IRENA
International Renewable Energy Agency

9 December 2019

Tenth session of the Assembly
Abu Dhabi, 11-12 January 2020

Background Note
Ministerial Plenary Session
Hydropower

1. The *Ministerial Plenary Session on Hydropower* at the tenth session of the IRENA Assembly will build on the momentum created at the ninth IRENA Assembly and facilitate an exchange of experiences on strategies being implemented to utilise hydropower worldwide in addressing current and future needs. The discussions will address opportunities and challenges and will draw on the experience and expertise in both, the public and private sector to develop solutions while minimising associated risks.

2. During the ninth session of the Assembly, IRENA organised a plenary session entitled "The Changing Role of Hydropower in the Energy Sector Transformation", where awareness was raised amongst decision-makers regarding the importance of adequate operation and maintenance (O&M) regimes for ensuring the longevity of existing hydropower fleets around the world, and the importance of ensuring access to finance for this purpose. The opportunities and challenges around strategic reinvestment and refurbishment of existing fleets were discussed, as well as the solutions for the accelerated adoption of modernised and innovative O&M protocols for the current and emerging hydropower fleet.

Context

3. Hydropower is the largest source of renewable electricity in the world, supplying around 17% of the world's electricity and providing jobs for 18 million people globally. Hydropower is projected to remain one of the major sources of renewable electricity generation in the future, especially in countries which possess significant untapped potential. However, many of these countries have difficulties in ensuring availability and reliability of their hydropower assets. Constraints in strategic planning, utilisation of new technologies, capacity building and management remain common challenges.

4. With the growing contribution of variable renewable energy (VRE) in the power system, new operating regimes and strategic planning for hydropower are important to address the intermittency of feed-in from other sources. The evolving demands for flexibility require investments in advanced hydropower design, maintenance and modernisation; otherwise, there would be increasing performance losses, higher costs, accelerated degradation of components, and escalating safety concerns.

5. The Ministerial Plenary Session will focus on four central themes: i) hydropower's adjusted role in providing flexibility in high-VRE systems; ii) the contribution of hydropower storage in the energy transition; iii) climate change resilience and adaptation; and iv) financing hydropower activities, including strategic reinvestment, policy and market mechanisms.

(i) Flexibility

6. Addressing the vast and continuing increase in the deployment of VRE requires an increase in the flexibility of the power system. There is a need to maintain a reliable and continuous service despite potentially rapid changes in supply or demand. Flexible power plants, grid interconnection, demand-side response, and storage can provide this flexibility. Both existing and new hydropower plants can provide an important source of flexibility. Further research and investment to increase the flexibility of hydropower will thus increase its contribution.

7. At least 400 GW, a third of global hydropower capacity, will be due for modernisation and life-extension over the next two decades. A similar amount of new capacity is currently being planned. This presents a timely and significant opportunity to incorporate the latest technology to improve hydropower's flexibility, including an array of digital solutions, for greater complementarity with VRE sources.

(ii) Storage

8. Hydropower projects with reservoirs, as well as pumped hydropower storage (PHS), represent the vast majority of energy storage capacity worldwide. Hydropower can be switched off when there is enough input from VRE sources, while storing energy in its reservoir as water accumulates. In addition, PHS provides large-scale energy storage by absorbing surplus VRE in the system. Both forms of hydropower can then release the energy to the system when there is a shortfall from other sources. Storage intervals can be from seconds to seasons and can also provide a suite of qualitative power-system services to support reliable grid operation.

9. Despite declining costs for electro-chemical batteries, the storage of energy in water is expected to remain the predominant solution for grid-scale stability. As much as 75 GW new PHS capacity could be added in the next 10 years. The services of hydropower storage and chemical storage are complimentary; they can work in concert to support the increasingly volatile and complex power grids of the future. For example, chemical batteries can address short duration events, with hydropower taking over for longer periods. However, the current market and policy frameworks are not encouraging investment in new or even existing hydropower assets to provide these services.

(iii) Climate

10. Increased extreme weather events and changes in hydrological patterns are being experienced in a world altered by climate change. Planning hydropower facilities to be resilient throughout their long life will ensure that future generations inherit infrastructure that will not be compromised by climate change. Industry practice is evolving in this area and support is needed to assess existing facilities.

11. At the same time, large-scale reservoirs represent significant possibilities to store vast amounts of freshwater. Carefully planned, this infrastructure can provide essential services, including: regulated flows, flood and drought management, irrigation, municipal water supply, aquaculture and transportation. Market forces do not incentivise hydropower design and operations to provide these services, and rarely does policy fill this gap.

(iv) Finance and Investments

12. Well planned hydropower projects can provide grid stability, energy storage and flexibility for future renewable energy systems. In addition, low-carbon hydropower contributes to meeting national emission-reduction targets to mitigate climate change and provides climate adaptation services through flood protection and drought management.

13. Preparing projects according to established international industry practice and optimising multiple services, will help ensure that the right projects are built in the right place. Project preparation facilities could help in bringing forward a pipeline of hydropower proposals that are both more sustainable and beneficial. This would also reduce the financial risks associated with hydropower project preparation for governments, developers and investors. New sources of green finance and refinance are being explored to match the risk profile of hydropower through its life cycle.

Objectives of the session

14. The Ministerial Plenary Session will facilitate an exchange of experiences among the participants with the objective of identifying key opportunities and challenges in the sector.

15. The event will provide Ministers and key private sector decision-makers greater insights on the role of hydropower in the energy transition as a source of flexibility, reliability and resilience to power systems.

16. The Ministerial Plenary Session will also raise awareness on the need for financing hydropower activities, including strategic reinvestment policy and market mechanisms and the importance of fleet modernisation to ensure the longevity of existing infrastructure, as well as on the need to account for climate resilience and adaptation measures.

Guiding questions

- How will the role of hydropower in the energy transition evolve in the coming years?
- What are the solutions needed to ensure that financing needs for both, refurbishing existing fleets and deploying new projects are met?
- How can regulatory frameworks/markets be modernised to appropriately compensate grid balancing and flexibility services provided by hydropower projects?
- How can IRENA support its Members to foster the continued deployment of hydropower?
- What are the specific areas where IRENA should focus its efforts (technology, innovation, policy, markets, cooperation, sustainability)?

Associated Publications

- Innovation Landscape Brief: Innovative operation of pumped hydropower storage (forthcoming)
- Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables (2019)
- Planning for the renewable future: Long-term modelling and tools to expand variable renewable power in emerging economies (2017)