Session: Downstream flows
What is a sustainable compromise?

Dr Helen Locher
Hydro Tasmania

For more information: www.hydropower.org/congress
Downstream Flows – an industry perspective (not a position!)

Presentation by Dr Helen Locher

2015 World Hydropower Congress
19-21 May 2015, Beijing, PR China
This presentation outlines NINE points that it is helpful to understand in relation to industry perspectives on downstream flow regimes.
1. Foregone generation through downstream flow regimes can limit targeted benefits from hydropower

- Hydro projects are to meet identified needs.
- Restricting generation potential can result in resource inefficiency and need for other generation

**Significant contribution…**

- 19 percent of electricity from hydropower – more than 50% in 63 countries
- dams support 30-40% of irrigated area & 12-16% of global food production
- 12% of all dams have a water supply function
- 75 countries have dams for flood control

Hydropower is proven, mature, predictable, price-competitive, long-lived, low O&M costs, low carbon, multi-use, provides grid services, source of electricity, water and follow-on benefits
2. Investors need certainty on requirements for hydropower developments

Requirements are best established at the outset.

Hydro power project life cycle
3. Water has a generation value that the hydro-generator seeks to maximise

**Water Price** = Value of Generation × Generation Foregone

**Value of Generation** = Flat Swap Contract Price + ½ REC Price + Water Scarcity Premium

**Generation Foregone** = MW hours per Mega Litre

---

### Hydro Tasmania water price for the 2014/15 season

<table>
<thead>
<tr>
<th>Reservoir or River</th>
<th>Generation foregone MWh/ML</th>
<th>Annual price per ML (Jul14-Jun15)</th>
<th>Summer price per ML (Dec14-Apr15)</th>
<th>Winter price per ML (Jul14-Nov14 + May15-Jun15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthurs Lake</td>
<td>1.8969</td>
<td>$93.57</td>
<td>$94.19</td>
<td>$92.94</td>
</tr>
<tr>
<td>Great Lake</td>
<td>2.2278</td>
<td>$109.88</td>
<td>$110.62</td>
<td>$109.15</td>
</tr>
<tr>
<td>Ex Poatina or S.Esk</td>
<td>0.2794</td>
<td>$13.78</td>
<td>$13.88</td>
<td>$13.69</td>
</tr>
<tr>
<td>Parangana (via mini)</td>
<td>0.7950</td>
<td>$39.21</td>
<td>$39.48</td>
<td>$38.95</td>
</tr>
<tr>
<td>Cluny Lagoon</td>
<td>0.1072</td>
<td>$7.86</td>
<td>$7.86</td>
<td>$7.86</td>
</tr>
<tr>
<td>Lake Meadowbank</td>
<td>0.0675</td>
<td>$7.86</td>
<td>$7.86</td>
<td>$7.86</td>
</tr>
<tr>
<td>Lake Pal Hanna</td>
<td>0.0731</td>
<td>$7.86</td>
<td>$7.86</td>
<td>$7.86</td>
</tr>
</tbody>
</table>

**Minimum Fee $7.86 per ML**

Updated 5 May 2014

4. Operational hydropower projects have differing abilities to accommodate changing expectations for downstream flows

- It can be difficult to retrofit cost-effective delivery mechanisms or accommodate the impact on generation revenues.

- Mature age facilities may have established new downstream equilibrium conditions that are generally accepted.
5. Downstream flow objectives should be clear and agreed, with practical indicators for success

- Predominance of ecological objectives should not be assumed.
- Criteria for judging success should be linked to parameters that are readily monitored.
- There are many compounding influences on the downstream environment.
6. Flow determination processes should be “fit for purpose”

- Major interdisciplinary studies are not always required.
- Local knowledge is valuable.
- Trial flow regimes with monitoring can be cost-effective.

Gordon River, Australia  Teesta River, India  Miel River, Colombia
7. Alternatives or offsets should be considered

- There may be many practical considerations around delivery of flows – turbine capabilities, valves, water value.
- Non-flow based mechanisms to achieve objectives can be preferred

*re-regulation storage*  *bank protection works*  *artificial spawning channels*
8. Dedicated downstream flow releases are not always needed

- Highly segmented channelized rivers
- Steep inaccessible river channels
- High tributary inflows downstream dam
- Tidally affected rivers
- Alternatives available to meet objectives
9. Costs should be apportioned fairly

- Downstream industries and enterprises may opportunistically benefit from releases
- Who pays for public good benefits?

**Example environmental flow delivery costs**

<table>
<thead>
<tr>
<th>River</th>
<th>Environmental flow</th>
<th>Foregone mean annual generation</th>
<th>Cost/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gordon River, Tasmania, Australia</td>
<td>Minimum flow + ramp-down options</td>
<td>0.8% (timing rather than volume incurs costs)</td>
<td>$2.2m to $3.2m AUD</td>
</tr>
<tr>
<td>Mersey River, Tasmania, Australia</td>
<td>Minimum flow</td>
<td>2.9%</td>
<td>$1.8m AUD</td>
</tr>
<tr>
<td>South Esk River, Tasmania, Australia</td>
<td>Minimum flow</td>
<td>2.9%</td>
<td>$0.8m AUD</td>
</tr>
<tr>
<td>Zambezi River, Mozambique</td>
<td>Minimum flow options</td>
<td>4.5% to 6.1%</td>
<td></td>
</tr>
<tr>
<td>Ume/Vindel River, Sweden</td>
<td>Minimum flow</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td>Upper Yuba River, California, USA</td>
<td>Minimum flow + ramp-down options</td>
<td>2.2% - 5.6%</td>
<td></td>
</tr>
</tbody>
</table>
There will be many case-by-case influences on the industry perspective on downstream flow regimes

**Company Characteristics**
- Multi-national / local
- Large / small-medium
- Public utility / private / PPP
- Hydropower experience
- Corporate policies / capacities

**Project Characteristics**
- Age / life cycle stage
- Large / small
- Reservoir / run-of-river
- Single HPP / hydropower system / cascade
- Location / geography / # dams

**Market Context**
- Single off-taker
- National or regional grid
- Trading market
- Market position

**Development Context**
- Developed / developing
- Regulatory requirements
- Institutional capacities

**Other**
- Project or corporate financial position
- Stakeholder issues and relations
Each case is individual
1. Foregone generation through downstream flow regimes can limit targeted \textit{benefits} from hydropower
2. Investors need \textit{certainty} on requirements for hydropower developments
3. Water has a \textit{generation value} that the hydro-generator seeks to maximise
4. Operational hydropower projects have differing \textit{abilities} to accommodate changing expectations for downstream flows
5. Downstream flow \textit{objectives} should be clear and agreed, with practical indicators for success
6. Flow determination \textit{processes} should be “fit for purpose”
7. \textbf{Alternatives} or offsets should be considered
8. Dedicated downstream flow releases are \textit{not always needed}
9. \textbf{Costs} should be apportioned fairly
Better understanding of the perspectives and issues for industry should help frame collaborative ways forward.