Change in Run-Of-River Power Production Calculated with the New Climate Change Scenarios CH2018

Tobias Wechsler, Massimiliano Zappa and Manfred Stähli, Swiss Federal Research Institute WSL

SCCER SoE Task 2.1 meeting, 03 Sep 2019, Lausanne
Climate change impact on Swiss hydropower production: a synthesis of the current knowledge

2019

Supported by:
Schweizerische Eidgenossenschaft
Confédération Suisse
Confederazione Svizzera
Swiss Confederation
Innosuisse – Swiss Innovation Agency
Run-of-river power plant Birsfeld (Photo: commons.wikimedia.org)
CH2018 – Update of the climate change scenarios for Switzerland

Technical Report

Temperatur
Abweichung von der Normperiode 1981-2010
2060
Sommer
RCP8.5
Mittlere Schätzung

© Klimaszenarien CH2018
Calculating the change in RoR power production

Mid-century or 2060: Refers to the period from 2045 to 2074
End of the century or 2085: Refers to the period from 2070 to 2099
Calculating the change I

**Step 1:** Measured (1981-2010) or simulated (future; with changed meteorological variables) **daily mean runoff**

**Step 2:** Construction of **Flow Duration Curve** (ordering by size) for a year or a half-year

**Step 3:** Calculation of the **usable water volume**
Calculating the change II

\[
P [kW] = \varphi \times g \times \eta \times MQ \left( \frac{m^3}{s} \right) \times h [m]
\]

\[
P [kW] = 1 \times 9.81 \times 0.8 \times MQ \left( \frac{m^3}{s} \right) \times h [m]
\]

\[
\begin{align*}
\varphi &= \text{Density} \\
g &= \text{Gravitation} \\
\eta &= \text{Efficiency}
\end{align*}
\]

\[\sim 8\]

Calculation of the current and future power production with the assumption of unchanged installation and residual flow regulations.
### Selection of RoR plants in Switzerland

<table>
<thead>
<tr>
<th>Name of power plant</th>
<th>River</th>
<th>Annual production according to operators [GWh/a]</th>
<th>Annual production calculated [GWh/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albbruck-Dogern</td>
<td>Rhein</td>
<td>580</td>
<td>581.4</td>
</tr>
<tr>
<td>Birsfelden</td>
<td>Rhein</td>
<td>550 – 560</td>
<td>556.8</td>
</tr>
<tr>
<td>Amsteg</td>
<td>Reuss</td>
<td>460</td>
<td>461.7</td>
</tr>
<tr>
<td>Lavey</td>
<td>Rhone</td>
<td>400</td>
<td>412.1</td>
</tr>
<tr>
<td>Biaschina</td>
<td>Ticino</td>
<td>380</td>
<td>360.6</td>
</tr>
<tr>
<td>Wildegg-Brugg</td>
<td>Aare</td>
<td>300</td>
<td>289.2</td>
</tr>
<tr>
<td>Aletsch</td>
<td>Massa</td>
<td>138</td>
<td>183.2</td>
</tr>
<tr>
<td>Reichenau</td>
<td>Rhein</td>
<td>110</td>
<td>111.6</td>
</tr>
<tr>
<td>Aue</td>
<td>Limmat</td>
<td>27</td>
<td>27.8</td>
</tr>
<tr>
<td>Windisch</td>
<td>Reuss</td>
<td>12</td>
<td>12.3</td>
</tr>
<tr>
<td>Glaris</td>
<td>Landwasser</td>
<td>7.8</td>
<td>7.5</td>
</tr>
</tbody>
</table>
hier vielleicht noch die fehlenden Werte in Spalte 3 ergänzen
Manfred Stähli; 15.08.2019
Results: HP plant Wildegg-Brugg - Aare
Results: HP plant Glaris (Davos) - Landwasser
Change in mean annual production
Change in mean winter production
Projection for RoR power production in Switzerland

• **Annual production:**

• **Winter production:**