# Energy from Moving Water

**Symposium at Kulturhuset Stockholm, 2007-11-12**
**Reflections on the meeting: Peter Collins**

The search for energy from moving water is part of each nation's or region's effort to meet what seems to be a relentlessly increasing demand for energy, associated with growing populations and/or improving standards of living. These are long-term trends and have to be addressed in a way that is sustainable in the long term: i.e. reliably and without disproportionate environmental impact. For areas with appropriate geography, hydropower seems to be an attractive option from both perspectives.

However, as today's discussion has made clear, hydropower is also quite a complex option. We need to show ingenuity and lateral thinking to get the best from it. It was therefore fitting that the day should begin with Carin Blom and Catharina Backman extracting some magical music from the columns of still water in their array of glasses. This was a stimulus to the search for a fresh approach.

**Policy**

The opening session, setting out the policy context, highlighted that the achievement of a coherent energy policy requires many different groups to work together. Scientists, engineers and politicians have to recognise the constraints that each group faces, and all have to recognise the role of public opinion in influencing policy outcomes.

It is not just a matter of setting out the facts. Decision-makers have to struggle with the complexities of risk/benefit analysis when those gaining the benefit (for example, the inhabitants of a town well downstream from a hydroelectric dam) may be different from those bearing the risk (for example, by living just below the dam) or those paying the cost of having to move from the area flooded by a new reservoir. They also have to understand the nature of scientific and political uncertainty, and to make decisions even when not all relevant information is available. And, to add to the pressure, the quality of the decision-making with major civil engineering projects is publicly visible for a very long time.

Policy sometimes drives science rather than following it. That is not necessarily a bad thing: think of the moon landings, which were established as policy before the science and engineering were in place to deliver them and which stimulated a host of positive developments. The counter-example is President Nixon's campaign to cure cancer, which failed because the science could not be delivered to order. In energy policy, there is a danger that the imperatives of guaranteeing a secure and environmentally sustainable supply can lead decision-makers to seize on unrealistic fashions. It remains to be seen, for example, whether the EU's approach to renewables, described by Grant Lawrence, is technically deliverable, and the current political expectations for biofuels are almost certainly misplaced.

What is clear, as Anders Wijkman emphasised, is that policy objectives are most likely to be achieved if the countries of the EU work together to support the needed R&D and to create the right economic conditions. On a day when most of the speakers were scientists or engineers, it was striking that it was only the MEP Wijkman who called for additional funding for research!

A pre-requisite for political acceptability is safety, especially with structures like dams where failure is likely to have catastrophic consequences. So this naturally attracts much policy attention. And there is more than one view. Rebecca Hort reported the Swedish National Audit Office's investigation that identified problems with official monitoring of dam safety in Sweden. Urban Norstedt put the industry position that zero risk was impossible and that a prescriptive regulator without the necessary technical competence was the worst scenario for delivering safety. They could both be right, of course.

**Technology**

Moving water comes in many forms. We heard from Christer Nilsson that, globally, one dam is completed every day – a fact that merits as much publicity as the much quoted completion of one or two coal-fired power stations per week in China. However, large-scale hydropower is not the whole story.

Arni Snorrason enticed us with the prospect of pico hydroinstallations and the possibility of integrating them into a national grid. He then took us to his native Iceland and the importance of geothermal energy. That is well known, but I was surprised to learn that no fewer than 73 countries had the possibility of extracting geothermal energy, and that globally the theoretical potential was a hundred times that of hydropower. Snorrason stressed the need to think on an EU or larger scale, not just locally or nationally.

Anders Wörman pointed out that, globally, renewables delivered 13.1% of total energy supply, with hydropower providing 2.2%. Within the EU, at least 75% of hydropower potential was already being exploited. In contrast, Mats Leijon argued that wave energy and tidal energy were at a very early stage of development, despite having much greater potential at EU level than traditional hydropower. The low priority given to their exploitation was matched by the very modest research effort currently under way – though one of the major research centres was up the road at Uppsala.

**Constraints and opportunities**

Arni Snorrason warned us to allow for the impacts of climate change on the prospects for extracting energy from moving water. If the river above a dam was diverted or dried up, the dam would be little use as a source of electricity. Such impacts are as yet difficult to predict at local level, but they could come into play over the lifetime of a major installation and therefore add to the complexity facing the decision-maker.

A different sort of constraint emerged in Kirit Parikh's description of hydropower in India, where opportunity cost was the theme and conflict with irrigation was increasingly common. This highlighted how policy-makers had to thread their way through many interconnected social, political and ecological issues: merely working out how to build and finance a hydroelectric dam was the easy bit.

Ghislain de Marsily expanded on the theme of interconnectedness – water for direct power generation had to be balanced with water for cooling power stations, irrigating land and sustaining ecosystems. Such issues were likely to be exacerbated, especially in the Mediterranean region, as climate change kicked in.

Problems like the build-up of sedimentation behind a dam are reasonably familiar. Jamie Pittock exposed a less expected instance of the law of unintended consequences, with his description of the effect that a dam could have on the temperature of river water a long way downstream and the impact of this on the viability of populations of fish that could breed only within narrow ranges of temperature. He stressed the need for better environmental impact assessments.

Bengt Kriström took an economist's approach to dealing with unintended consequences, with his analysis of how much it was worth paying (in additional construction costs and lost revenue) to enable salmon to swim upstream past a dam. It was an instructive exercise in modelling uncertainty – an experience common to economists and scientists alike. It turns out that the public – at least in Sweden – cares a good deal about salmon.

**Conclusion**

The image chosen to promote the day's discussion is a large wave, full of urgency and dynamic intent (if a wave can be said to have intent!). We owe it to ourselves and to following generations to display comparable urgency and dynamism in how we approach energy policy. In doing so we must also beware the destructive potential of moving water – the endless capacity for good intentions to be accompanied by harmful unintended consequences. So sometimes we have to sit still and allow ourselves to think laterally, listen to the music while we muse on how to keep the lights on.