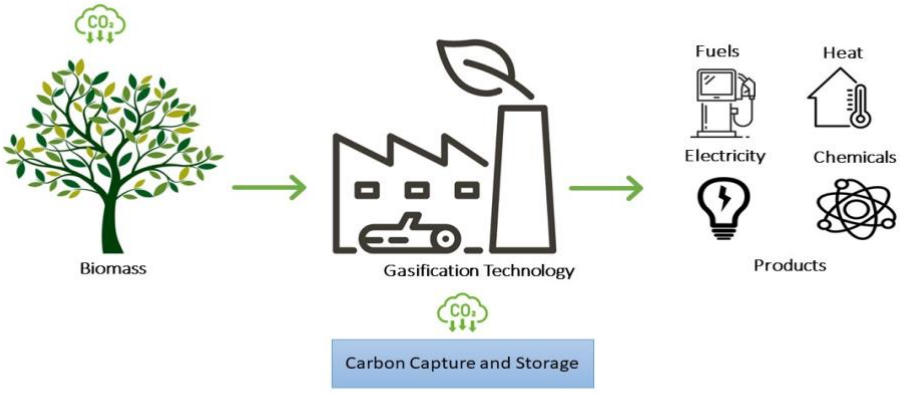
Factsheet: Biomass feedstock for fuelling gasification technologies



Advanced gasification technologies

Advanced gasification technologies (AGTs) refer to thermal conversion technologies (gasification or pyrolysis) for conversion of biomass or waste into aviation fuel, diesel, hydrogen, methane, and other hydrocarbons. AGTs are projected to play an important role in meeting UK's net zero emission targets especially when targeted towards use in sectors (heat, industrial, and transport) where options for decarbonization is difficult or expensive.

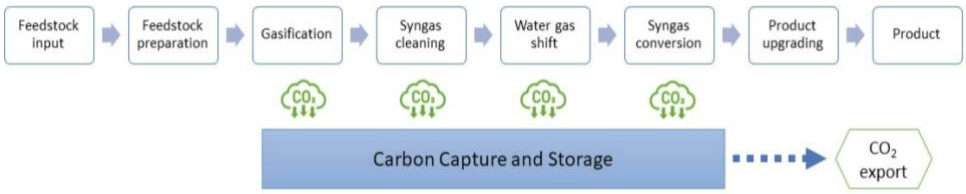
These conversion methods have the benefits over direct combustion by being able to significantly reduce emissions of pollutants into the atmosphere and generate high heat efficiency.

However, AGTs have yet to be commercialized and many projects on AGTs have attained limited success.

The department for energy security and net zero report titled "Advanced gasification technologies: review and benchmarking" provide a comprehensive overview of the current state of AGTs in the UK.

Biomass feedstock for fuelling gasification technologies

- Various biomass feedstocks are currently used in fuelling gasification technologies including refused derived fuel, plastic waste, municipal solid waste, and solid recovered fuel.
- Biomass feedstocks (such as energy crops, wood, waste wood, forestry, and agricultural residue) are more suitable feedstock to fuel AGTs for achieving significant impact on the transition to net zero emission.
- Gasification is considered to be the most efficient biomass to fuel conversion method.
- The biomass gasification process typically consists of key component systems involving feedstock input and combustion at high temperatures in gasification reactor to produce syngas. The syngas produced is cleaned to remove tar and other contaminants to produce syngas of acceptable quality for use in syngas upgrading systems to produce low carbon hydrogen and hydrocarbon products.



AGT technologies should be accompanied by carbon capture storage systems to reduce carbon dioxide emissions.

Feedstock suitability matrix

Fuel Type	Potential UK availability	Suitability for Gasification/Pyrolysis Technologies	Difficulty grade	Feedstock Pre-treatment Requirements	Feedstock Pre-treatment Costs	Net Zero impact	Feedstock cost	Overall Suitability
Clean Wood chip	Significant availability imported, limited UK availability	Generally good, suited to fluidised bed solutions	Low	Chipping and screening, drying	Low	Neutral, negative with CCUS	Hight	Good
Wood pellets	Imported, significant availability	Generally good, suited to fluidised bed solutions	Low	Chipping and screening, drying	Low	Neutral, negative with CCUS	High	Good
Energy crops SRC	Grown to demand	Generally good, most technologies	Low	Chipping and screening, drying	Low	Neutral, negative with CCUS	Very high	Good
Energy crops miscanthus	Grown to demand	Poor, requiring specialist equipment	High	Chopping and metal separation	Low	Neutral, negative with CCUS	Very high	Poor
Waste wood	Limited, current market close to saturation	Generally good, suited to fluidised bed solutions	Medium	Chipping and screening, density and metal separation	Medium	Neutral, negative with CCUS	Medium	Medium
Straw	Limited, current market close to saturation	Specialist equipment due to low melting point	High	Chopping and metal separation	Low	Neutral, negative with CCUS	Medium	Poor

Feedstock properties to consider for efficiency of the gasification process

Typical feedstock properties for design basis

Parameter	Unit	Wood Chip	Wood Pellets	Municipal Solid Waste
Carbon	% ar	25.50	47.43	26.30
Hydrogen	% ar	3.15	5.86	3.69
Nitrogen	% ar	0.15	0.28	0.77
Oxygen	% ar	20.89	38.85	15.64
Sulphur	% ar	0.01	0.02	0.13
Chlorine	% ar	0.01	0.01	0.96
Ash	% ar	0.30	0.56	17.86
Moisture	% ar	50.00	7.00	34.65
Net Calorific Value (NCV)	MJ/kg	8.14	17.24	9.70

Favourable conditions for AGTs

- Low ash content
- Lower content of alkali metals
- High content of cellulose and low content of lignin
- High heat value
- High content of volatiles and carbon combined with a low content of oxygen.
- Moisture content of feedstock

Further information:

Department for Business, Energy and Industrial Strategy (2021). Advanced gasification technologies: review and benchmarking. BEIS Research Paper Number 2021/038

Related Biomass Connect Articles:

Biomass feedstock for fuelling gasification technologies