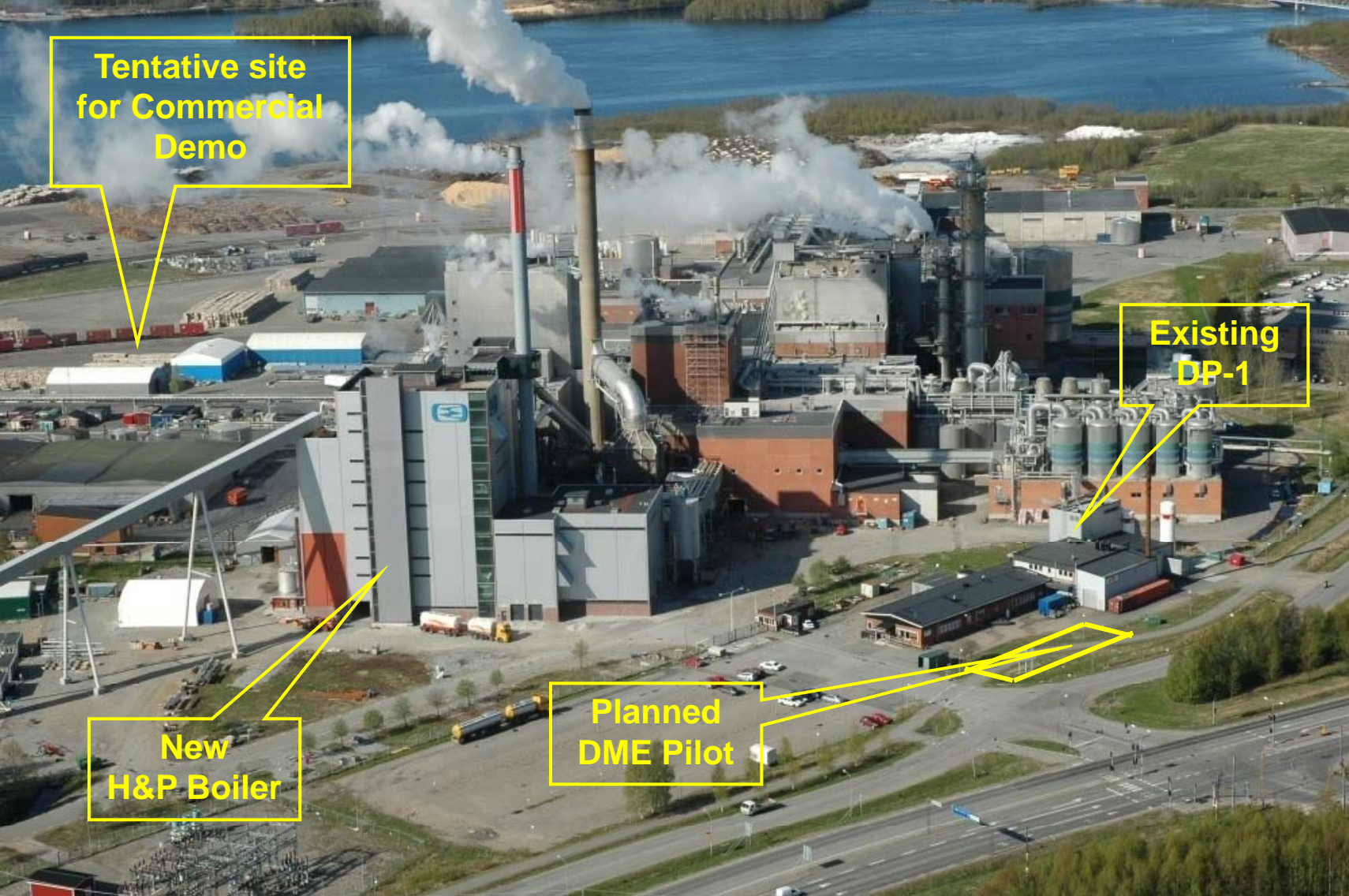


- **Most cost-effective and productive mill in NewPage system**
- **High quality Kraft and RMP mill”**
- **Significant operating leverage (over 760,000 tons/year)**
- **Supports a broad range of grade mix (freesheet and groundwood)**
- **1,140 employees**
- **\$74 million annual payroll**
- **\$20 plus million annual capital outlay**
- **\$5.2 million state & local taxes**

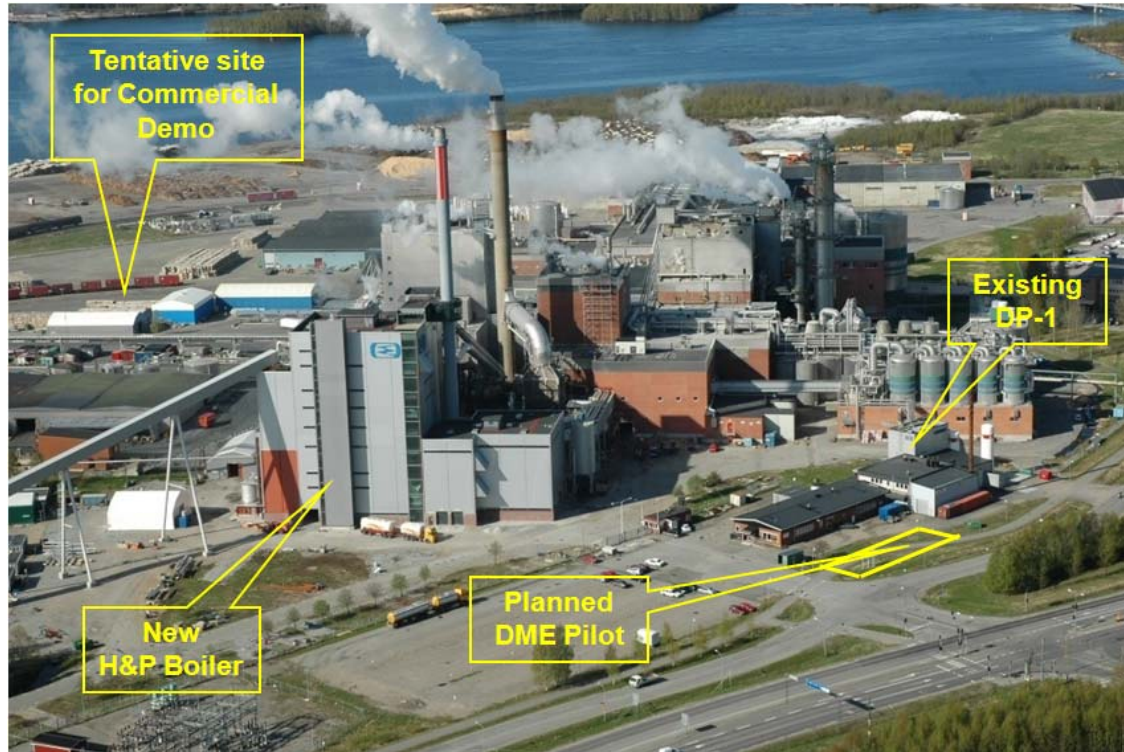
BLGMF Plant Block Flow Diagram



Smurfit Kappa, Piteå. Site for BioDME Pilot. Tentative site for Swedish Demo.



Smurfit Kappa, Piteå. Site for BioDME Pilot. Tentative site for Swedish Demo.



STATUS:

- Prefisibility study completed April 08
- Partners have agreed to continue work without delay

THANK YOU!