

Run of the River

In-stream Hydropower

By removing the need for a traditional dam-reservoir system that conventional hydropower relies on, run-of-the-river hydro installations bypass many of the ecological concerns such as anadromous fish disruption and land conversion. Such systems are very diverse in their designs, allowing them to be placed anywhere from the top of a mountain stream to the bottom of a large river, each without disturbing the natural flow of water.

Although altering a river in any way will impact the ecosystem, if a project is planned, designed, and regulated well, the ecological impact of micro-hydropower is fairly minimal. Diverting water from the river can be an issue if it exceeds the regulated amount. If the water level becomes too low, the temperature of the water may increase and negatively impact the ecosystem.

Pros

- Has minimal impact to stream flow
- Does not impact fish migration or lifecycles
- Many different designs for different stream types

Cons

- Disrupts stream for installation and maintenance
- Only produces energy when stream is flowing

Cow Power!

Dairy Anaerobic Digesters

Anaerobic digestion is a type of decomposition facilitated by a diverse group of microorganisms in an oxygen free environment. The decomposition process can occur with many feedstocks including waste grease, sugar/carbohydrate crop, food waste, agricultural residue, and manure among many other materials. By controlling the process, these waste residues can be converted into value added products including biogas (methane), electricity, and solid/liquid fertilizer.

With the manure produced from dairy cows in feeding and contained facilities, farms are able to collect their manure into a digester to convert it into biogas and then electricity!

Pros

- Adds value to dairy byproducts
- Can be used by many different farm types
- Produces solid fertilizer as output
- Reduces natural methane emissions

Cons

- Large upfront cost to a farm
- Small farms may not produce enough manure
- Still generates carbon dioxide

Pyromania

Biochar and Syngas

Almost any type of organic matter can be converted into syngas (methane) through a process called *pyrolysis*. From raw wood to crop residue or even cow manure, by heating the stock in the absence of oxygen, a stew of hydrocarbons will be produced which can then be used to run a turbine, or be converted into other types of fuels including biodiesel.

In general, pyrolysis occurs when the feed stock is heated to around 500 °C where the carbon structures are broken down, releasing a combination of CH₄, H₂, CO₂, and CO which can then be condensed into a liquid fuel or be used directly for electricity production.

Pros

- Can use many different feed stocks including otherwise unusable materials
- Production can be carbon-neutral
- Can be an effective way to sequester carbon in inert biochar

Cons

- Often uses raw wood which requires land
- Large startup costs

Long-term Sustainability

Of the three energy sources listed above, the most sustainable source would subjectively be dairy-based anaerobic digesters. This is because they utilize a byproduct of another system which inherently ensures a consistent input. The regulations regarding digester facilities is very friendly to new construction, which is as opposed to the other listed sources which often reach regulatory roadblocks.

The major factor here is that biodigesters work well with our current system of energy production, by allowing them to be distributed within a grid network for electricity production or using the biogas within existing networks.

Inspirational

Bio-based alternative fuels to be some of the most interesting and useful alternative fuel sources currently being developed. This includes biochar and biodiesel type fuels. The combination of chemistry and natural products that go into their production make them so interesting. From a simple feedstock like wood or an oil seed, you can create so many different types of fuel using very simple processes. Many of these fuels can also be used with current infrastructure with facilitates the energy transition process by reducing some barriers to adoption.



Instagram



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