

Building a wood gasifier (also known as a biomass gasifier) is a DIY project that requires basic welding and fabrication skills. It's based on designs like the FEMA emergency gasifier or simplified downdraft systems, often built from scrap materials like barrels, tanks, or pipes. The goal is to produce syngas (primarily carbon monoxide and hydrogen) from wood or biomass, which can then fuel a modified gas-powered generator. Note that this produces toxic gases, including carbon monoxide, which is odorless and deadly—always build and operate outdoors in well-ventilated areas, use CO detectors, and never run indoors. Wear protective gear during construction and testing. Improper builds can lead to fires, explosions, or engine damage from tar buildup. If you're not experienced, consult local regulations and consider professional help.

Required Materials

- Fuel hopper: Metal container like a 55-gallon drum or old propane tank (cut in half or modified).
- Fire tube/reaction chamber: Steel pipe (e.g., 6-8" diameter, 16-24" long for a small generator; scale based on power needs—refer to sizing charts in sources).
- Grate: Perforated metal plate or bowl (e.g., stainless steel with 1/4-5/16" holes for ash sifting).
- Air inlet nozzles: Small pipes (1/2-1" diameter, angled downward).
- Cyclone filter: Built from pipe or a cone-shaped vessel to separate particulates.
- Radiator/cooler: Square tubing or pipes for gas cooling (non-galvanized to avoid zinc fumes).
- Condensate collection jar: Glass or metal container.
- Blower: 12V DC fan (e.g., from a car heater) for startup.
- Piping: Metal tubes for gas outlet, insulation for heat retention.
- Fuel: Dry wood chips, pellets, or chunks (moisture <20%).
- Miscellaneous: Chains for grate suspension, valves for air/gas mixing, seals/gaskets, and a pressure relief valve.
- For generator: Modify intake with a tee fitting and valve for syngas input.

Required Tools

- Welder (arc or MIG).
- Angle grinder with cutting discs.
- Drill with bits (various sizes).
- Measuring tape, clamps, and basic hand tools (wrenches, pliers).
- Nibbler or shears for sheet metal.
- Safety gear: Gloves, goggles, respirator.

Step-by-Step Instructions

1. **Design and Plan the System:** Determine size based on your generator (e.g., for a 5-10kW unit, aim for a 6" fire tube). Use free plans like the FEMA design for basics.

Ensure the setup includes four zones: fuel storage (hopper), pyrolysis (heating), combustion (gas production), and ash collection. Add a pressure relief to prevent explosions.

2. Build the Hopper and Reactor Core:

- Cut and weld a metal container into a hopper shape with steep sides (to prevent bridging).
- Attach the fire tube vertically inside: Weld a steel pipe to the hopper base.
- Install air nozzles at the restriction point (bottom of fire tube): Drill holes and weld 4-6 small pipes angled down to inject air, ensuring even combustion and tar cracking.
- Add the grate below: Suspend a perforated plate with chains or bolts; it should shake to remove ash.

3. Assemble the Gas Cleaning System:

- Build a cyclone filter: Weld a cone or cylinder with tangential inlet for gas to swirl, dropping particles into a jar.
- Add a radiator: Weld pipes in a zigzag pattern inside a jacket for cooling; connect so condensate drains back.
- Include filters: Pack with non-combustible material like steel wool to catch tar.

4. Install Startup and Control Components:

- Mount the blower: Connect to the air inlet for initial draft.
- Add ignition port: Weld a capped pipe near the grate for lighting.
- Pipe the output: Route cleaned gas to the generator via flexible tubing with a flare valve for testing.

5. Modify the Generator:

- Add a pre-carburetor: Install a tee and valve on the intake to mix syngas with air.
- For startup, use gasoline if it's dual-fuel; switch to syngas once running (engine vacuum pulls gas).

6. Test and Start Up:

- Fill hopper with dry wood.
- Ignite via port with a wick, turn on blower.
- Monitor for blue flame at flare (indicates good gas); adjust air.
- Connect to generator and run at partial load initially.
- Clean filters regularly to avoid clogs.

For detailed diagrams and variations (e.g., no-weld versions using bolts), check tutorials like those on Instructables or YouTube. Efficiency is about 50-70% of gasoline, and expect to refuel every 1-2 hours. Always prioritize safety—CO poisoning kills quickly.