THE FUTURE OF MOLECULES

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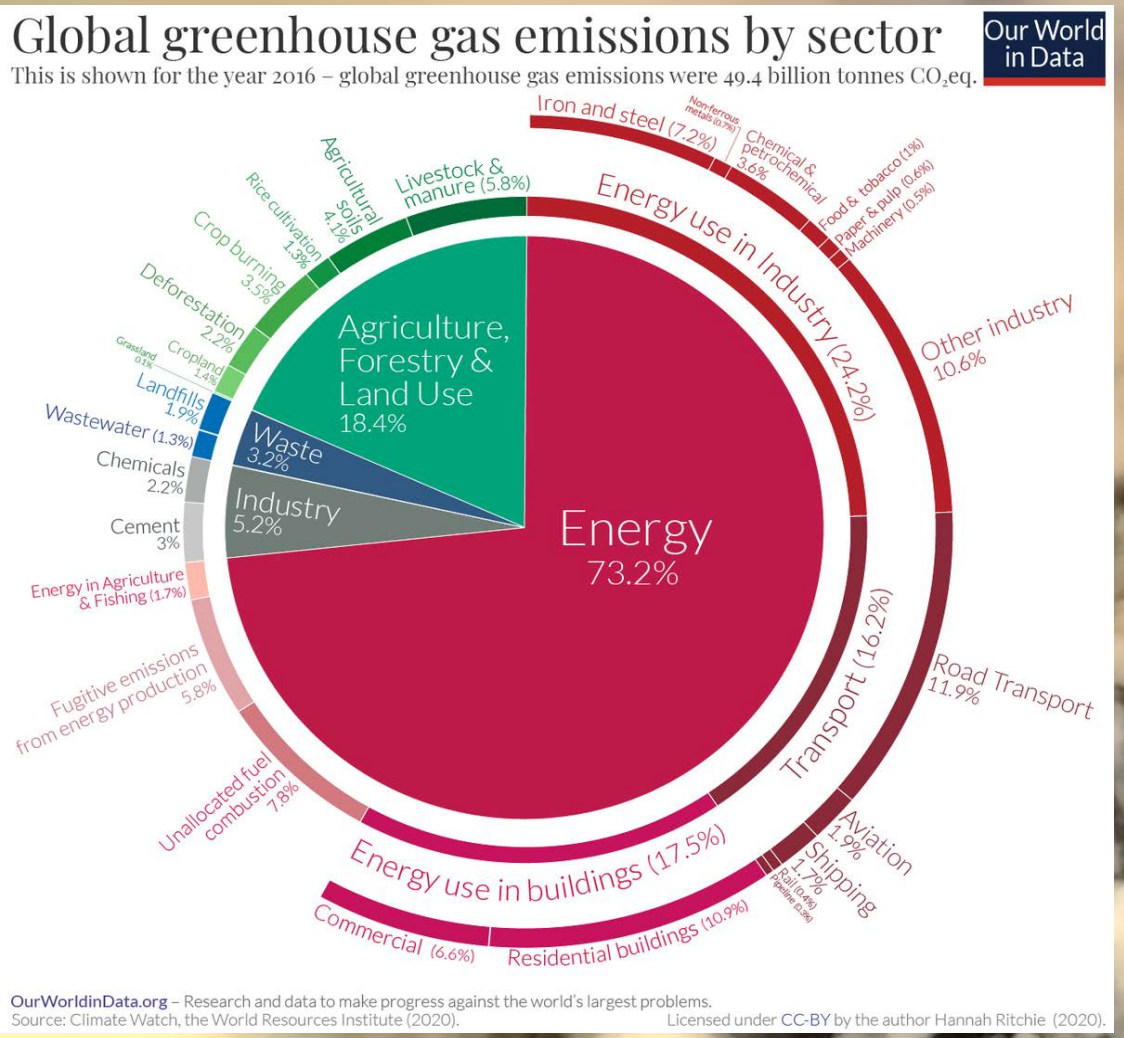
torrgas

Nobody knows(or wants to know)



Crop burning emits equivalent greenhouse gas as all shipping and aviation combined

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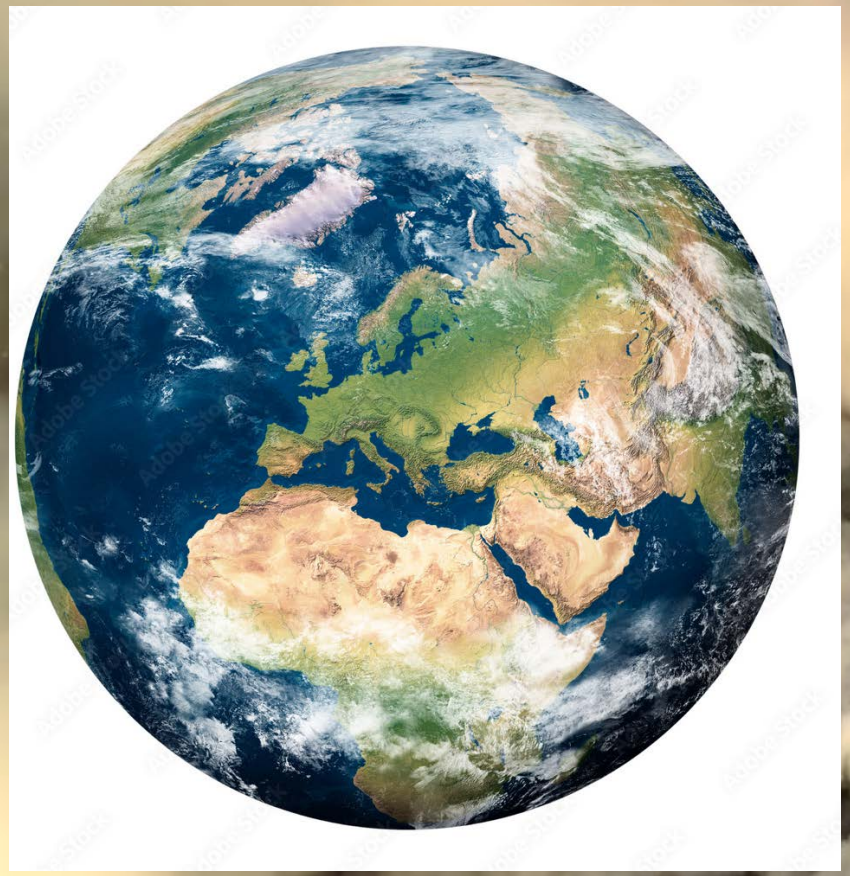


17x

Source:
David Attenborough

Torrgas solution: two-stage gasification of torrefied biomass (1)

- Application of torrefied biomass
  - Homogeneous feedstock => steady operation
  - Significantly lowering logistic costs
  - Large variety of feedstocks applicable => biomass availability

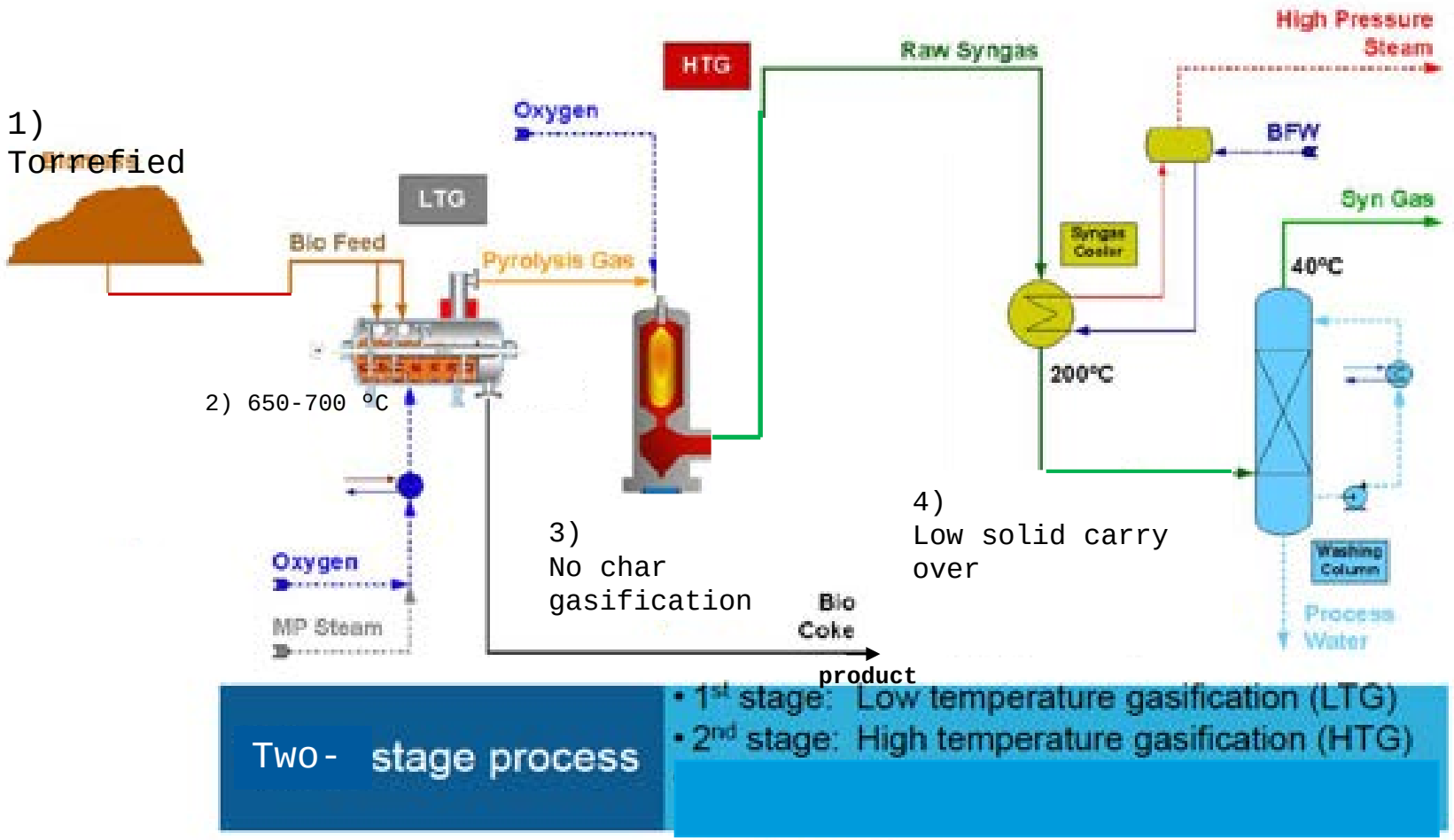
Y	Tough	N
Y	Fibrous	N
Y	Hydrophylic	N
Y	Biodegradable	N
Y	Heterogeneous	N
Y	Poor energy density	N

Torrgas solution: two-stage gasification of torrefied biomass (2)

Item	Feature
Step 1: low temperature gasification (< 750°C)	+ Removal of ash from pyrolysis gas => no ash in temperature gasifier => reduction in problems (no slagging)
	+ High quality byproduct: char
	- Lower efficiency to syngas
Step 2: high temperature gasification (~ 1200°C)	+ Cracking of tars => robust technology, high quality for application in catalytic processes 0.1 mg/Nm^3 dry basis)*
Step 2: oxygen based gasification	+ nitrogen free syngas => high quality syngas for application in the process industry

* typical for biomass gasifiers: FB 6,000-14,000 mg/Nm^3, downdraft 400-800 mg/Nm^3

Torrgas two-stage gasification sytem



1)
- More stable operation
- No dryer needed

2)
- Higher gas yield
- Lower char yield

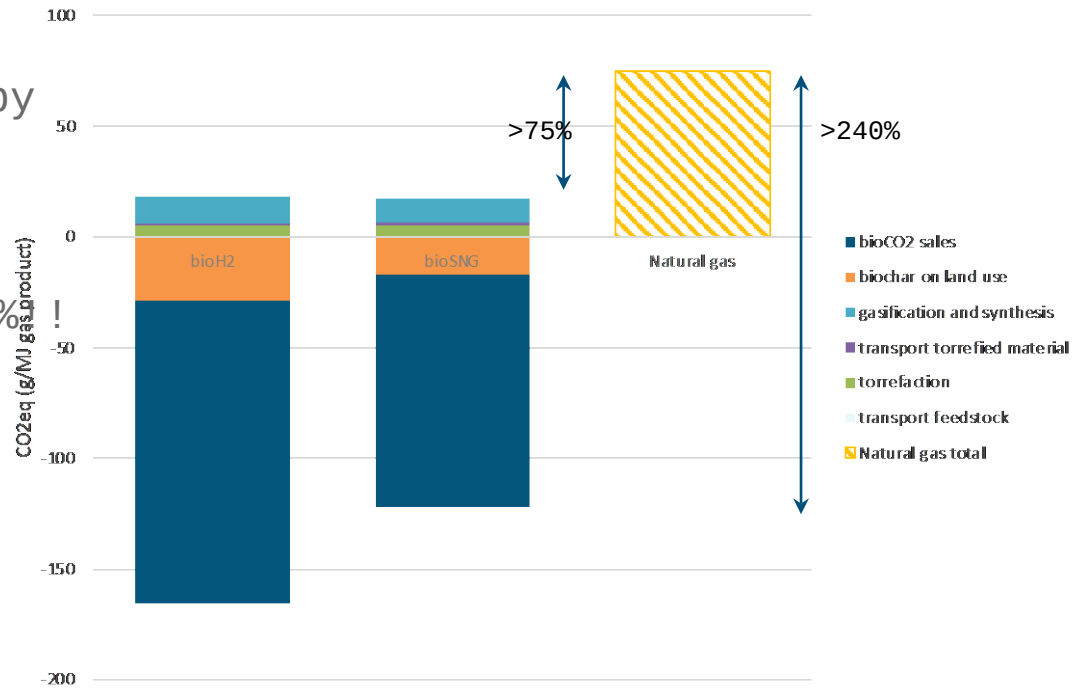
3)
- Minerals remain in biocoke => no slagging
- No char gasification required => simpler operation
- From 3 to 2 stage gasification

4)
- Low solid carry over => no cyclone needed

Technology: CO_2 emission reduction

Sustainability

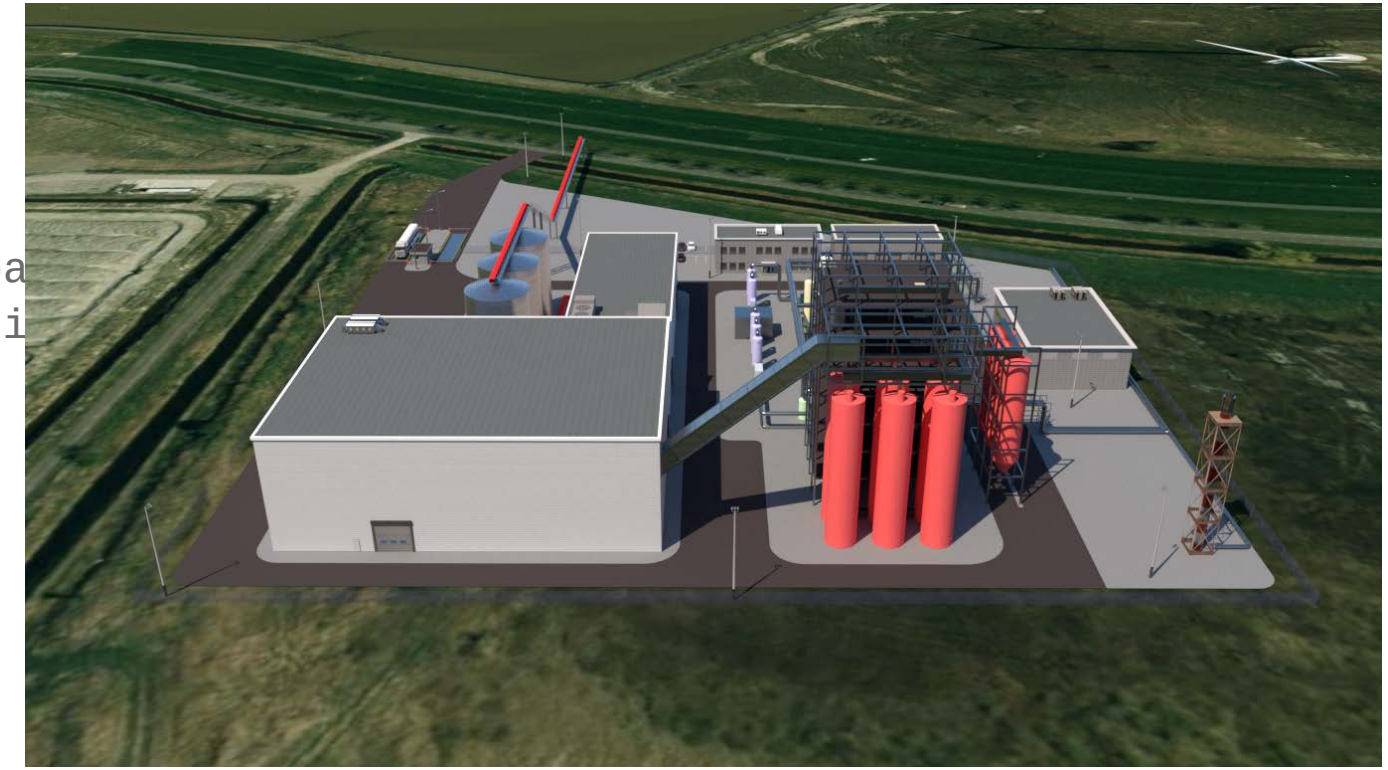
- LCA carried out by Studio Gearup according to REDII methodology
  - CO2 emission reduction >75%
- Further CO_2 emission reductions possible by
  - Application green power in the process
  - Selling of green CO_2
- Potential to become carbon negative > 240% ! Reduction(utilization biochar and liquid CO2)



Hydrogen projects under development (1)

brigh2 °
green hydrogen

- 50 MWth torrefied biomass input
- External torrefaction
- H_2 production capacity 6.5 kton/a @ 40 ba
- H_2 quality acccording to local grid speci
- Byproducts
  - biochar
  - Foodgrade CO2 (local offtake)



Torrgas gasification

- Available
- Affordable
- Sustainable

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