The Myth of Clean Hydropower

Dams and Reservoirs Emit Greenhouse Gases and Make Climate Change Worse

Reservoirs are a major source of global greenhouse gases, scientists say

By Chris Mooney  September 28, 2016  Email the author

Switzerland’s Grimsel reservoir dam, which provides hydroelectric power; a new study suggests reservoirs contribute more than had been known to greenhouse gases. (EPA/Peter Klaunzer)
Dams Create Many Problems

- Dams Block Rivers – Fish, Sediment, Nutrients, Water.
- Dams Almost Always Make Water Quality Worse.
- Dams Can Cause Extinction to Fish and Aquatic Life.
- Dams Displace People, and cause human rights violations.
- Dams are Expensive.
- Dams can make flooding worse.
- Dams exacerbate coastal flooding, beach erosion, and sea level rise.
- Dams increase disease in humans.
DAMS: The Methane/GHG Problem

Since that time, studies have been done by:
- U.S. EPA
- U.S. Army Corps
- Dozens of international university research scientists
- IPCC scientists (2006 Kyoto Protocol)
- IPCC 2019 Update
- U.S. National Science Foundation

In 2015 and 2016, global media attention began showing up in the Washington Post, Climate Central, EcoWatch, Smithsonian, Science Magazine, The Guardian, Mongabay, etc.
How Dams and Reservoirs Create GHG Emissions: 1. Deforestation

- Forests sequester carbon.

- Estimates: Billions of acres of forests have been cleared worldwide for hydropower (reservoirs plus transmission lines). These forests do not regrow and are flooded.

- Over 6 million acres have been flooded in Quebec.
How Dams and Reservoirs Create GHG Emissions: 2. Methane and CO2

(anaerobic breakdown of organic matter)
How Dams and Reservoirs Create GHG Emissions: 3. CH4/CO2/N20

DOWNSTREAM: Dried-up Wetlands, Riparian Areas, and Mangroves
Dam and Reservoir Greenhouse Gas Emissions Are Worse Where:

- the dam is bigger and the reservoir is larger, and especially where the surface area of the reservoir is larger;
- the weather is warmer and wetter, and the water temperature of the reservoir is warmer;
- the initial flooding of the landscape involves large areas of vegetation;
- more vegetation and sediment run off into the reservoir;
- the reservoir’s water level goes up and down on a seasonal or hydropower-ramping cycle causing vegetation to grow on the dry banks of the reservoir, and then become submerged when the reservoir level rises causing that vegetation to drown and decompose;
- the reservoir is newer and the landscape more recently flooded;
- the reservoir is near agricultural areas where fertilizer-heavy water and erosion runs off into a reservoir feeding the biological cycle that grows algae and other submerged vegetation;
- and, where any other type of heavy nutrient load is pouring into a reservoir including that from direct human wastes, stormwater runoff, or wastewater treatment plants.

Big, flat, warm reservoirs in tropical countries are the worst. Canadian reservoirs can also be consequential GHG emitters.
“Those researchers suggest all large reservoirs globally could emit up to 104 teragrams of methane annually. By comparison, NASA estimates that global methane emissions associated with burning fossil fuels totals between 80 and 120 teragrams annually.” — Climate Central 2014
Hoover Dam and Lake Mead:

Hoover Dam is a hydroelectric plant that supplies electricity to all of southern California.
### GHG Emissions from Quebec Hydropower

Professor Bradford Hager, MIT

#### Caniapiscau Reservoir

### Table 1: Estimates of CO2e for Hydro Québec’s reservoirs > 1 TWh/yr

<table>
<thead>
<tr>
<th>System</th>
<th>Area (km²)</th>
<th>TWh</th>
<th>CO2e g/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>data TWh</td>
</tr>
<tr>
<td>Robert-Bourassa (La Grande-2)</td>
<td>2835</td>
<td>37.4</td>
<td>37.4</td>
</tr>
<tr>
<td>Churchill Falls*</td>
<td>4816</td>
<td>30.8</td>
<td>30.8</td>
</tr>
<tr>
<td>Bersimis</td>
<td>798</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>La Grande 4</td>
<td>765</td>
<td>10.1</td>
<td>10.1</td>
</tr>
<tr>
<td>Manic 5</td>
<td>1973</td>
<td>9.8</td>
<td>9.8</td>
</tr>
<tr>
<td>La Grande 3</td>
<td>2420</td>
<td>8.7</td>
<td>8.7</td>
</tr>
<tr>
<td>La Grande 2A</td>
<td>2835</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>Manic 2</td>
<td>124</td>
<td>6.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Manic 3</td>
<td>236</td>
<td>5.8</td>
<td>4.9</td>
</tr>
<tr>
<td>Bersimis 2</td>
<td>38</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>La Grande 1</td>
<td>70</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Outardes 3</td>
<td>11</td>
<td>4.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Outardes 4</td>
<td>625</td>
<td>3.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Lafarge-1</td>
<td>960</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Eastmain-1</td>
<td>600</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>St-Marguerite 3</td>
<td>253</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Outardes 2</td>
<td>26</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Brisay/Caniapiscau</td>
<td>4318</td>
<td>1.2</td>
<td>1.2</td>
</tr>
</tbody>
</table>

### Chart: Carbon Footprint (kg CO2e/MWh)

- **Churchill Falls**

---

---
New York City Electricity Sources

- Sixty percent of NYC’s electricity is generated by natural gas powerplants.

- Natural gas GHG emissions range from 395 – 1,000 kg CO2e/mwh.

- Quebec hydropower facility GHG emissions range from 100 – 2,250 kg CO2e/mwh with an average of the 16 plants of 386.

**Outcome:** Switching from natural gas to Quebec hydropower will likely cause NYC to emit more GHG emissions, not less.
National Initiative Has Begun
TellTheDamTruth.com