BIO-ELECTRICITY

Efficient and Clean Production of Electricity from Biomass via Pyrolysis and Hydrogen Utilizing Fuel Cells

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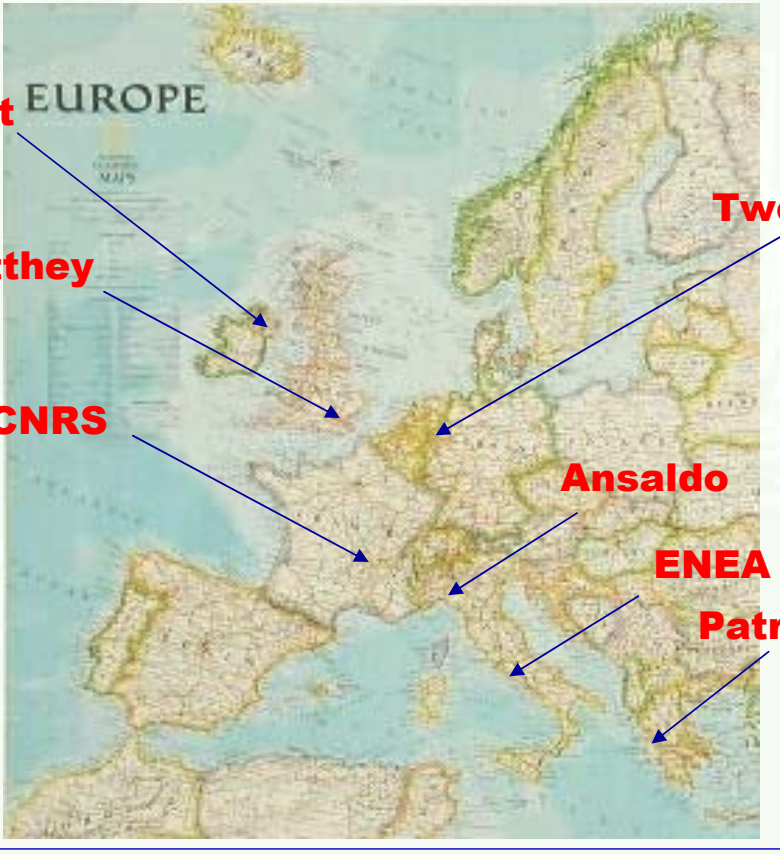
Thermo Chemical Conversion of Biomass

BIO-ENERGY
ENLARGED PERSPECTIVES

Budapest ,16-17 October 2003

PARTNERS

- ***Universities:*** **Belfast, Patras, Twente**
- ***Research Institutes:*** **CNRS, ENEA**
- ***Industry:*** **Ansaldo Ricerche S.R.L., Johnson Matthey**



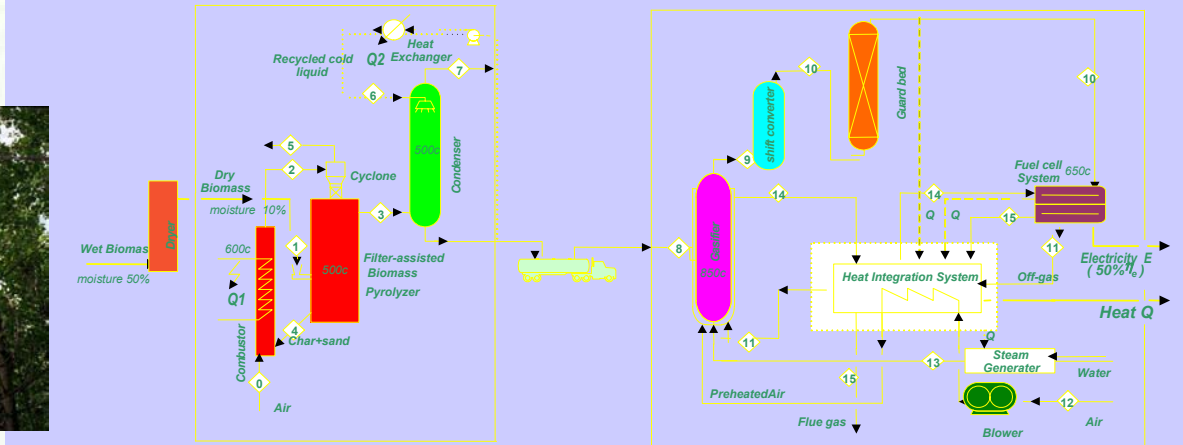
TIME SPAN

1-12-2002 – 1-12-2005

CONCEPT

Bio-oil Producer

Bio-oil Processor

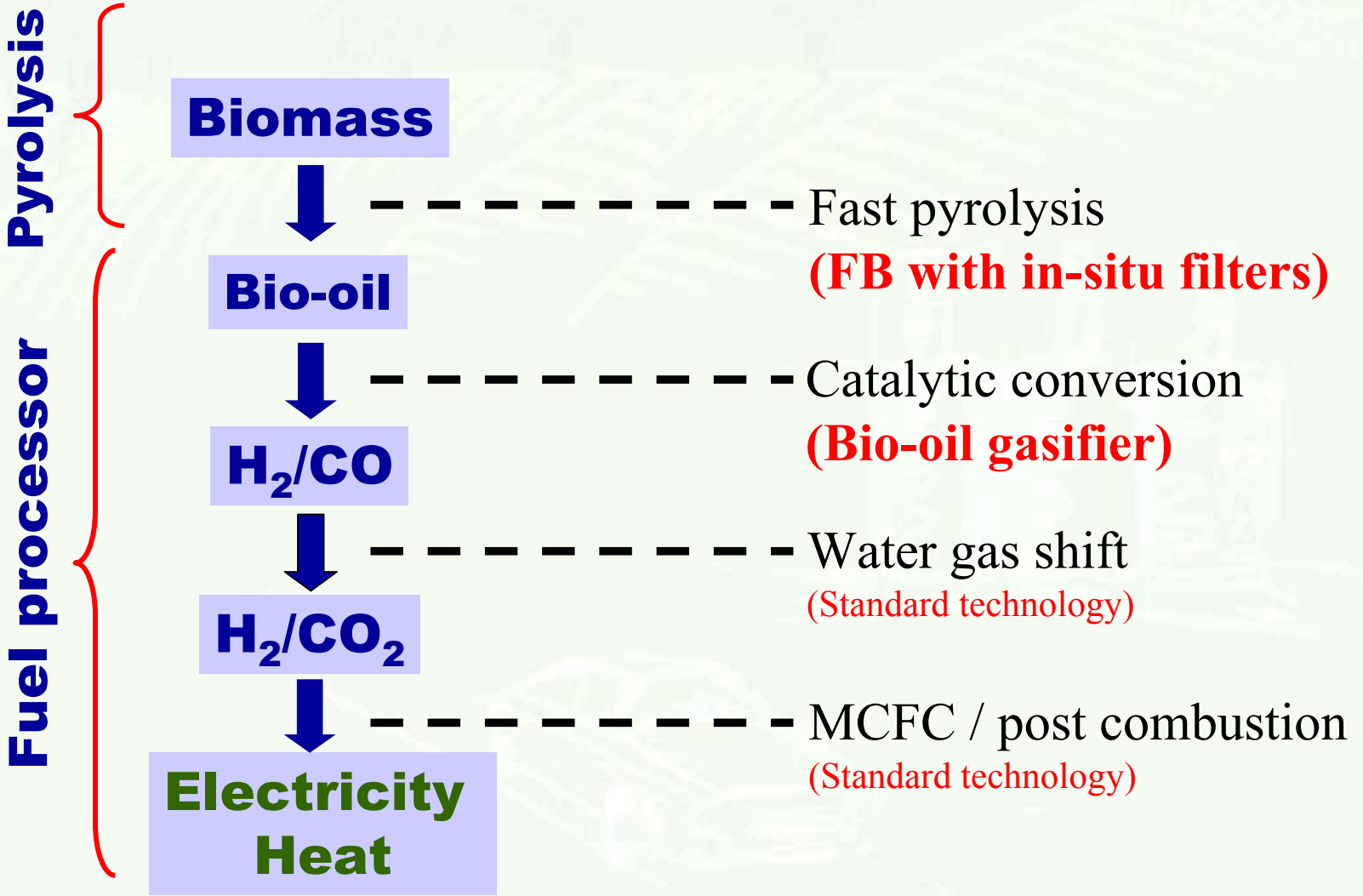


Bio-oil production on large scale → **Out of grid energy production (ca. 500 kW_e)**

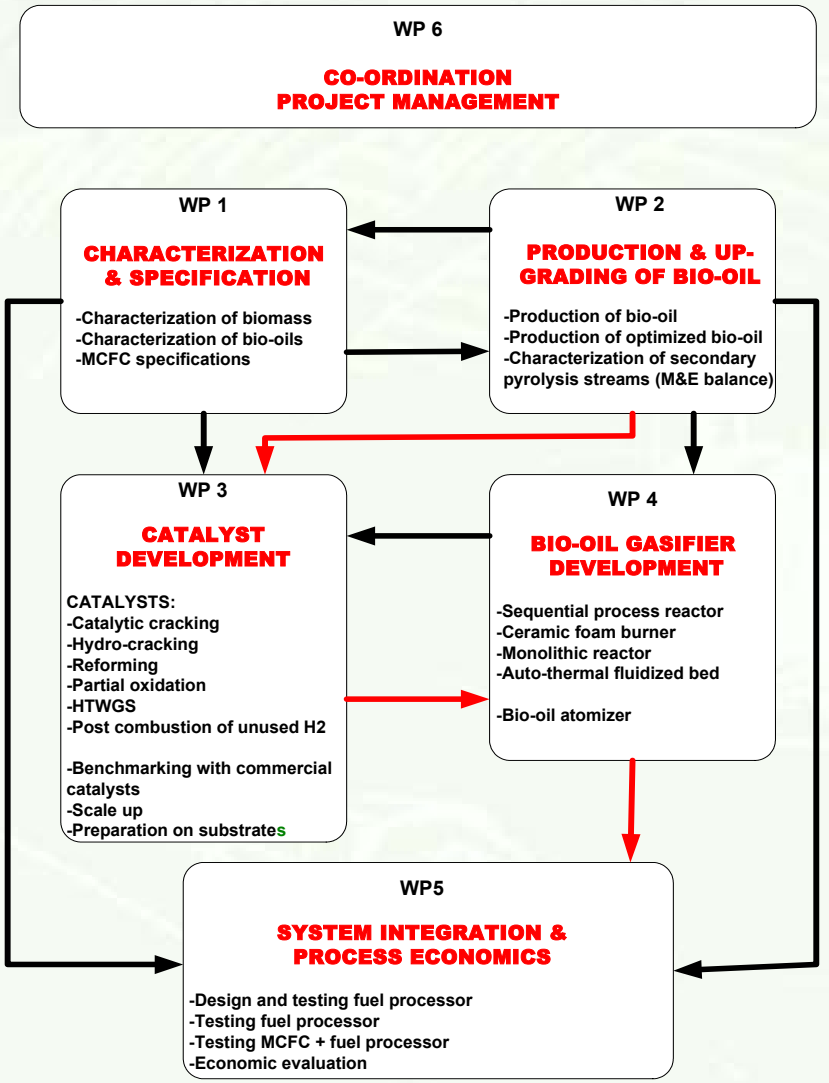
OBJECTIVES

- Production of hydrogen and electricity from bio-oil
- Catalyst and process development
- Small-scale demonstration in an integrated set-up
- Out of grid energy production (500 kW_e)
- Low emissions / waste
- Cost and energy efficient

METHODOLOGY



WORKPACKAGES



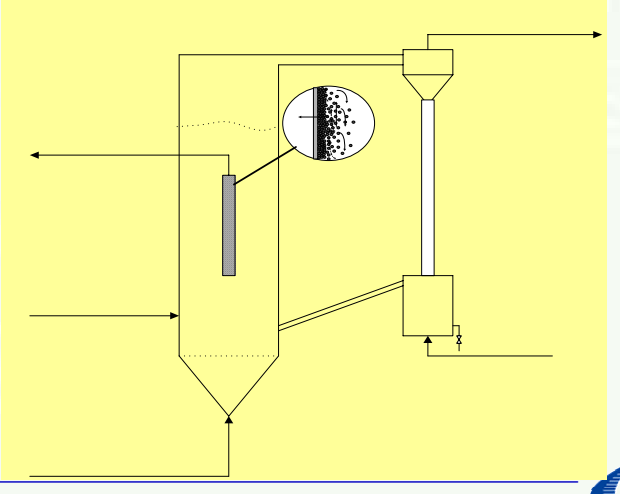
PRODUCTION & UPGRADING OF BIO-OIL

Pyrolysis

Biomass (s) —*Heat*→ Char (s)+Bio-oil (l)+Gas (g)

Source: www.BTGworld.com

FB with In-situ filtering



Char removal is a crucial issue

- **Char acts as a vapor cracking/polymerization catalyst -> instable oil / processing difficulties**
- **Hot vapor filtration gives a high quality char free product.**

CATALYSTS DEVELOPMENT

CATALYSTS

- Catalytic cracking
- Hydro-cracking
- Reforming
- Partial oxidation

Steam reforming

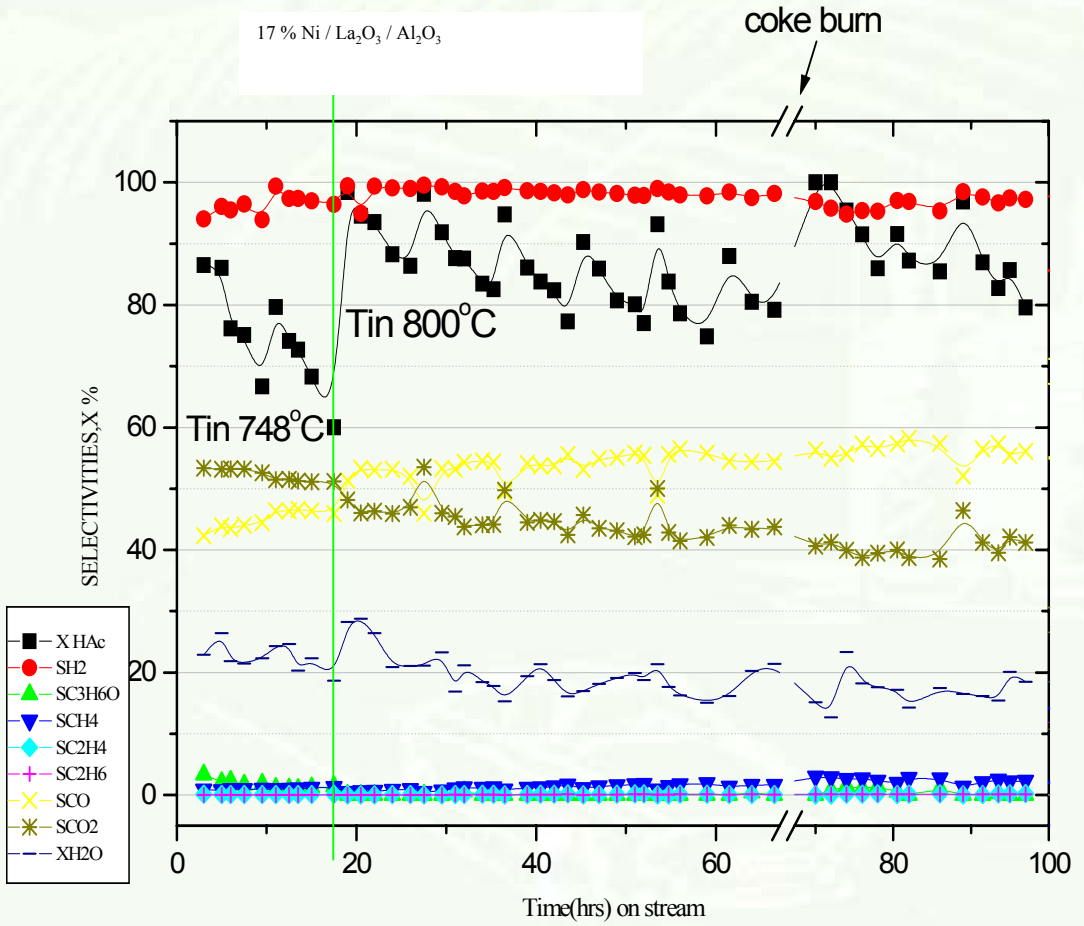
Metals	Carriers
Pd	Al_2O_3
Rh	$CeZrO_2$
Ru	La_2O_3
Pt	
Ni	

Catalytic bio-oil gasifier

Testing with model compounds and real bio-oil

CATALYSTS DEVELOPMENT:

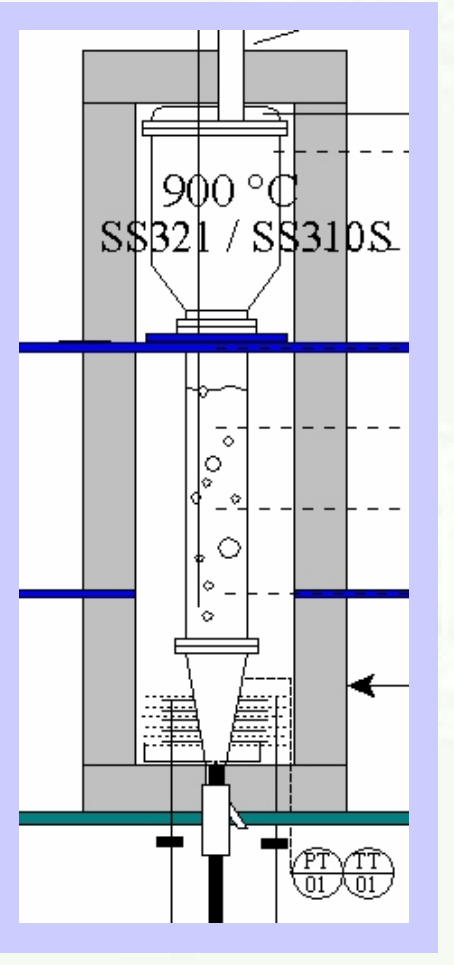
Steam reforming of acetic acid



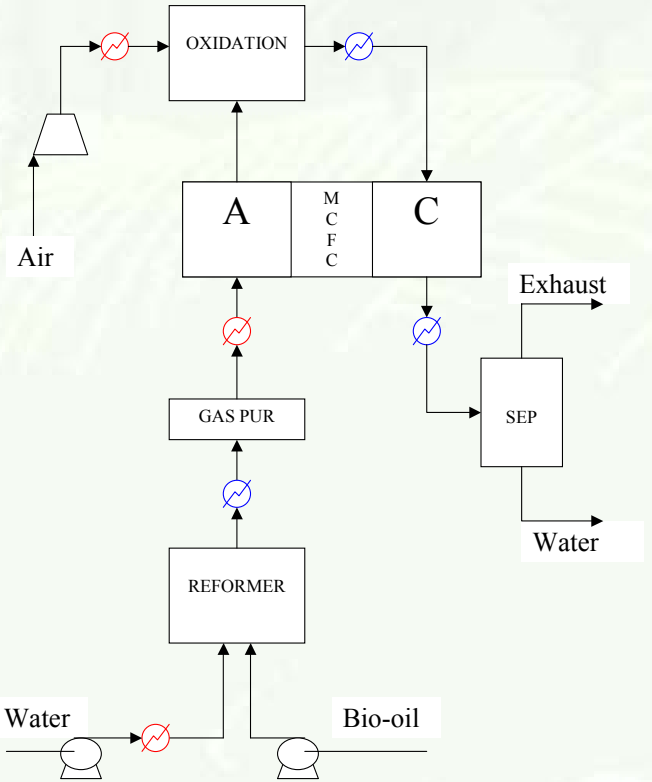
BIO-OIL GASIFIER

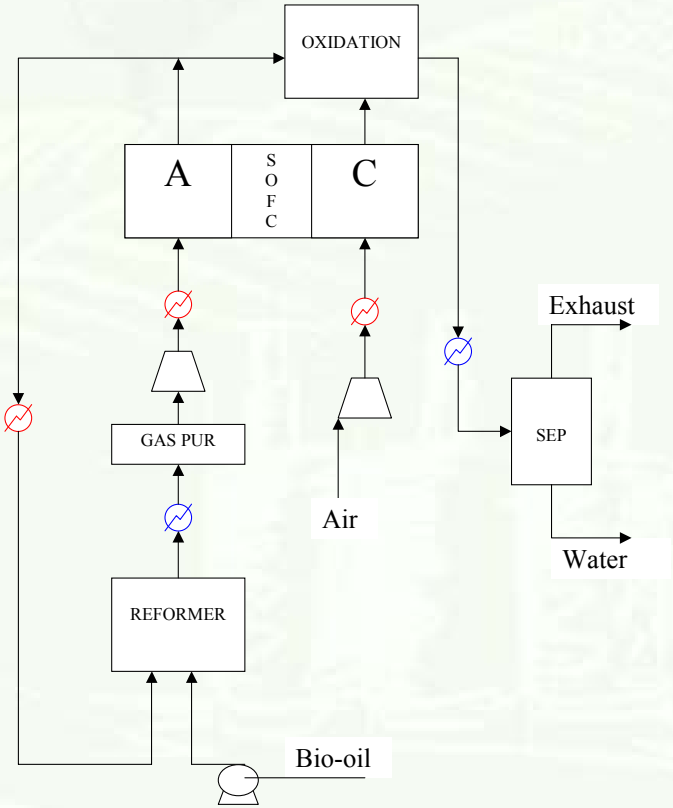
REACTOR DESIGN

- **'Cold' bio-oil injection**
- **High heat duty for reactor**
- **Regeneration of catalyst**



SYSTEM INTEGRATION





- **Pure steam reforming**
- **Simple design**
- **Low quality heat released**

- **Steam and CO_2 reforming**
- **High electric efficiency**
- **High quality heat released**

CONCLUSION

- Project is on schedule after 10 months

- Bio-oil samples delivered for characterization
- Selection/development catalyst for bio-oil gasification is a crucial task
- Reforming of bio-oil model compounds is possible
- Fluid bed technology will be applied
- SOFC offers better opportunities than MCFC