

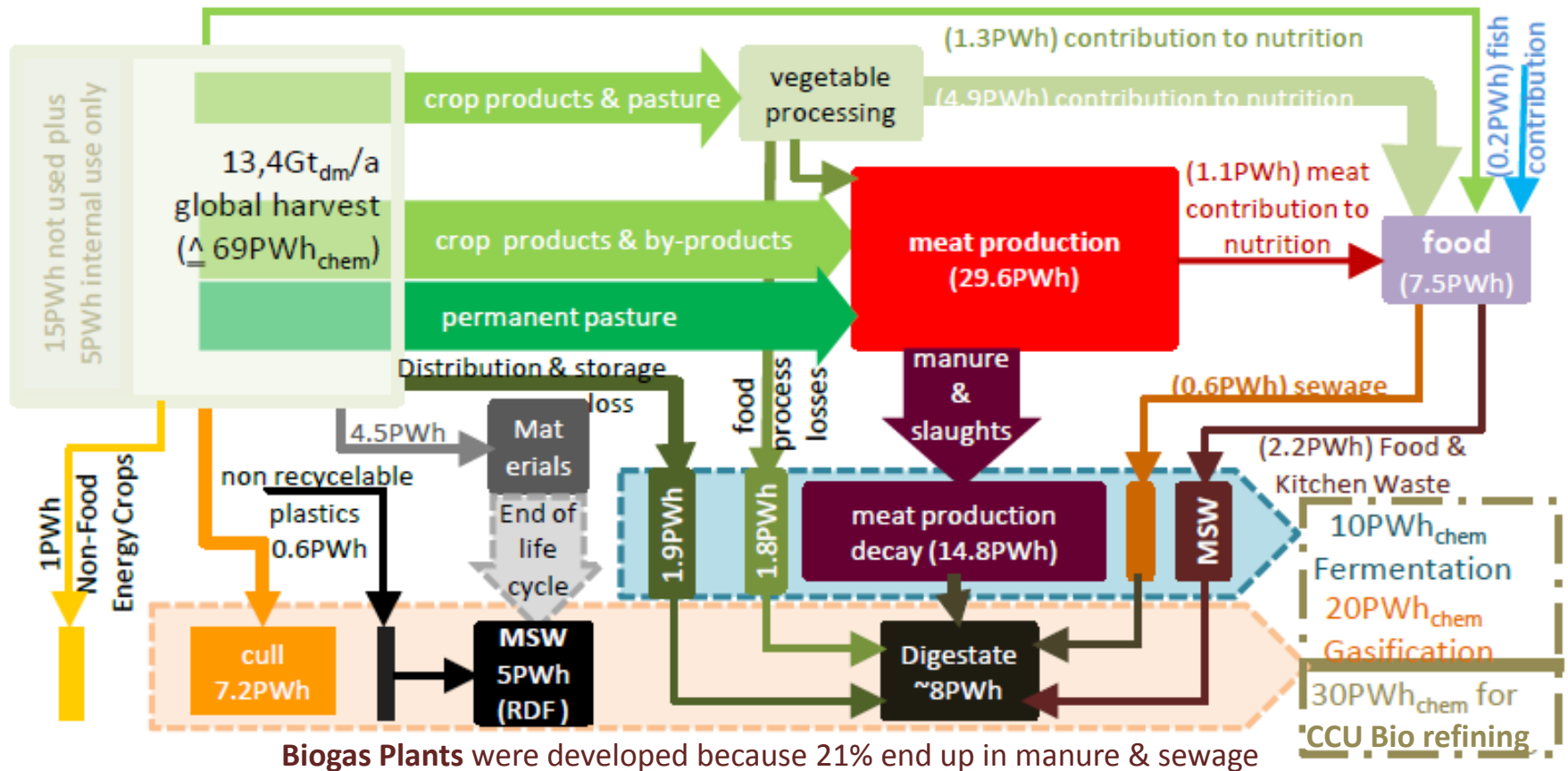


Potential Economics from Organic Waste's Carbon Recycling

ISWA 2013
world conference Vienna

Global Feedstock for Bio-Refineries

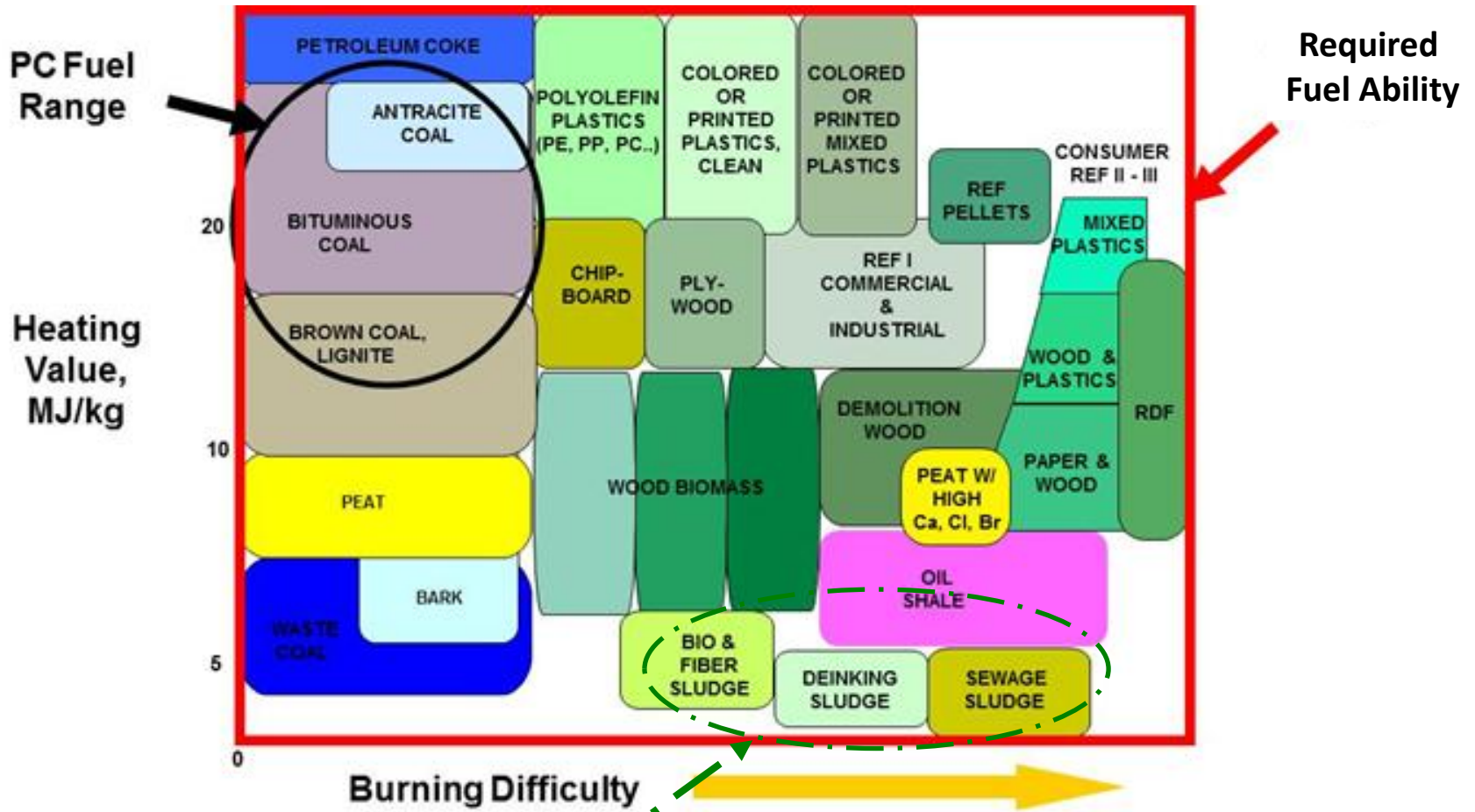
Waste from global renewable Organic Matter Use



- 30PWh_{chem} ≈ 20% World Primary Energy Equivalent or USA's Energy consumption only!
- **WHY NOT USE IT AS A SECONDARY RESOURCE TO COVER PRIMARY ENERGY NEEDS ?**

Need for bio-chemical and thermo-chemical

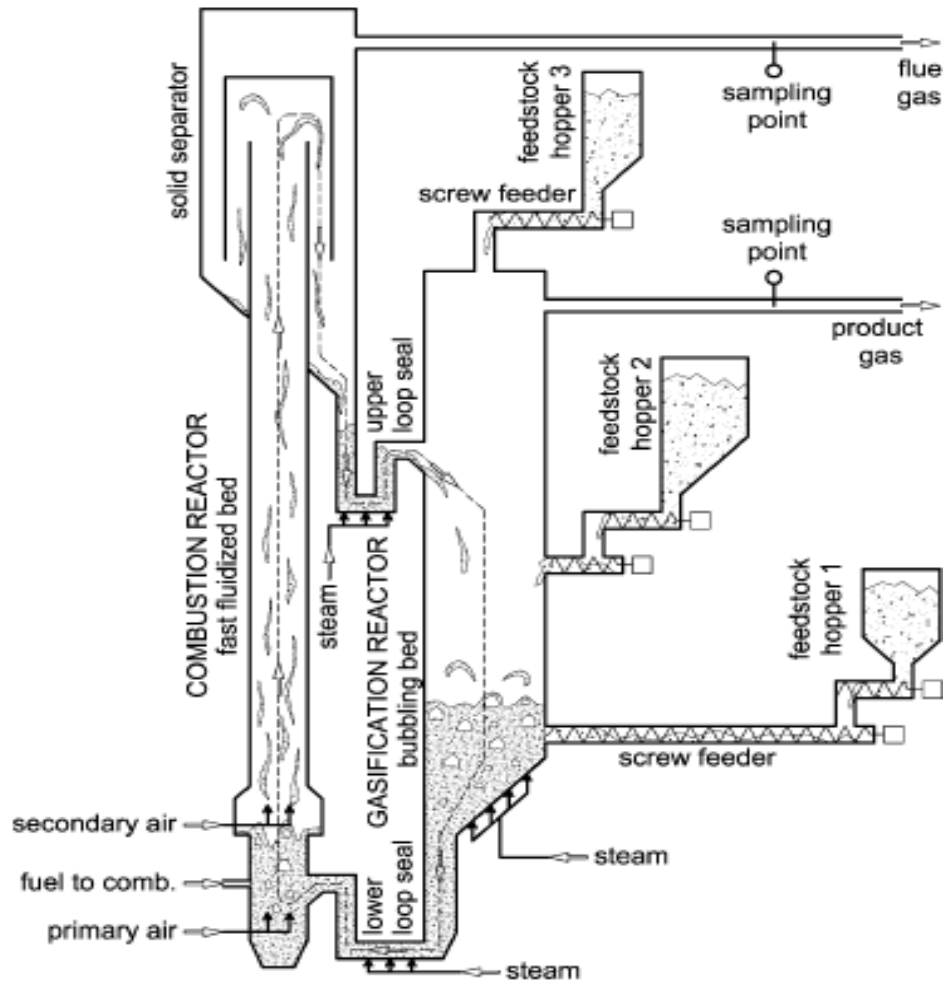
Decomposition of Organic Matter



up to 30% of the heating content of fuel could come from even sewage sludge

steam driven dual fluidized bed gasification

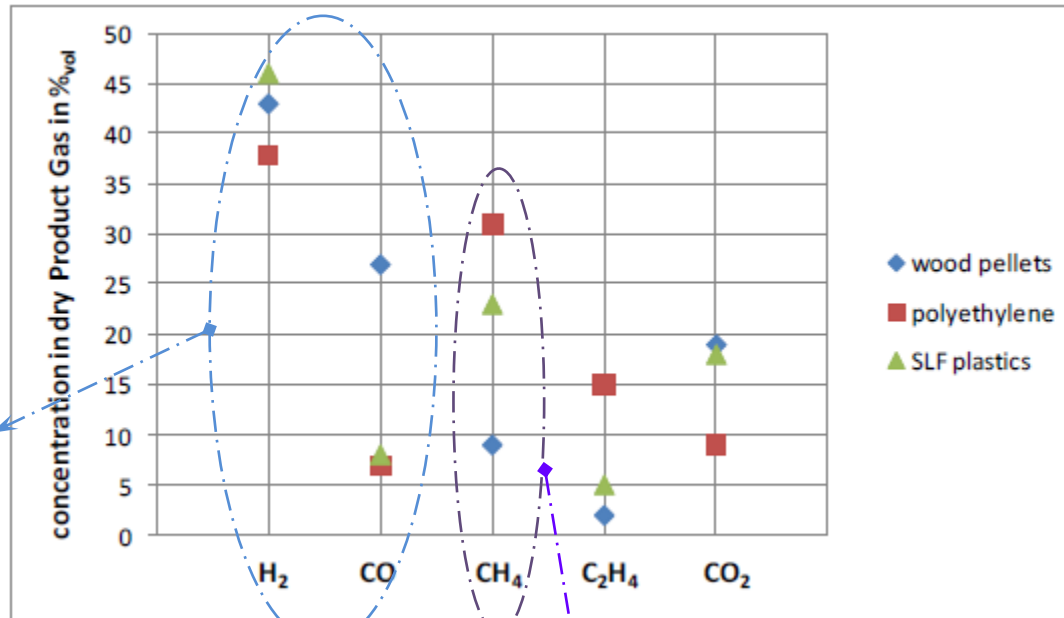
for thermo-chemical decomposition of waste



- ✓ no direct combustion of wastes
- ✓ anaerobic atmosphere in the “destruction chamber”
- ✓ waste transformation into usable energy is induced by a heat transferring medium
- ✓ producer-gas contaminants are primarily Hydrides that can be separated out by gas-cleaning
- ✓ ashes are extracted by cyclones and final filtering
- ✓ combustion chamber can be run air at NO_x uncritical temperature
- ✓ the system has a multi-year industrial scale track record

SD-DFB Gasification Fuel Flexibility

Gas Yields from different feedstocks



SYNTHESIS GAS

- higher value usage paths than CHP

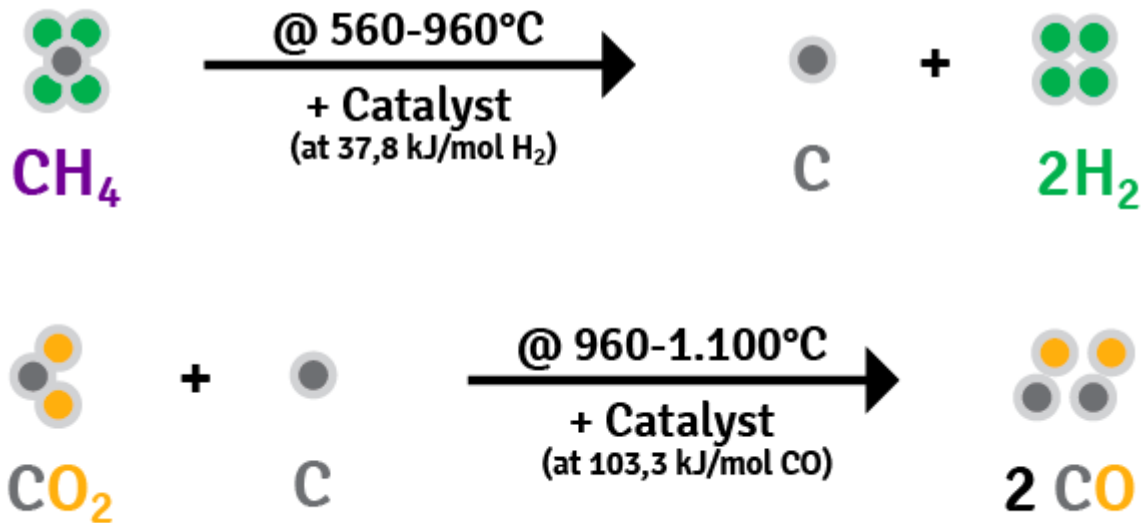
typical RDF fractions of MSW

METHANE in competition with **NATURAL GAS** cannot be exploited at price covering costs

- state of art CHP co-combustion
 - requiring off-take subsidies
 - you loose it if you don't use it

The KEY to uplift **ADDED VALUE**

Carbon Capture for CO₂ & WASTE HEAT RECYCLING Use

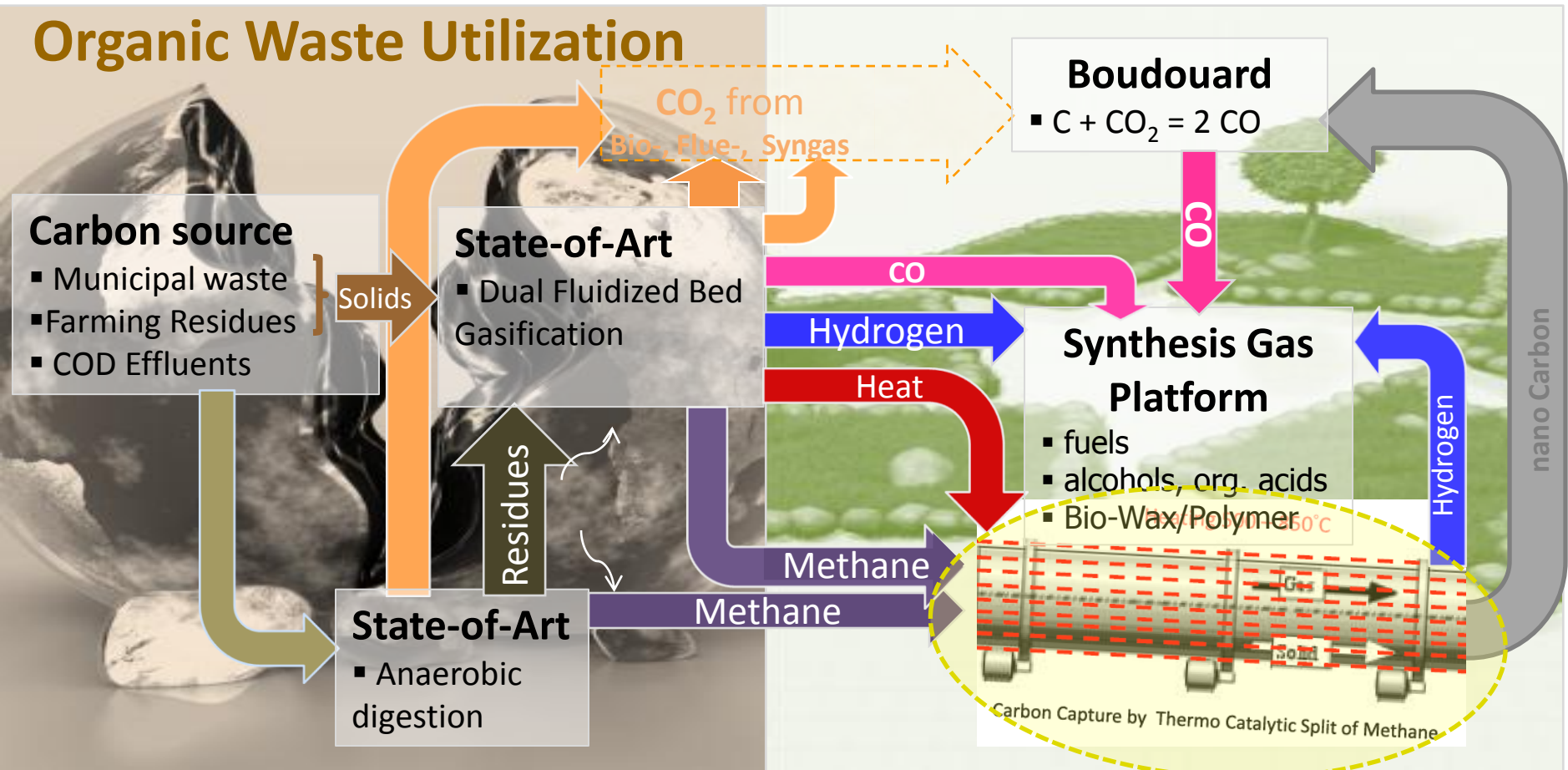


“**DRY THERMO-CATALYTIC DISSOCIATION**” of hydrocarbon gases had been industrialized from synthetic diamond fabrication for high performance materials. Application to **DECOMPOSITION-GAS** from organic matter the Technology **UNLOCKS FULL TRANSFORMATION OF WASTE-HYDROCARBONS** to chemical **SYNTHESIS HYDROCARBON PRODUCTS**.

Our unique contribution to Bio-Refineries

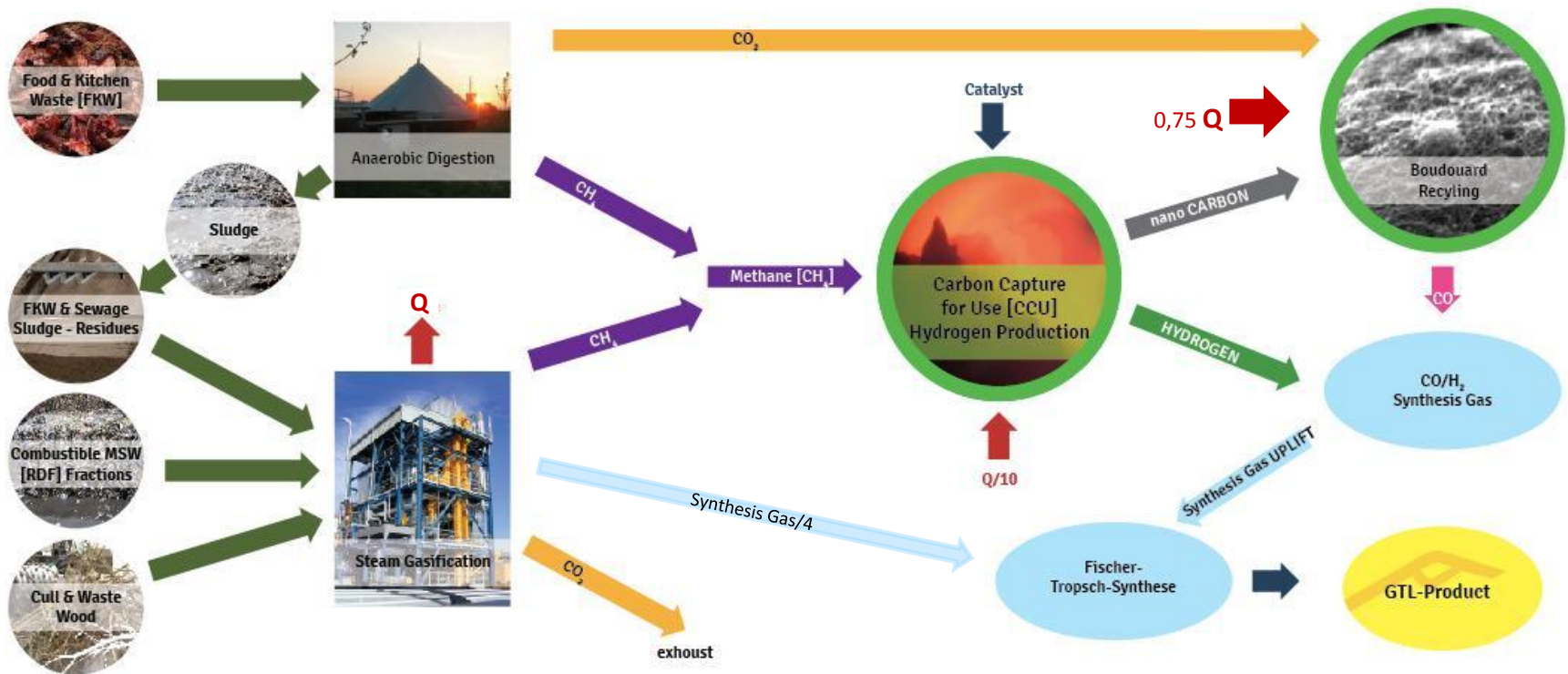
Extending the Value Adding Hierarchy by Carbon Recycling

Organic Waste Utilization



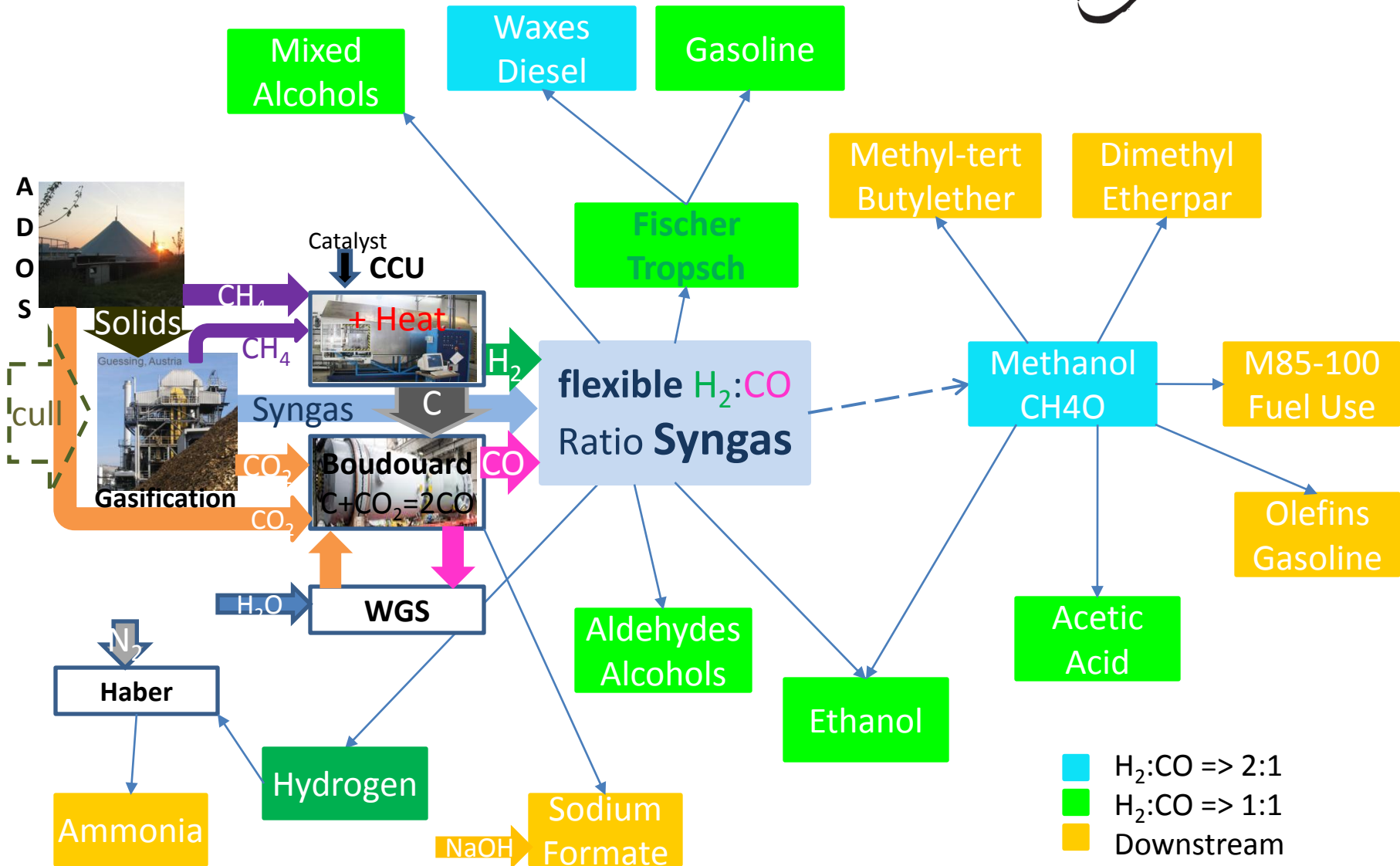
Integrating Materials Technology in MSW

we synthesize **Waste** into the **Fuel** of tomorrow by **OUR UNIQUE SOLUTION PROPOSITION [USP]**



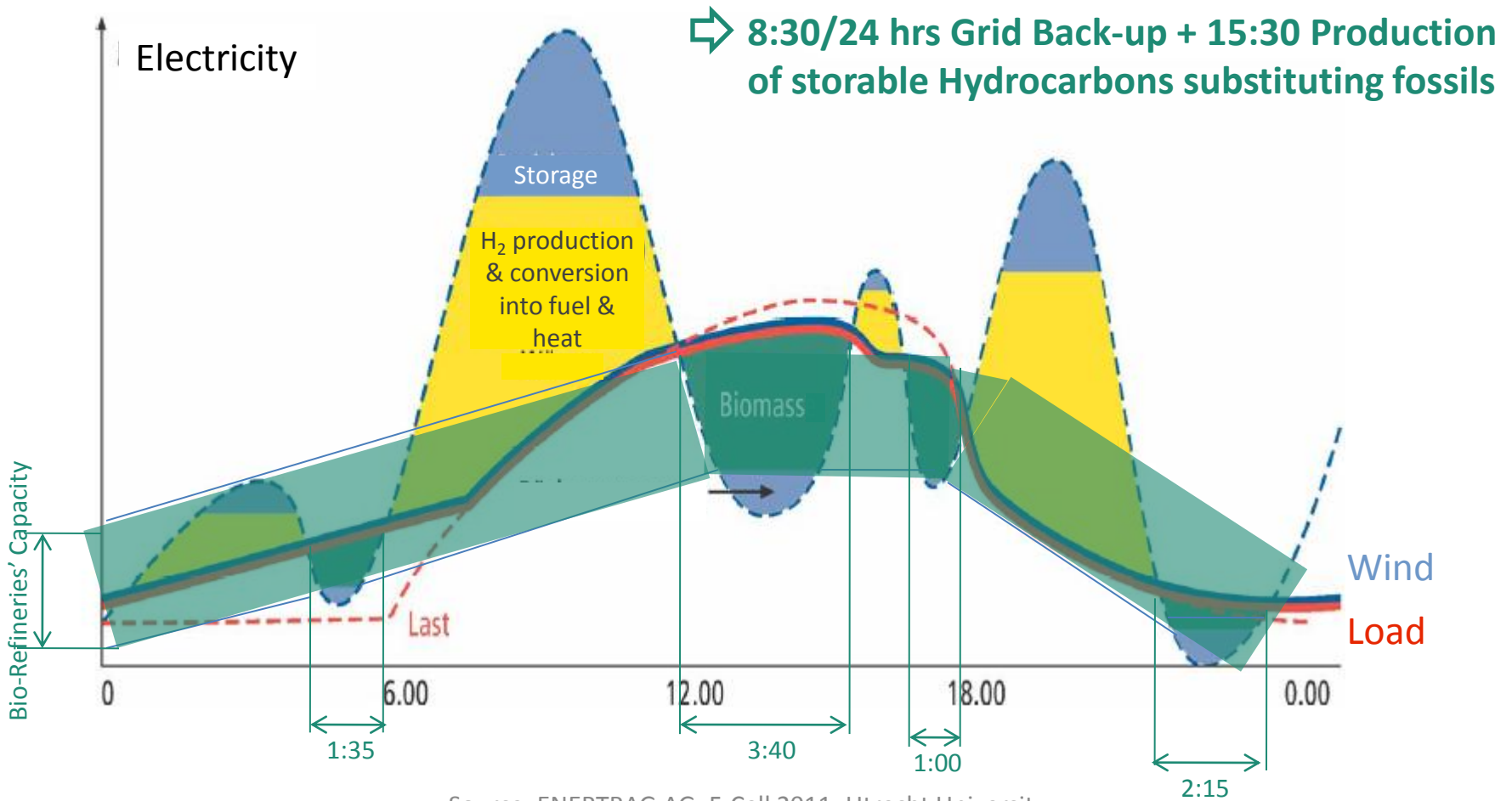
“In 30 years we will either fly on 2nd generation bio-fuel or not at all anymore.”
 (Dr. Alexander Zschocke, Senior Manager Aviation Bio-Fuels of **Lufthansa**, Fuels of the Future Conference, Berlin 2012)

Synthesis Chemistry Plattform



A Bio-Refinery hedging NRE Volatility

by flexible use of the Synthesis Gas Platform



Competitive Analysis (worldwide averages)

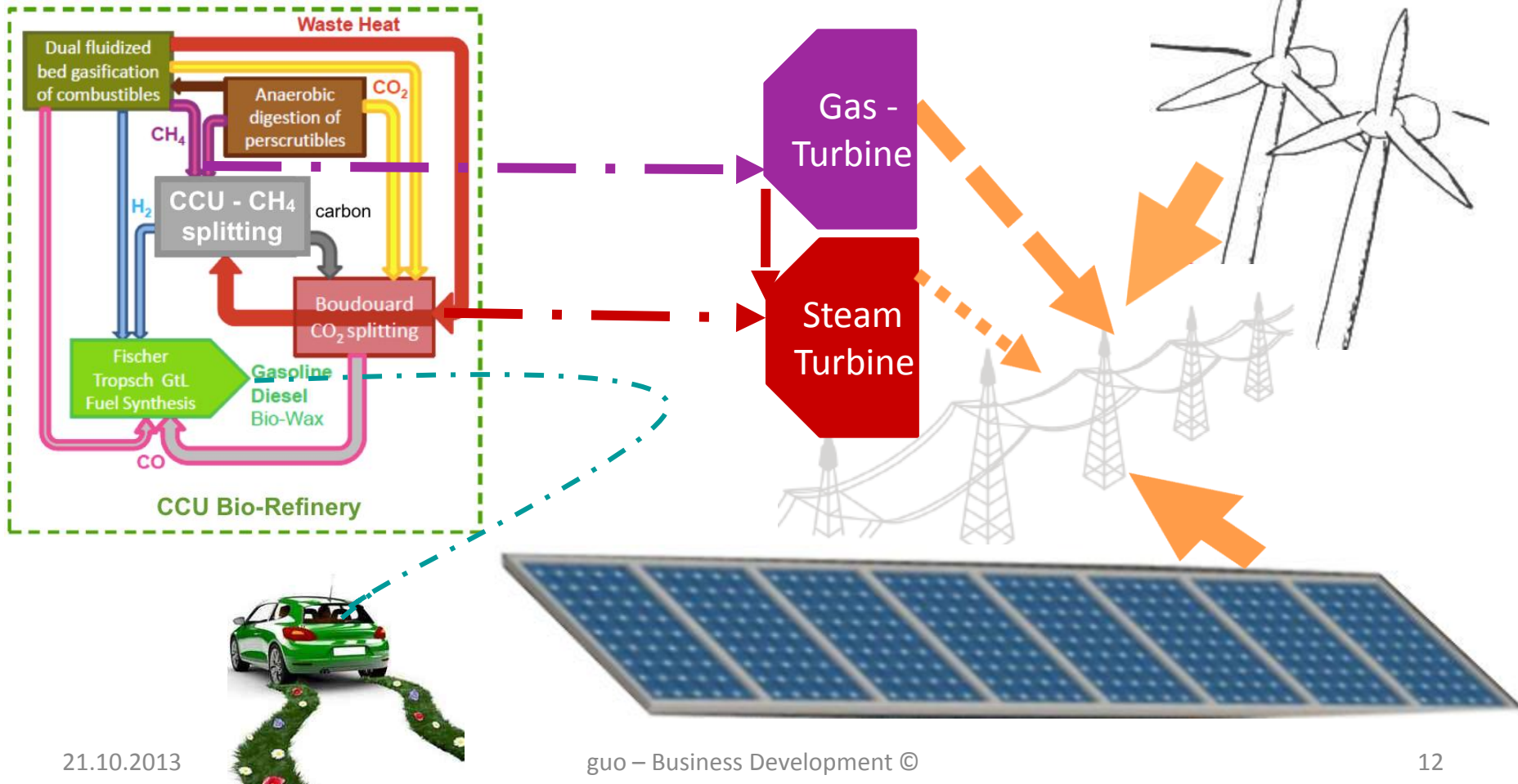
Technology comparison based on MSW (organic fractions)

		Biorefinery	ADOS	Incinerations	Landfills
Waste collected	fermentable	✓	✓	with auxiliary fuel	✓
	combustibles	✓	with extra treatment	✓	✓
Cost/ ton of waste handled		57€	20€	145€	60€
Main deliverables		Carbon & Hydrogen for synthetic gasoline	biogas	waste heat	landfill gas
Application of deliverables		advanced green clean fuel for ICE vehicles & aviation	400kW _{el}	230kW _{el}	250kW _{el} *)
CO ₂ reductions / million tons of waste handled		1,170,000 tons	300,000tons	400,000 tons	150,000 tons*)
Revenue/ton waste handled (sludges @ 40% _{water} ratio)		145€ @ € 0.56/ltr. Gasoil & € 1.18/kg Bio Wax	27€ @ € 0,044/kWh _{el} CHP € 0.015/kWh _{th}	22€ @ € 0,044/kWh _{el} CHP € 0.015/kWh _{th}	16€ *) if captured
EBIT %		15 - 20%	8%	<5%	10%
Payback time		<6 years	>7 years	12 years	?infrastructure?

Carbon Capture for Use [CCU] Bio-Refinery

combines proven state of arts into **NEW APPROACHES:**

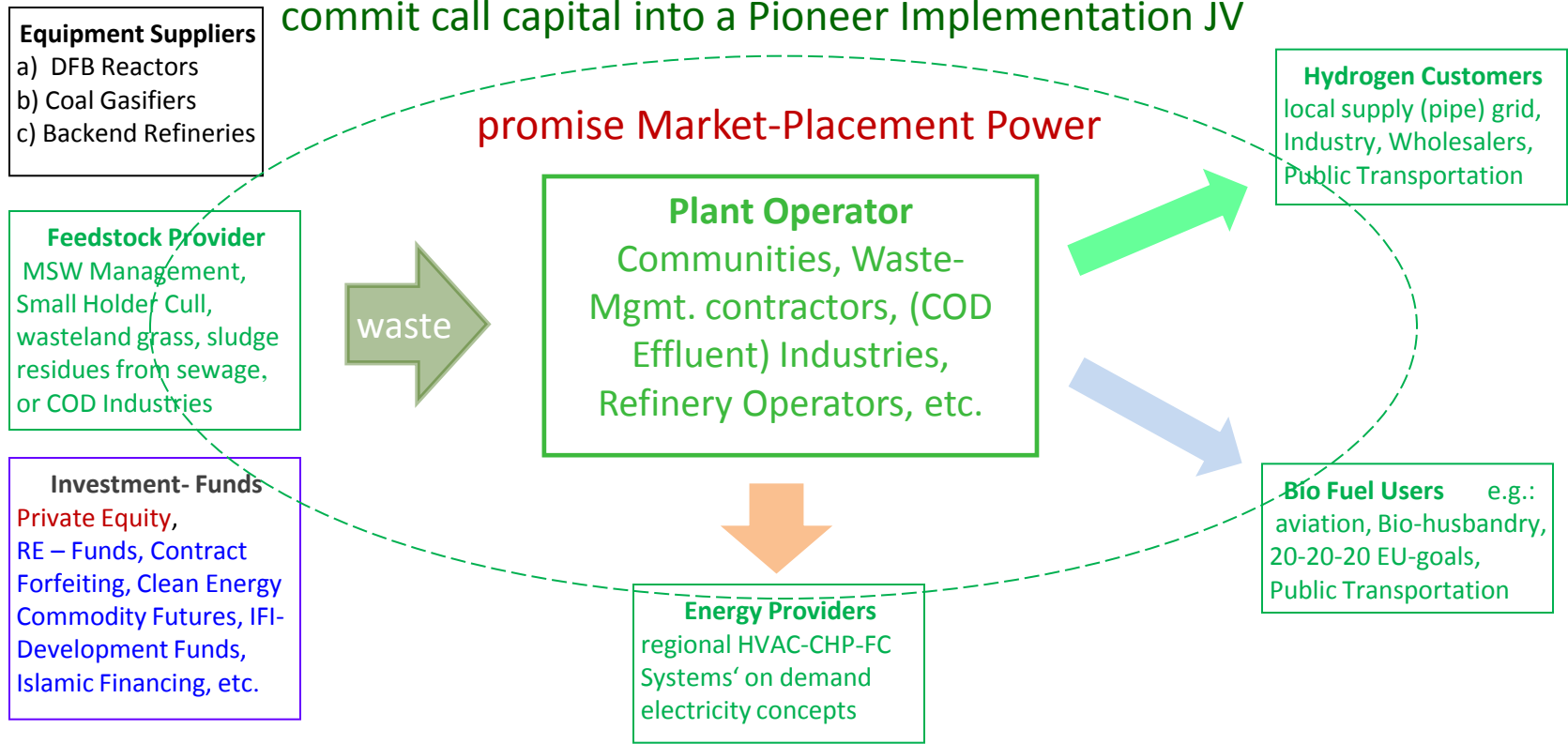
Making **ECONOMY** from **ECOLOGY** through world-market competitive self-sustaining use of waste



International Operators' Consortium

covering multiple local Waste to Value Supply Chains

commit call capital into a Pioneer Implementation JV

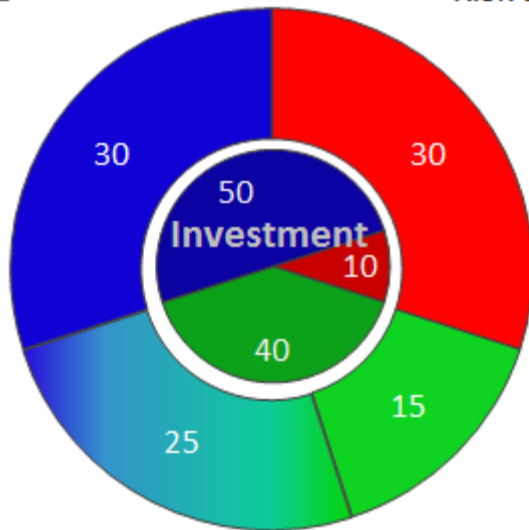


COMPETENCE & MARKET POWER of each NATIONAL SET OF CONSORTS plus uncoupling from POLITICAL (regulatory) RISKS shall enable VENTURE CAPITAL financing of DEMO-VALIDATION

Proposed Innovation Financing Structure

differentiated RISK PROFILE SHARE BONDS (with partial variable share allocation)

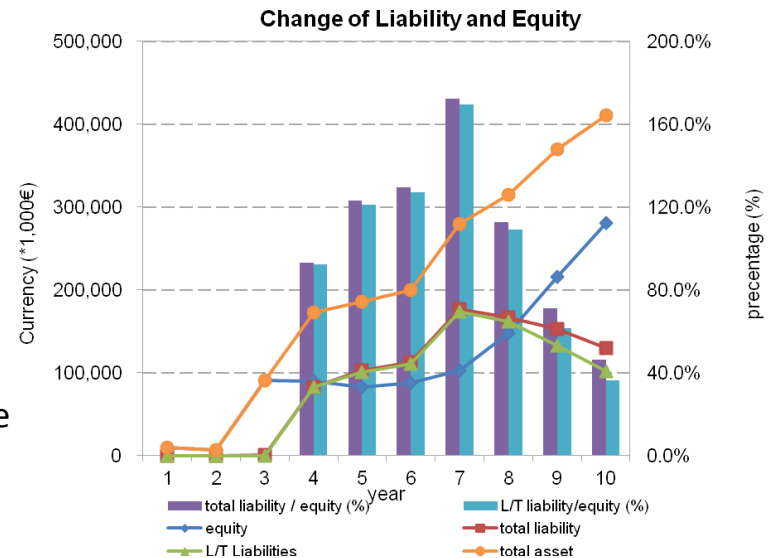
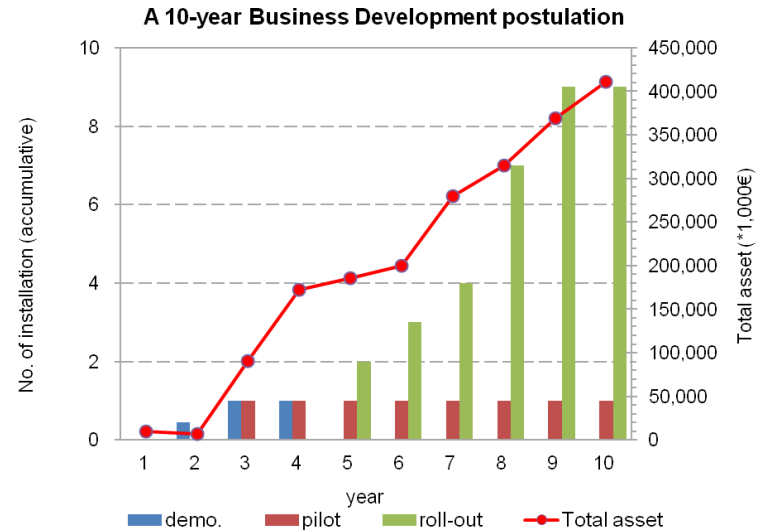
- 1. 100% Risk
- 2. 25% Risk
- 2. Variable
- 3. Risk Benefit



- 1. Venture Capital
- 2. Operators' Consortium
- 3. Institutional/ Private Sector

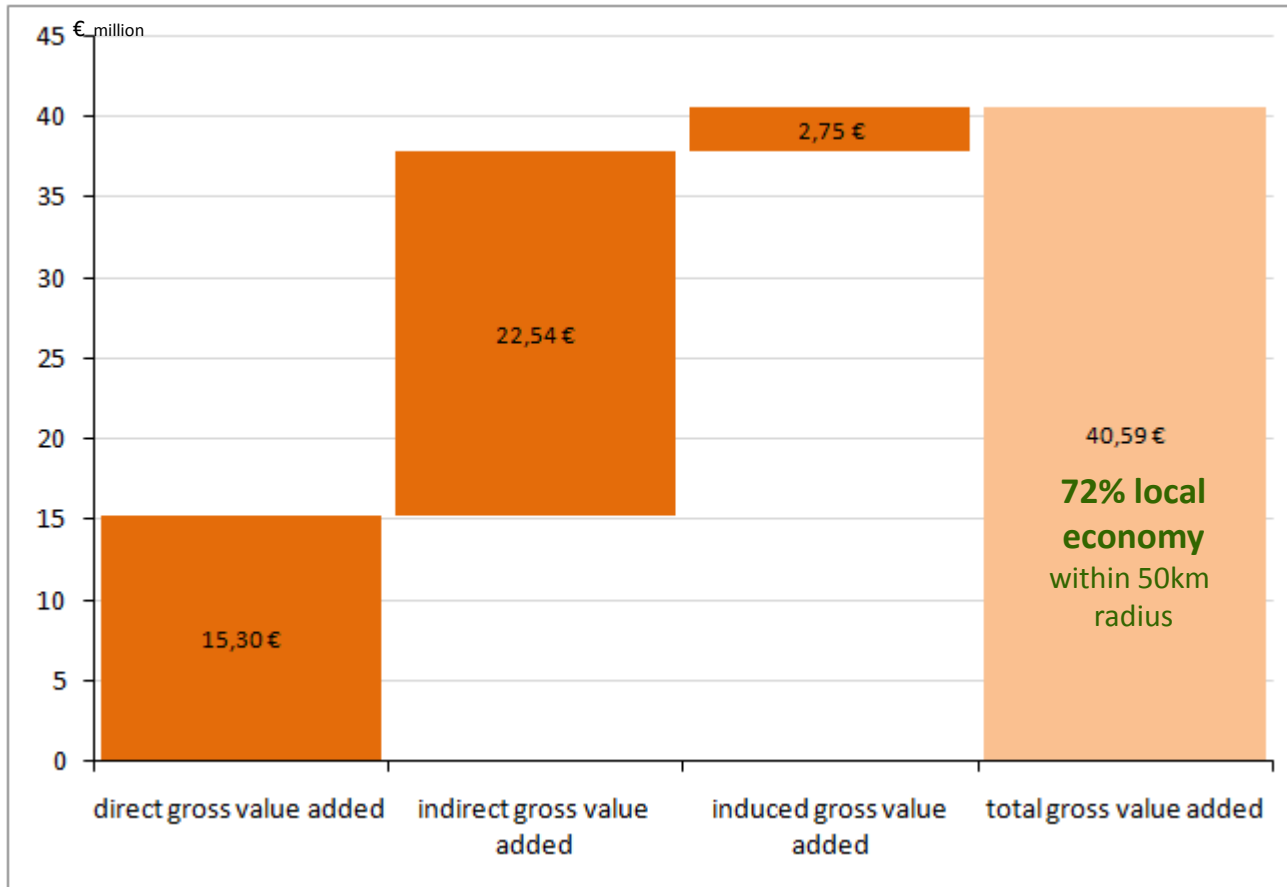
ECONOMICALLY lean & ECOLOGICALLY the cleanest Solution :

- 10-year IRR > 20%/a at ≥ €0.55/ltr. gasoline & less aerosols
- investment returns follow energy price index → inflation hedge
- resource- & energy- efficiency => sustainability
- long term cost leadership in Waste to Energy Business



Total GDP Added Value per installation

from organic MSW fractions of 250,000 ±20% capita



△ 60% of capex

408% ∅ GDP/employee

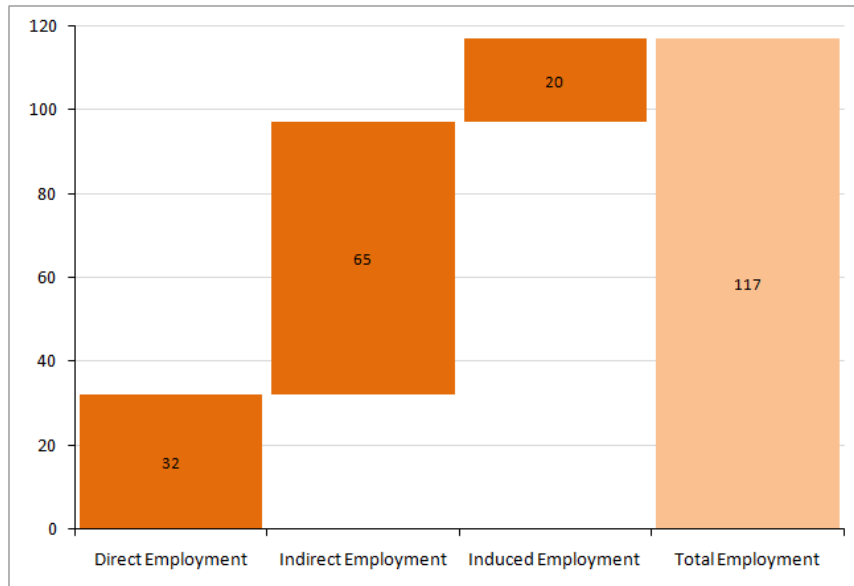
235% waste fees/capita

140,000bbl gasoline/diesel
import reduction by
local closed loop
circular economy
+ 60,000t CO₂ recycling
in transportation fuel

Employment Effects per installation

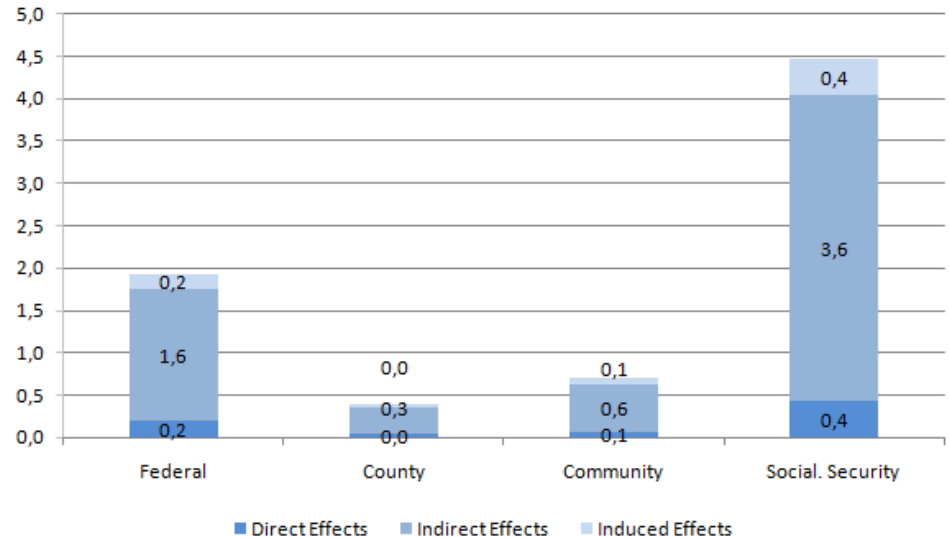
per plant in operation

Full time equivalent headcounts



Total: € 7.5mill/a

National Budget contribution for e.g. Austria's taxes and employment charges scheme (per plant in operation)



from 1 plant's operation at 250,000 \pm 20% capita organic MSW fractions

- there is a worldwide potential for 12,000 plants alike today, expected to double until 2030 (population growth + urbanization trends)
- This can create a capital equipment market segment of € 55bln/a giving room for employment of over 600,000 adding gross value to its host countries GDP
- capital equipment built in AUT contributes **€ 13mill/plant** to National Budget



Please contact us to join the
CONSORTIUM and make this **HIGH IMPACT**
OPPORTUNITY a real **Innovation!**

Stefan Petters

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