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The 22nd International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium

Well-to-Wheel Visualization

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 - www.optiresource.org for further information
- Optiresource Foundation

Motivation of an OEM for alternative drivetrains

- Individual mobility and efficient transport are an important basis of modern society and economy
- An affordable, reliable and environmentally benign long term fuel supply is a prerequisite for unrestricted mobility

Driving Forces

- Effective global reduction of CO₂ Emissions
- Securing of Energy Supply by Reducing the Dependence on Oil Imports from Politically Unstable Regions
- Reduction of the Consumption of Fossil Fuels, and
- Need for Cleaner Fuels to Support Emission Reductions

Elements of a hydrogen supply infrastructure

Primary Energy

- Crude Oil
- Natural gas
- Coal
- Uranium
- Solar
- Wind
- Hydro
- Geothermal
- Biomass
- Waste

Production

- Reforming
- Gasification
- Electrolysis
- HT-Splitting
- Thermo-Solar
- Solar direct
- Central
- On site

Distribution

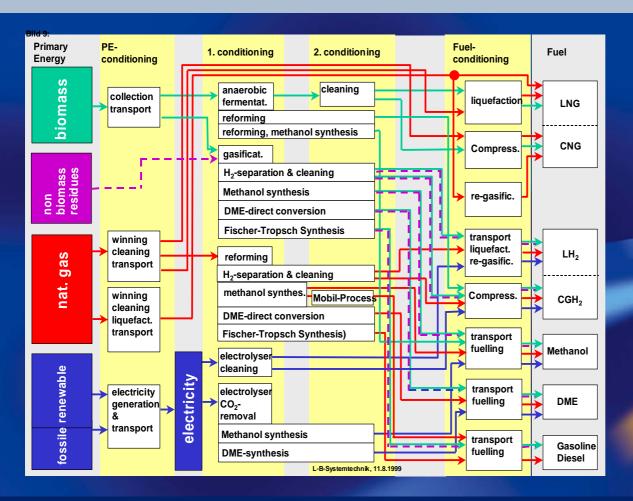
Conditioning

- Compression
- Liquification
- Synthesis

Transport

- Pipeline
- Truck
- Ship

Well-to-Wheel parameters and data origin

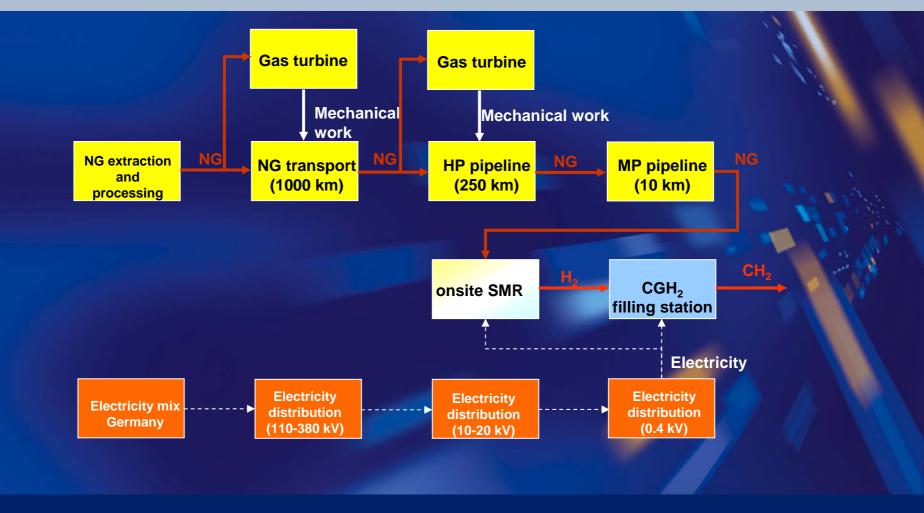


Basic WtW data (for EU) have been researched by CONCAVE/EUCAR/JRC and are widely accepted,

...but high complexity affords detailed knowledge of correlations and processes as well as powerful calculation methods (e.g. E3database from LBST).

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Example for a H₂-supply chain: CH2 from on site reforming of natural gas



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Present WtW studies

VOLUME 1

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XECUTIVE SUMMARY REP

Wellson Wheel Energy Use and

http://www.transportation.anl.gov **GM WtW North America**

A CONTRACTOR

June 2001

http://www.lbst.de/gm-wtw

ENERGY USE JUD GAS WILL

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FUE

USE GAS E VERICE SYSTEM

TOTAL FINA ELF

GM WtW Europe

http://ies.jrc.cec.eu.int **CONCAWE/EUCAR/JRC**

FUTURE AUTOMOTIVE ANALYSIS OF POWERTRAINS OF AND

1 THE EUROPEAN CONTEXT

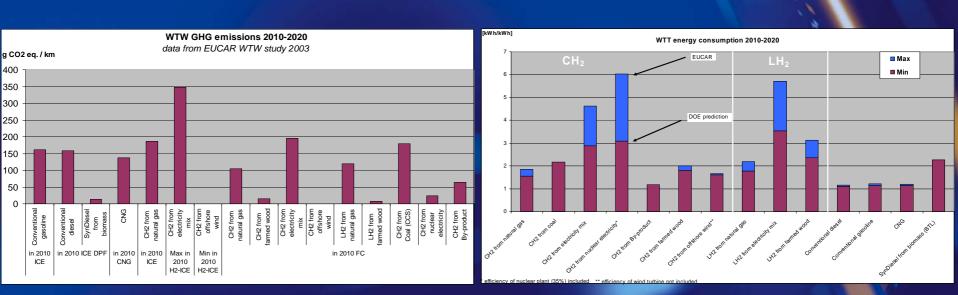
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WELL-to-WHIELS Report Version 10 January 2004

Sample of actual WtW data visualization



Premises are difficult to show, data are difficult to compare, add and sort. No interactivity and difficult replication.

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Criteria to define a vehicle development strategy

Energy Consumption
 CO2 emissions
 Fossile fuel consumption

First 3 criteria to be considered in Optiresource

Investment, cost

- Marketshare, market
- Performances
- PM, NOx, HC emissions
- Grey energy
- Recycling

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Basic specifications of OPTIRESOURCE software

- Interactive and easy-to-use SW to get quick and clear answers to many questions:
 - how do different energy chains compare in terms of energy consumption, GHG emissions etc.?
 - what are the chains allowing for the optimization of the consumptions and emissions?
 - what is the impact of different energy scenarios?
 - and many others.....

Interactive software & database are stored in a USB key

- SW only needs Windows 2000/XP with MS ".net Framework"
- SW is designed as a modular and scalable system. The same data-base has different "modes" and different user interfaces
- In the current version 2 "modes" and 3 user interfaces are implemented

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Implementation of OPTIRESOURCE software

"Modes"

- "Query mode": the user selects the chains according certain criteria and then the results are visualized (more than 500 chains available)
- "Scenario Mode": the users defines scenarios in terms of energy supply and energy demand and then visualize and compare them (available starting from January 2007)

User interfaces

- User interfaces:
 - "For Experts"
 - "For All Users"
 - "For Exhibitions"

Example for WtT results: Energy consumption and GHG-emissions for H₂production from various primary energy sources

		Prima	ary energy	Process		Fuel	P	owertrain		
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EGION	Europe	Sun	ie	wood fam., 0/S gas.+ref		Dimethylether (Methanol	(DME)			
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rdrogen										
10 / Natural C drogen	3as / NG pipe 4000km, central reforming+H2 liq.,	road / Liquid								
10 / Wind / el	I. gen. (wind), cen. e.sis, H2 pipe, O/S com. / Co	mpressed Hydrogen								
10 / Wood Wa drogen	aste / wood col., cen. gas.+ref., H2 pipe. on site	com. / Compressed								

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Example for TtW results: Energy consumption and GHG emissions of various drivetrains

	ster Language View Reset Ex	port I Help	I Quit I Ab	bout CAR-OR v1.1								
		Primar	y energy	Process		Fu	el	Po	wertrain			
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2010 / Compress	sed Natural Gas / Hybrid: Otto Engine (conventional -	PISI) / A Class										
2010 / Diesel / H	Hybrid: Diesel Dir. Inj. Particul. Filter (DICI) / A Class											
2010 / Gasoline	/ Hybrid: Otto Engine (conventional - PISI) / A Class											

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Example for WtW results: Vehicle drive train: Fuel cell hybrid Fuel: Hydrogen from different primary energies

		Primary	/ energy	1	Process				Fu	el		Powe	ertrain			
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Example for WtW results: Vehicle drive trains: Fuel cell and ICE

Fuels: Compressed hydrogen, gasoline and compressed natural gas



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Example of QUERY-MODE visualization "for All Users"



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Outlook

Now....try out yourself - on the EVS-22 DaimlerChrysler stand

Join the Optiresource Foundation:

- In order to involve mores stakeholders, DaimlerChrysler intends to create a Foundation, open to other companies: you can join!
- Joining the Foundation, you participate in the definition of the specifications for the further development of the software.
- Buy & use (starting 2007, January) Optiresource software for optimizing your vehicle/fuel development strategy.
- Suggest further aspects to be included in the software.

....check out www.optiresource.org

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Thank you very much for your attention!

ご清聴どうも ありがとうございました。

Just what the environment needs from a car. Water.

If nature had one wish, what do you think it would be? A car that doesn't produce exhaust? We thought so too, That's why our hydrogen powered Fuel Cell vehicles only emit water. In fact, as they've proven in recent road tests, they may well be the alternative drive systems of the future. At DaimlerChrysler Research we're developing these intelligent technologies today. For the automobiles of tomorrow.

To find out more about 'Energy for the Future' visit www.daimlerchrysler.com.

DAIMLERCHRYSLER Answers for questions to come.