IEA Implementing Agreement For Hydropower Technologies & Programmes

Overview of IEA Hydropower Implementing Agreement (IEA Hydro)

Promoting Flexible Use of Hydropower,
Tokyo, Japan
4th February, 2013

IEA Implementing Agreements

- Since 1974, the IEA has provided a structure for international co-operation in energy technology R&D
- The Implementing Agreements (IA) of the IEA are the vehicles of co-operation between countries and organisations focusing on particular energy sources
- Research projects are conducted by working groups of the Implementing Agreements called Annexes
- Work is conducted in phases of up to 5 years

Membership of IEA Hydropower

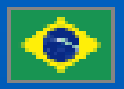
Who can join?

- all OECD & non-OECD countries
- Governmental Agencies
- International Organisations
- Companies

★ All Participants must join at least one Annex

Member & Participating Countries

Member Countries


Brazil – Ministry of Mines an Energy


Finland – TEKES (Finnish Funding Agency for Technology & Innovation) & Kemijoki Oy

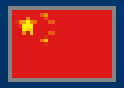

Japan – New Energy Foundation (NEF), Agency for Natural Resources & Energy (MITI)


Norway – Norwegian Water Resources & Energy Directorate (NVE)


US – US Department of Energy, Oak Ridge National Laboratory (ORNL)

Other participating countries


Canada


China


France

IEA Hydropower Vision & Mission

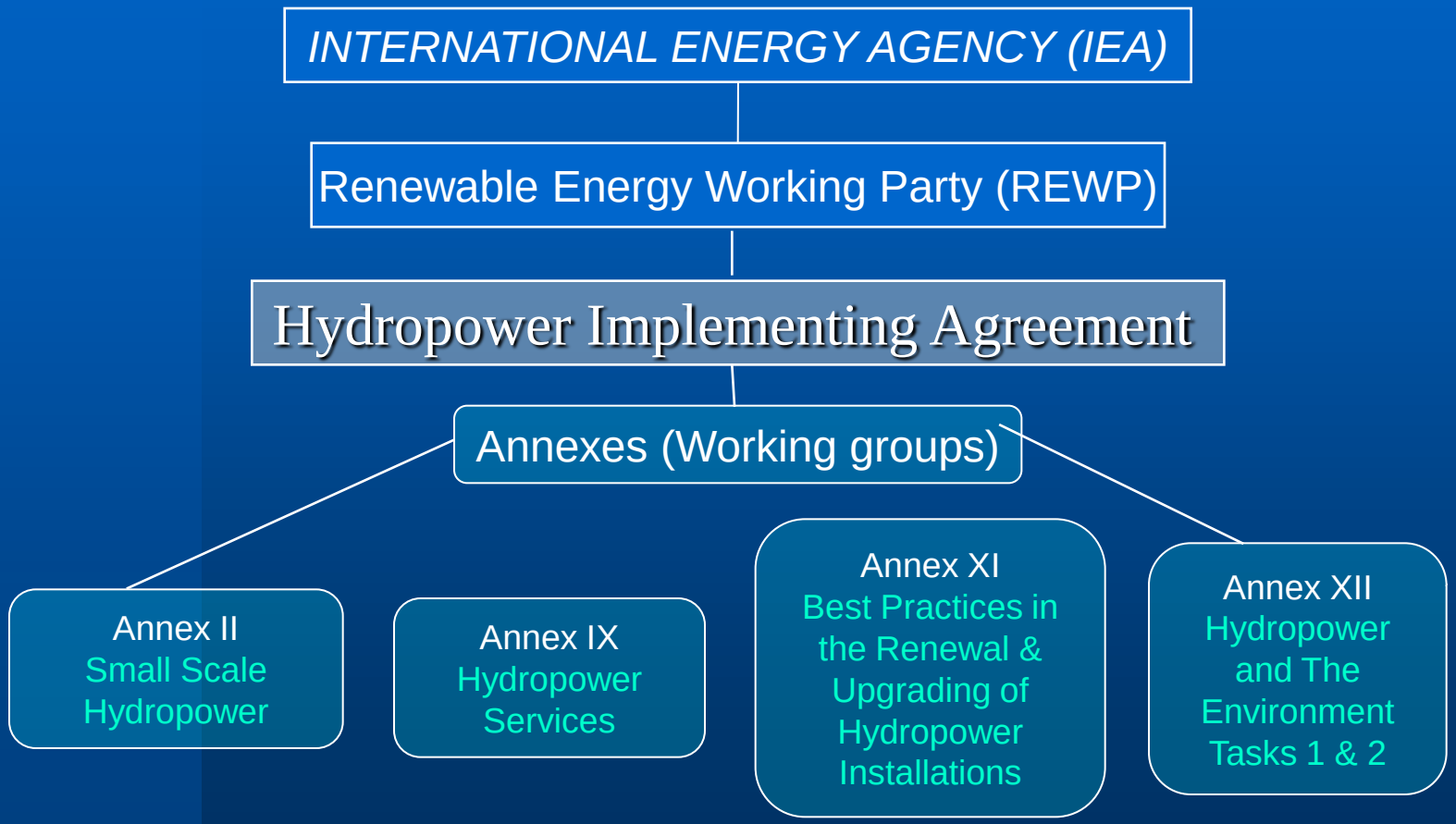
Vision

- Through the facilitation of worldwide recognition of hydropower as a well-established and socially desirable energy technology, advance the development of new hydropower and the modernisation of existing hydropower

Mission

- To encourage through awareness, knowledge, and support the sustainable use of water resources for the development and management of hydropower

Organisational Structure



New & Ongoing Annexes

- Phase 4 (2010-2014)

IEA Hydro Annexes:

- *Annex X Wind Hydro Integration* was recently completed with a report prepared and issued by the Wind IA.
- *Annex II Small Scale Hydropower*, led by Canada has continued from Phase 1.
- *Annex IX Hydropower Services*, led by Norway was initiated during Phase 4
- Ann*ex XI Renewal and Upgrading of Hydropower Plants*, led by Japan was initiated during Phase 4

New & Ongoing Annexes

- Phase 4 (2010-2014)

IEA Hydro Annexes:

- *Annex XII, Hydropower and the Environment*, has continued from Phase 3. Task 1, led by Brazil has the focus on GHG emissions from freshwater reservoirs. Task 2, led by Finland, has issued an update of the Recommendations from Annex III

- *Proposed new Annex on Fisheries Issues*, will be considered at the 28th ExCo Meeting

Hydropower Technology Roadmap

International Energy Agency

IEA Roadmaps

- This Hydro roadmap is part of a series being developed by the IEA in response to the need to accelerate the development of advanced energy technologies to address the global challenges of clean energy, climate change and sustainable development.
- Ministers from the G8 countries expressed their desire to have the IEA prepare roadmaps to chart clear paths for deployment of innovative energy technologies.
- The IEA has undertaken, under international guidance and in close consultation with industry, to develop a series of global roadmaps covering 19 technologies.
- The roadmap purpose is to demonstrate the critical role of energy technologies in achieving the stated goal of halving energy-related CO_2 emissions by 2050.
- The roadmaps will enable governments, industry and financial partners to identify the practical steps they can take to participate fully in the collective effort required.
- A number of roadmaps have been produced – these include roadmaps for wind, solar PV and biofuels and concentrating solar power.
- Work has started on roadmaps on hydropower, geothermal and bio-energy for heat and power, and these will be complete by the end of 2012

IEA Hydropower Technology Roadmap

Roadmap Contents

- **Key Messages**
- **Rationale for Hydropower**
- **Hydropower Status**
- **Vision for Technology Deployment and CO_2 Abatement**
- **Enabling factors**
  - **Socio-economic and environmental issues**
  - **Public Acceptance**
  - **Multipurpose development**
  - **Financial issues**
  - **Technological improvements**
  - **Improving existing facilities**
  - **Network Integration**
- **Policy framework; Near-term Actions for Stakeholders**
- **Summary**

Rationale for Hydropower

Hydropower developments can provide a very flexible energy product.

Large amounts of energy

- **Hydropower currently supplies 16% of global electricity (a similar share to nuclear) and about 85% of global renewable energy with significant future potential, based on its continued development in a sustainable framework**

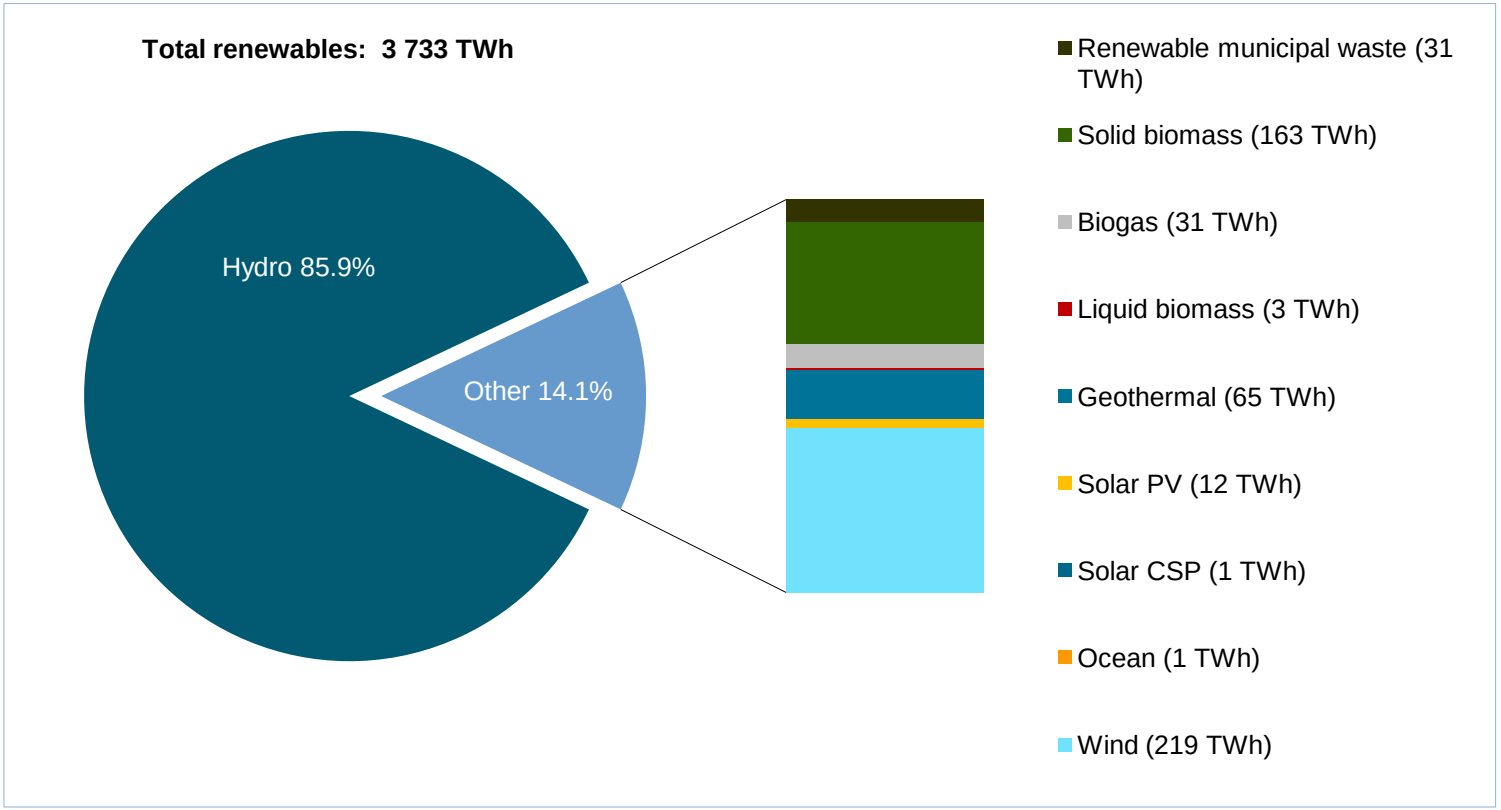
Distributed generation and regional development

- **In many regions of the world and in small areas within large countries, hydropower services a number of very important niche markets. These include regional supply and development as well as distributed generation within existing service areas.**

Integrator of intermittent energy sources

- **Hydropower is developing as a major enabler of variable renewable energy sources. Other renewable energy sources, such as wind energy and solar power are variable by nature and require facilities that can deliver firm power and shape their output to effectively integrate them into the electricity network. Hydropower, in particular reservoir and pumped storage, is the ideal provider of these services, from both an economic and sustainability perspective and this service will be an important future driver for development.**

Role of hydropower in renewable power generation mix



Source: IEA statistics

Hydropower currently supplies 16% of global electricity and is the most important renewable energy source for electricity generation

Hydropower Classification

- **Historically, hydropower has used classifications such as 'small scale hydro' and 'large hydro'.**
- **However, there is no worldwide consensus on definitions regarding size categories, and these do not provide technically or scientifically rigorous indicators of impacts or characteristics of hydropower.**

Realistic classifications, based on sustainability or economic performance, are used in the Roadmap:

- ***Storage Reservoir schemes*; normally provide a wide range of multi-purpose benefits from the water resource**
- ***Run-of-river schemes;* with limited regulation capability, divert flows and generate power roughly aligned to the natural flow regime.**
- ***Pumped storage schemes;* generate at times of low demand or low energy prices, or to support the electrical system**

What are dams, reservoirs and hydro plants doing for us?

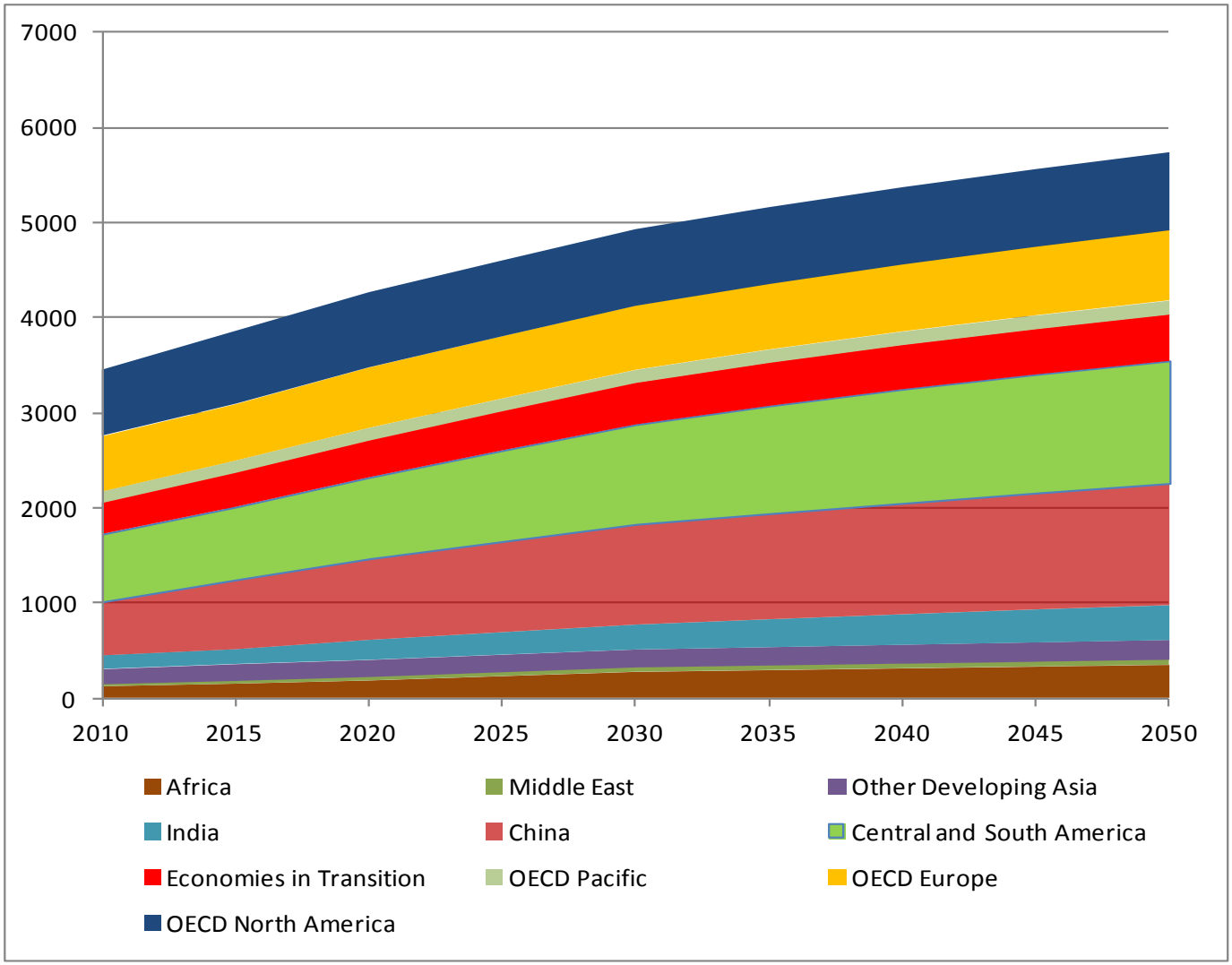
926 GW of clean renewable hydropower is in operation
(161.4 GW more is under construction)
~19% of world electricity production is produced by hydro
About 330 major dams (> 60 m) are under construction - 60% multipurpose

Region	Tech + economically feasible hydro potential (GWh/year)	Hydro capacity in operation (MW)	Hydro capacity under construction (MW)
Asia	4,475,500	402,000	125,750
Africa	770,000	23,500	5222
Europe	776,700	180,000	3000
N&C America	1,063,000	170,000	7800
S America	1,536,800	140,000	19,555
Australasia	88,700	13,370	70
Total	~8,709,950	~926,160	~161,500

Energy Technology Perspectives BLUE Map Scenario

- **The roadmap starts with the IEA Energy Technology Perspectives (ETP) BLUE Map scenario, which describes how energy technologies may be transformed by 2050 to achieve a global goal of reducing annual CO2 emissions by half that of 2005 levels.**
- **The ETP model uses cost optimization to identify least-cost mixes of energy technologies and fuels to meet energy demand, given constraints such as the availability of natural resources.**
- **The ETP model is a global fifteen-region model that permits the analysis of fuel and technology choices throughout the energy system. Technology options include about 1000 individual technologies.**
- **The ETP model has been used in many analyses of the global energy sector over a number of years.**

Expected growth of hydropower on a global scale (TWh/yr)



World's fastest growing economies… leading countries for hydro and dam development

	Installed hydro capacity (present) (GW)	Hydro capacity under construction (GW)	Major dams in operation (+ u/c))
China 	147	80	26,000 (+68)
India 	37	15	2600 (+10)
Brazil 	83	5.5	387 (+2)
Russia 	47	7	>100 (+5)

Near-term actions for stakeholders

Stakeholder	Action items
National and local governments	■ Include hydropower in energy and water planning ■ Establish national inventories of hydropower potential and prepare development plans with targets for hydropower ■ Reform electricity markets to value hydropower energy storage and other ancillary services ■ Attribute due value to non-energy contributions of multi-purpose hydropower developments ■ Progressively remove subsidies to fossil fuels ■ Invest in promoting public and private acceptance of hydropower

Near-term actions for stakeholders

Stakeholder	Action items
National and local governments	■ Promote policy framework covering the development of sustainable and appropriate hydropower projects ■ Streamline administrative processes to reduce the lead times for hydropower projects ■ Develop new risk-mitigating public financial instruments ■ Encourage national and international development banks to engage in hydropower development ■ Work with the private banking sector to reduce the cost of capital and level of risk

Near-term actions for stakeholders

Stakeholder	Action items
Industry	■ Document the approach to sustainability to be followed during project development ■ Consider rehabilitation, upgrading or redevelopment of existing HPP ■ Assess the feasibility of adding HPP units to existing dams ■ Adopt cutting-edge technologies with respect to efficiency and environmental performance. ■ Develop HPP technologies to better support the integration of large shares of variable renewables ■ Manage sedimentation in reservoirs ■ Develop tools to monitor and manage GHG emissions from reservoirs.

Near-term actions for stakeholders

Stakeholder	Action items
Industry	■ Develop technologies to better support the integration of large shares of variable renewable energy sources ■ Consider sustainability issues in the coordinated operation of hydropower plants
Universities and other research institution	■ Increase levels of education and training in all aspects of hydropower design, development and operation ■ Support young engineers ■ Understand the impacts of climate change on water resources and hydropower output, as well as any impacts on long-term climate change emanating from hydro projects

Near-term actions for stakeholders

Stakeholder	Action items
Non Governmental Organizations	■ Monitor progress towards sustainable hydropower development and policy milestones and publish results to keep governments and industry on track ■ Provide objective information on the potential of sustainable hydropower to mitigate climate change and increase energy security
Inter-governmental Organizations	■ Provide capacity building for regulatory frameworks and business models to help developing countries implement sustainable hydropower development

Thank you

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Secretary
IEA Hydro

www.ieahydro.org

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