



Gasification – Review of Work Packages

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Mission of ThermalNet

...providing support for more rapid and more effective implementations of **biomass gasification** at the market place

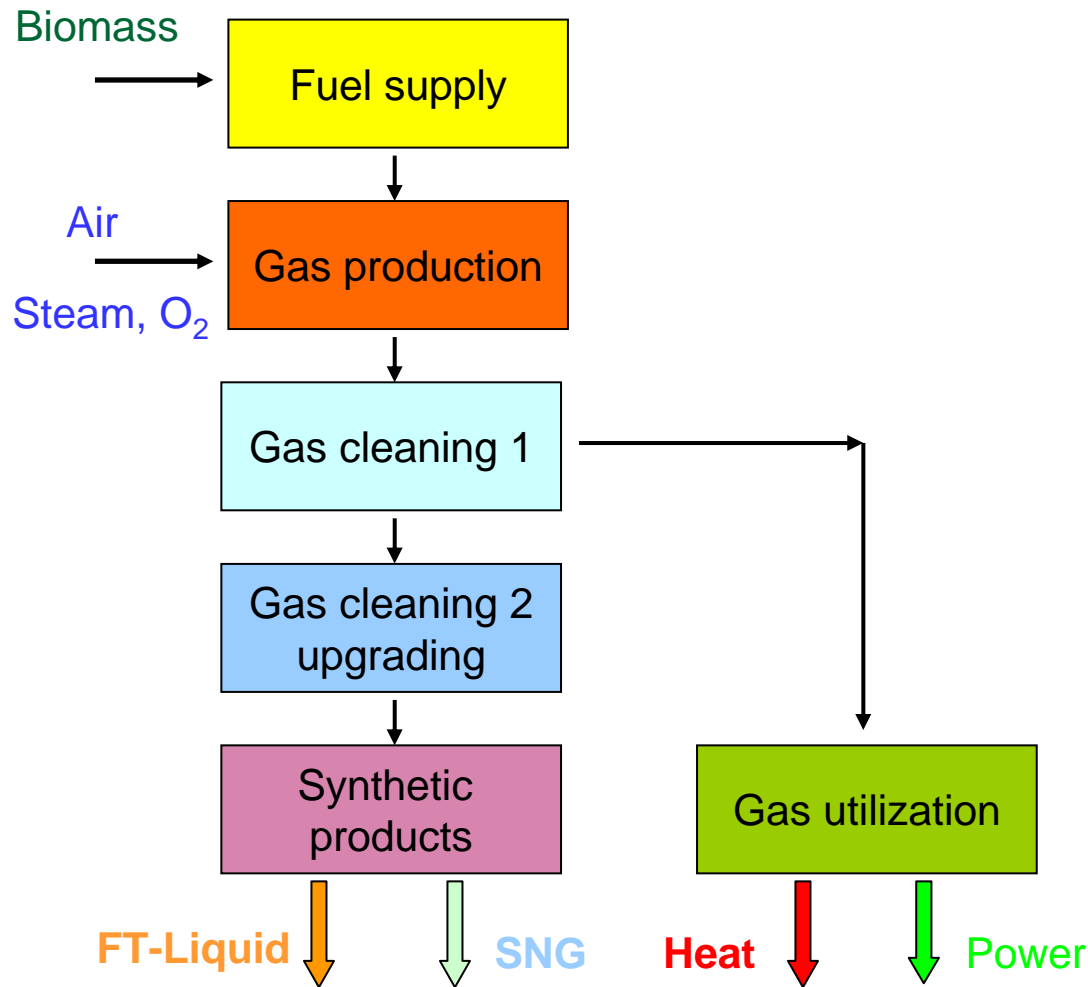


Main Topics to Solve – Kick off Meeting

- Increase fuel flexibility
- Fuel feeding
- Better understanding of gasification process
- Improve ash quality
- Gas cooling / fouling / erosion
- Advanced gas cleaning (syngas quality)
- Process integration (heat integration, closed material loops, minimize waste streams)
- Environmental, health and safety issues
- Further development of future applications (SNG, FT-synthesis, etc.)



Typical Gasification Process Chain



Fuel supply

Current situation

- For the existing gasification plants **fuel supply is solved case by case**
- Trends are going to **low cost fuels**

Topics to solve

- **Secure and economic biomass supply** is a crucial point for future thermal biomass utilization especially if synthetic products are considered
- A **broader biomass resource base** is necessary, especially agriculture land is needed for fuel production
- **Standardization and quality management** are necessary for a future biomass market and to secure and optimize operation of gasifiers



Work package 2C “Feedstocks and standards”

Work package 2A “Characterization and analysis” (partly)



Gas production

Current situation

- In principle, a **satisfying status of biomass gasifiers** have been reach during the last years
 - Fixed bed gasifiers for small scale
 - Two stage gasifiers for small and medium scale
 - Fluidized beds for medium and large scale
 - Entrained flow for large scale

Topics to solve

- For optimization of the gasification process **fundamental understanding** is necessary
- **Modeling and simulation** are important tools for better understanding and further optimization of gasification processes
- **Pressurized gasifiers** for syn-gas production



Work package 2E “Science and modeling”



Gas cleaning

Current situation

- Gas cleaning processes are always **integrated parts of the plant** depending on the gasification process and the gas utilization
- Gas cleaning has to secure a gas quality for the respective application
 - Gas cleaning for **gas turbines and gas engines** are available
 - Gas cleaning for **synthesis gas** are currently under development

Topics to solve

- **Economic and reliable** systems have to be improved or developed
- **Residues from gas cleaning** have to be avoided or recycled internally in the plant



Work package 2E “Gas treatment”

Work package 2B “Co-processing and co-firing

Work package 2D “Fouling, corrosion, erosion



Gas utilization as fuel gas

Current situation

- **Co-firing** has reached already commercial stage
- **IGCC** have been successfully demonstrated (e.g. Varnamo-concept)
- **CHP** based on gasification and gas engine operation is currently under demonstration

Topics to solve

- **Flue gas emissions** are still not satisfying (e.g. gas engines)
- **Availability** of several systems have to be improved
- **HSE-issues** for small scale are not settled completely
- **Successful demonstrations** needed



Work package 2B “Co-processing and co-firing”
Work package 2D “Fouling, corrosion, erosion”
Work package 3D “Environment, Health & Safety”



Gas utilization for synthetic products

Current situation

- A lot of **feasibility studies** have been carried out during the last years
- Process development are currently in **laboratory stage**

Topics to solve

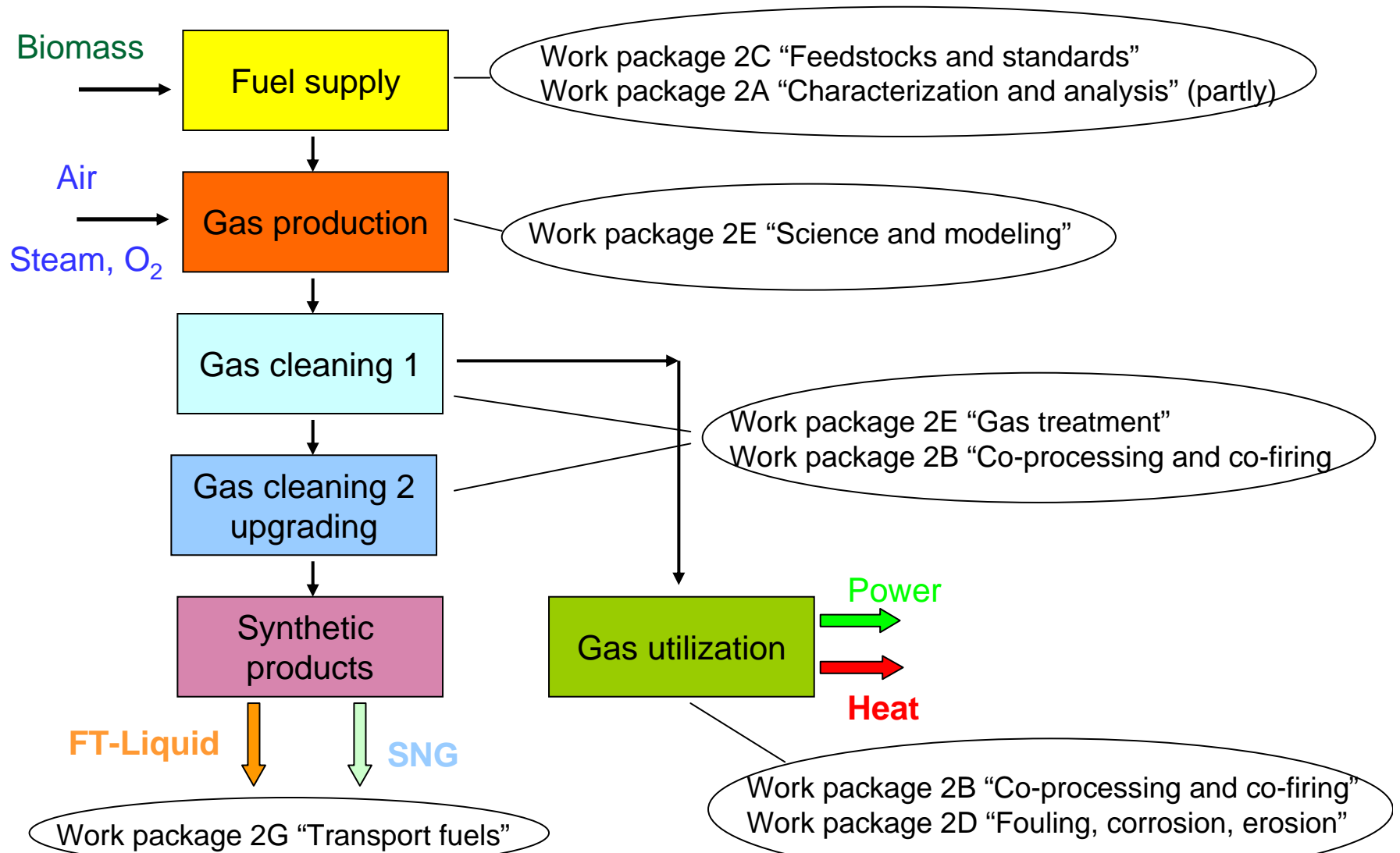
- **More and more reliable data** for studies needed
- **Synthesis gas cleaning** is one of the crucial points
- **Synthesis processes** (e.g. for Fischer-Tropsch-liquids, substitute natural gas) are well known but have to be adapted for the biomass case
- **First demonstrations** will be carried out during the next two years



Work package 2G “Transport fuels”



Typical Gasification Process Chain / Work Packages



Non-technical issues

- Extremely important for the implementation biomass gasification
 - WP3A “Barriers: technical and non-technical”
 - WP3B “Economics”
 - WP3C “Education and training”
 - WP3D “Environment, health, and safety”



Contribution to Gasification Technology

| TECHNICAL TASKS | contribution | comment |
|--|--------------|---|
| WP 2A Characterisation & analysis | small | mainly pyrolysis |
| WP 2B Co-processing and co-firing | yes | gasification one option |
| WP 2C Feedstocks and standards | yes | specific requirements for gasif. |
| WP 2D Fouling, corrosion, erosion | yes | include gasification |
| WP 2E Gas treatment | yes | producer gas / emissions |
| WP 2F Science and modelling | yes | pressure / O ₂ , H ₂ O, CO ₂ |
| WP 2G Transport fuels | yes | gasification and pyrolysis |
| WP 2H Biorefinery (IEA) | no | pyrolysis only |
| NON-TECHNICAL TASKS | | |
| WP 3A Barriers – technical / non-technical | yes | general for biomass |
| WP 3B Economics | yes | gasification examples |
| WP 3C Education and training | yes | general for biomass |
| WP 3D Environment, health & safety | yes | workshop on gasification |



Development of Gasification Technology

