



Placer County Air Pollution Control District

Woody Biomass Gasification Technology in California



**BIOMASS WORKING
GROUP**

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TREATING AND PROCESSING FOREST BIOMASS IN CA

One million acres of forested lands needing treatment in the coming years, resulting in millions of tons of forest wood waste to be processed

Natural Decomposition



Photo: L. Mortenson, USDA Forest Service

Pile Burning



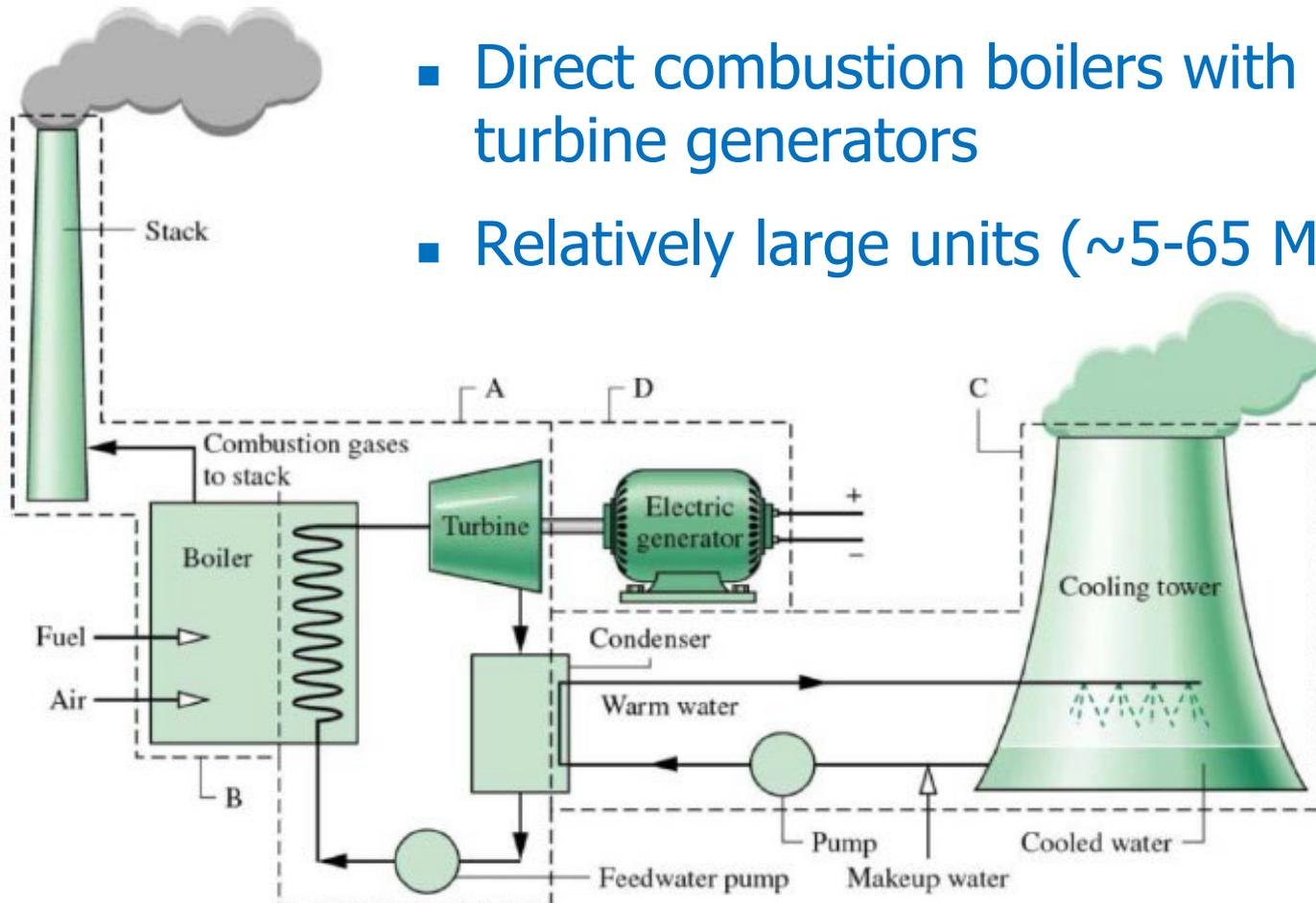
Photo: USDA Forest Service

There are other solutions available...



CONVENTIONAL BIOMASS SYSTEMS

- Direct combustion boilers with steam turbine generators
- Relatively large units (~5-65 MW)

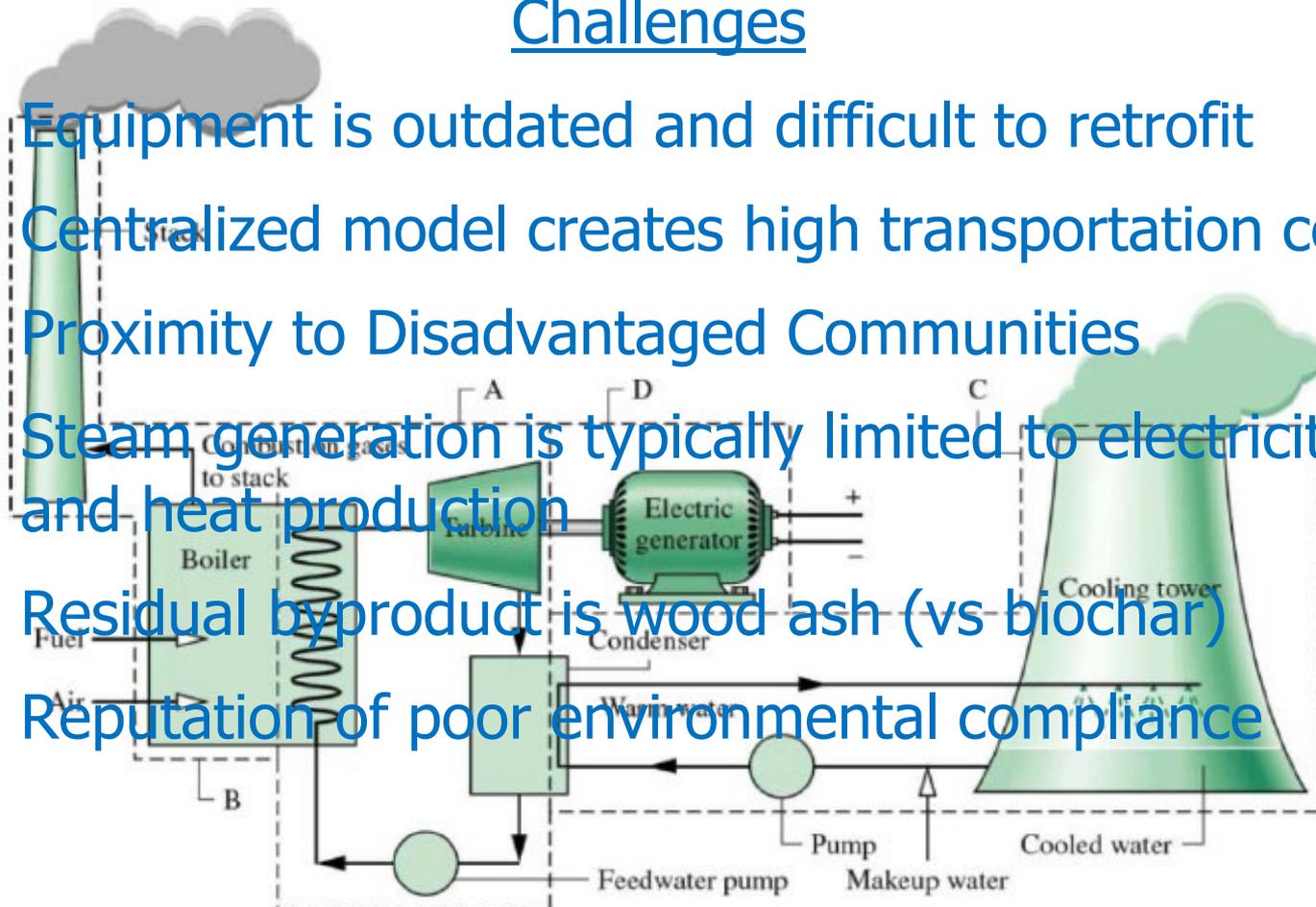




CONVENTIONAL BIOMASS SYSTEMS

Challenges

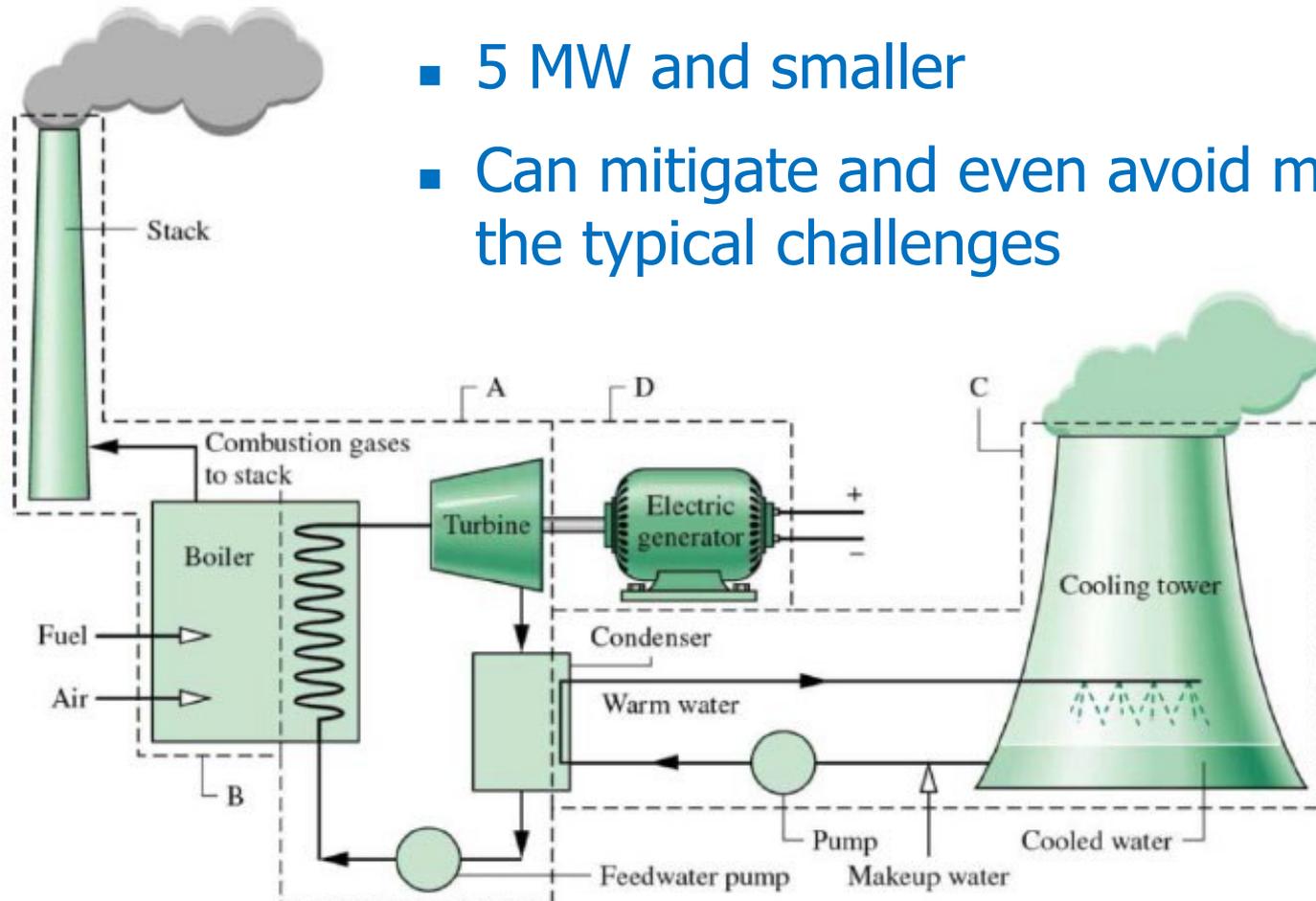
- Equipment is outdated and difficult to retrofit
- Centralized model creates high transportation costs
- Proximity to Disadvantaged Communities
- Steam generation is typically limited to electricity and heat production
- Residual byproduct is wood ash (vs biochar)
- Reputation of poor environmental compliance





SMALL-SCALE BIOMASS SYSTEMS

- 5 MW and smaller
- Can mitigate and even avoid many of the typical challenges

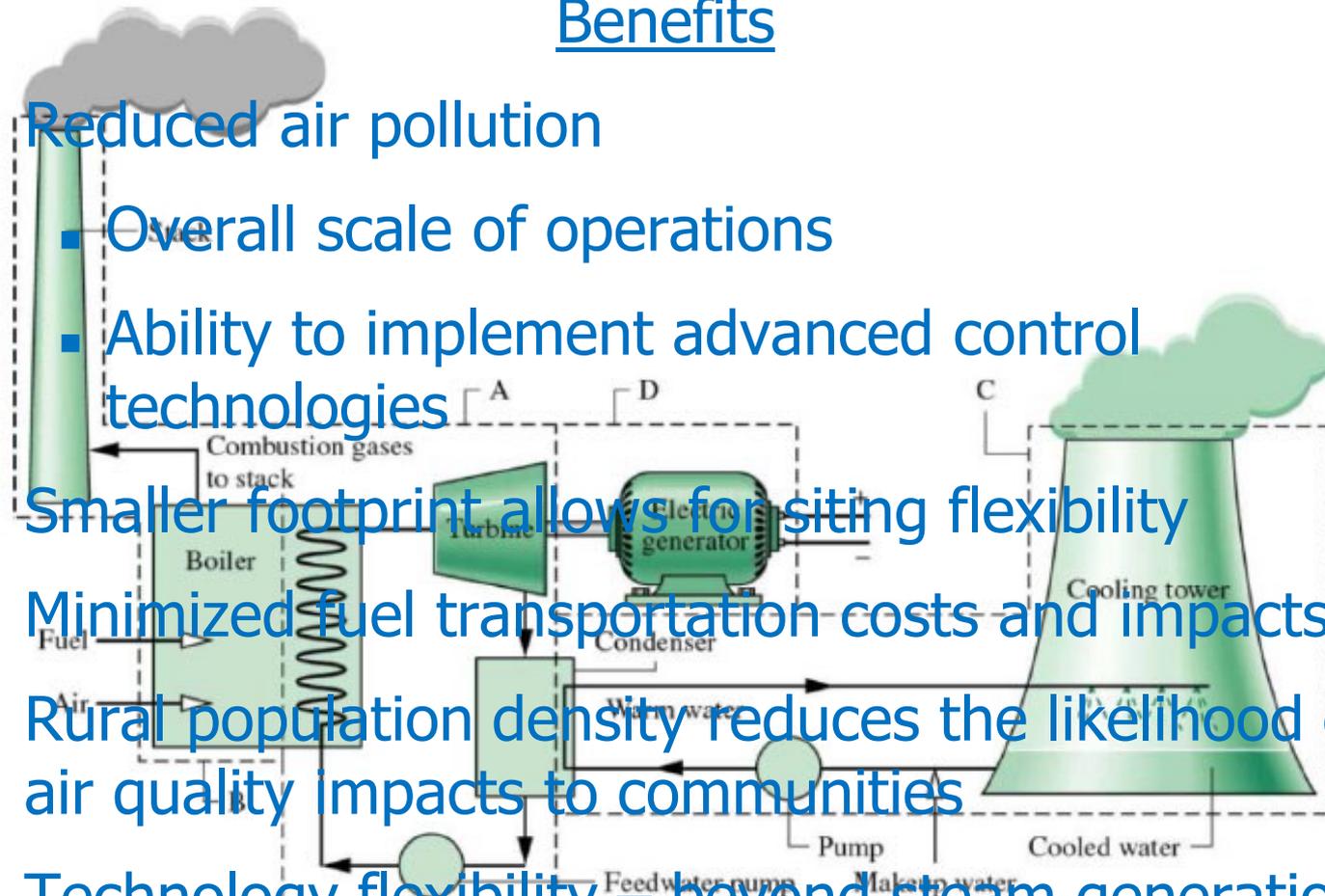




SMALL-SCALE BIOMASS SYSTEMS

Benefits

- Reduced air pollution
 - Overall scale of operations
 - Ability to implement advanced control technologies
- Smaller footprint allows for siting flexibility
- Minimized fuel transportation costs and impacts
- Rural population density reduces the likelihood of air quality impacts to communities
- Technology flexibility – beyond steam generation





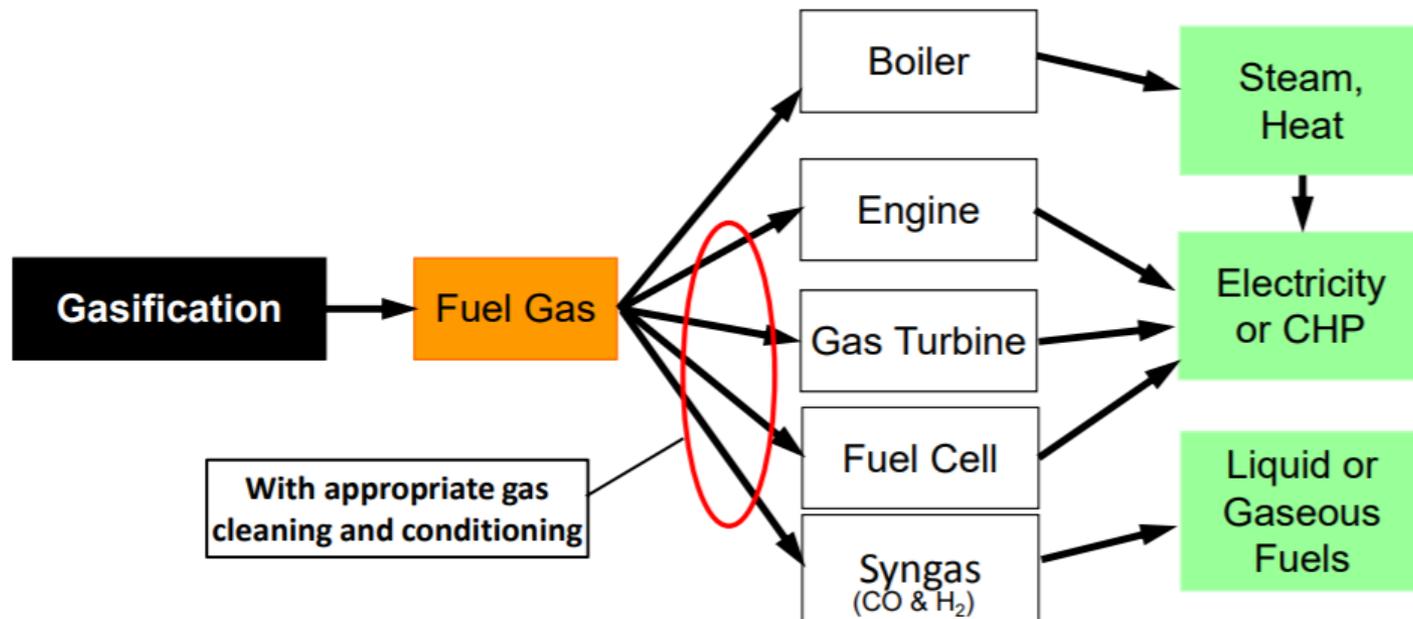
GASIFICATION / PYROLYSIS

- Thermochemical processes where biomass feedstock is converted to “producer gas” or “syngas” under reduced oxygen conditions
- Syngas consists primarily of CO, H₂, and light hydrocarbons
- If unconditioned, may contain various levels of tars or other contaminants



GASIFICATION / PYROLYSIS

- Syngas can be directly combusted or cleaned up and conditioned for a variety of other end-uses



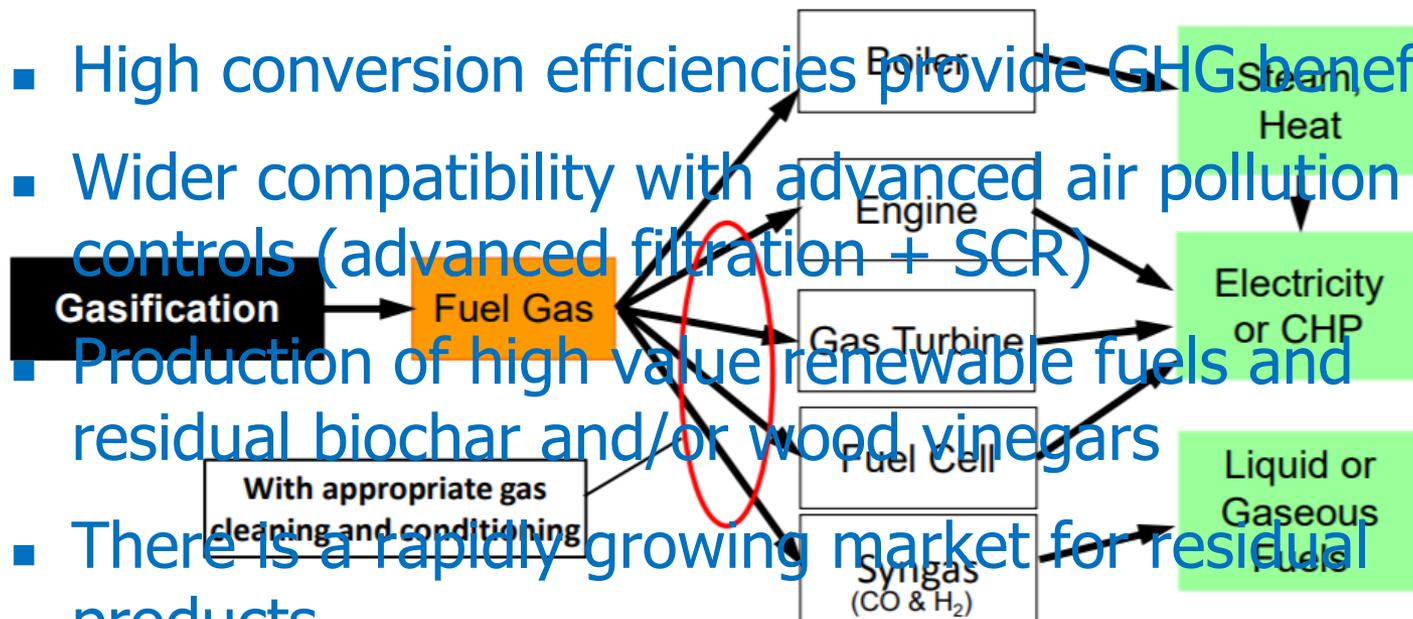
Gasification applications schematic (UC Davis 2015).



GASIFICATION / PYROLYSIS

Benefits

- End-product flexibility
- High conversion efficiencies provide GHG benefits
- Wider compatibility with advanced air pollution controls (advanced filtration + SCR)
- Production of high value renewable fuels and residual biochar and/or wood vinegars
- There is a rapidly growing market for residual products

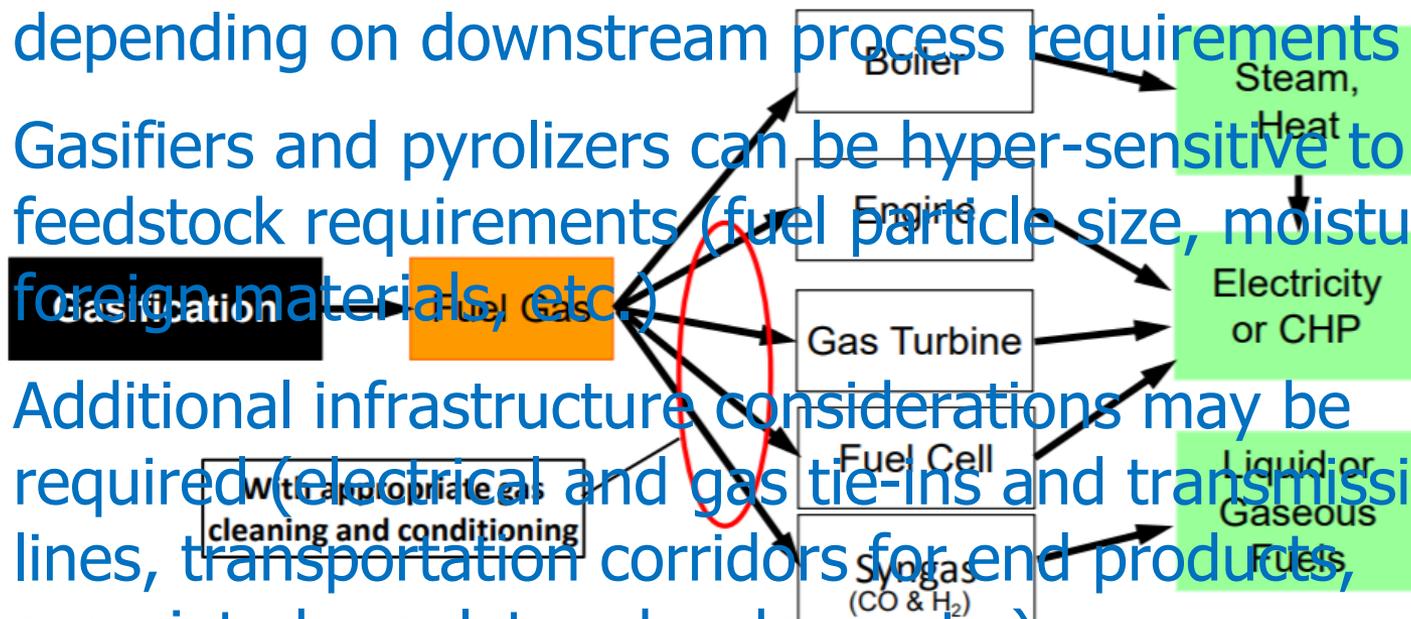




GASIFICATION / PYROLYSIS

Challenges

- Syngas cleanup can be difficult and costly to achieve depending on downstream process requirements
- Gasifiers and pyrolyzers can be hyper-sensitive to feedstock requirements (fuel particle size, moisture, foreign materials, etc.)
- Additional infrastructure considerations may be required (electrical and gas tie-ins and transmission lines, transportation corridors for end products, associated regulatory burdens, etc.)





CONCLUSION

- Various technologies exist today which can assist in processing California's current and future wood waste streams
- These technologies are not limited to large-scale conventional steam boilers
- Small scale systems can provide great improvements to air pollution emissions and overall system efficiencies, thus GHG reductions
- Can help to shift away from fossil fuels across multiple sectors (electrical production, transportation fuels, agriculture, etc.)



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