IRENA's Mission to Helsinki, Finland

Wednesday 25th - Friday 27th April 2018

Summary of key discussions and actions arising

1. Overview

An IRENA delegation visited Finland to brief government and industry stakeholders on IRENA's work, to learn more about Finland's activities in renewable energy and to discuss opportunities for potential cooperation. The delegation presented to and met with representatives from Business Finland, Aalto University Business School, the Ministry of Foreign Affairs, and the Ministry of Economic Affairs and Employment. Dialogue focused on opportunities to enhance RE project development tools, assess RE technology and cost trends, accelerate innovation, and speed the transition to a carbon-free energy future. Particular attention was given to modern bioenergy and digitalization technology solutions.

2. Wednesday 25th April: Geothermal Site Visit

IRENA officials toured the st1 Otaniemi geothermal project that has drilled over 6 kilometers below the surface. Finnish business could benefit from active participation in IRENA's Global Geothermal Alliance, and members of the Global Geothermal Alliance could benefit from Finnish expertise.

Actions: *Finnish government to provide business contact points. IRENA to connect Global Geothermal Alliance representatives with Finnish businesses.*

3. Thursday 26th April: Business Finland Seminar

A short meeting was held between Minister Anne-Mari Virolainen (Minister for Foreign Trade and Development) and the IRENA delegation. The positive engagement between Finland and IRENA was highlighted and the important role Sakari Oksanen (Deputy Director General, IRENA) had played in that.

Minister Virolainen then opened the seminar by highlighting the importance of renewable energy in Finland, emphasizing the strong track record of Finnish businesses, and welcoming the work of IRENA. IRENA outlined its activities to accelerate renewable energy deployment, including its work programme and strategy, roadmaps and scenarios for energy transformation, analysis of renewable energy cost trends, project facilitation tools, bioenergy work, and market, technology and innovation studies.

Presentations from Business Finland followed. Indufor discussed the key factors affecting access to sufficient biomass feedstock supply. Raumaster Group described its material handling systems for fuel yards and wood processing. WOIMA explained the advantages of its modular power plants to mitigate waste. Valmet highlighted the features of modular biopower plants to monetise local biomass. Wärtsila offered perspectives on the power systems of the future.

A variety of ideas for collaboration were generated in the course of informal conversations that took place between IRENA and businesses present during a networking lunch.

Actions: *IRENA representatives to follow-up with Finnish contacts and connect them with relevant teams.*

4. Thursday 26th April: Seminar and Roundtable at Aalto University School of Business

A seminar was organized by Smart Energy Transition programme at Aalto University on how to manage seasonality in the renewable energy system during the cold and dark winter weeks, and how Finland can benefit from developing smart energy solutions, with contributions by researchers at the university and VTT – Technical Research Centre of Finland. Kimmo Tiilikainen (Minister of the Environment, Energy and Housing) presented on "How Finland can contribute to Paris climate agreement by promoting clean

energy technologies – Business opportunities for Finnish companies". Dolf Gielen (Director, Innovation and Technology, IRENA) presented on "Global opportunities for renewable energy technologies and energy transition solutions".

The Ministry for Foreign Affairs organized a wide-ranging roundtable discussion with researchers and companies on priorities for renewable energy technology research and development. There was a lot of common ground between IRENA's work and the Finnish programmes and priorities that were discussed.

Actions: *IRENA representatives to highlight the Finnish programmes discussed to relevant IRENA teams. Finnish representatives to consider engaging in upcoming IRENA events and activities including IRENA Innovation Week and the IRENA managed CEM campaign on Long Term Energy Scenarios.*

An evening dinner hosted by the VTT Technical Research Centre of Finland allowed continued discussion of Finnish research and innovation in RE powered systems and the synergies with IRENA's work.

5. Friday 27th April: Seminar on Global Energy Transition and Finnish Responses

The Seminar was hosted by the Ministry for Foreign Affairs and opened by Matti Anttonen, Permanent State Secretary. IRENA reviewed its programme of work and analysis of Global Energy Transformation. Finnish speakers presented on energy transition policies, economic growth potential of integrating low-carbon and bio- economy, the Smart Energy Transition Program, Business Finland's Smart Energy Program; and Finnish cooperative programmes and financial instruments for international development.

Actions: *IRENA and MOFA to consider how Finland might further support sustainable bioenergy supply.*

6. Lunch hosted by Matti Anttonen, Permanent State Secretary, Ministry for Foreign Affairs

The IRENA delegation met with Matti Anttonen (Permanent State Secretary, Ministry for Foreign Affairs) and other members of the Ministry for Foreign Affairs. The discussion was wide-ranging and covered Finnish domestic and international policy objectives as well as IRENA's perspectives on the status and challenges involved in the global energy transition, the role of bio-mass, and the potential impact of key innovations. The Finnish team expressed a desire to find additional opportunities for cooperation with IRENA. The IRENA team praised the range and depth of exciting work that Finnish teams were engaged in, as highlighted during the visit, and emphasized the value of deeper Finnish engagement with IRENA. Opportunities for such engagement were briefly discussed, for example the possibility of Finnish government or business leaders supporting staff secondments to IRENA on topics of mutual interest.

Actions: *IRENA representatives to highlight opportunities for Finnish engagement in upcoming work programmes. Finnish agencies to consider staff secondments and programme support for IRENA activity.*

Annex A: Summary of Presentations and discussion in the Business Finland Seminar (26th April)

Business Finland is an agency directed and funded by the Finnish Ministry of Employment and the Economy, whose objective "is to promote the competitiveness of Finnish industry and the service sector by assisting in the creation of world-class technology and technological know-how". The agency assembled representatives from Finnish companies active in renewable energy and the energy transition. The event was moderated by Helena Sarén, Business Finland's Program Director for Energy.

Minister Anne-Mari Virolainen, Minister for Foreign Trade and Development opened the seminar by highlighting the importance of renewable energy in Finland, emphasizing the strong track record of Finnish businesses working on renewable energy, and welcoming the work of IRENA.

The IRENA delegation outlined its activities to accelerate deployment of renewable energy, including its work programme and strategy, roadmaps and scenarios for energy transformation, analysis of renewable energy cost trends, project facilitation tools, market, technology and innovation studies, and bioenergy work. In particular, the presentations highlighted:

- IRENA's report on **Global Energy Transformation**, released at the Berlin Energy Transition Dialogue in April 2018, key insights from that analysis included: that renewable energy and energy efficiency can provide over 90% of the reduction in energy-related carbon dioxide emissions that are needed to keep the global temperature rise below 2 degrees Celsius as agreed in Paris; that major improvements in energy intensity and a six-fold acceleration of the pace of growth in renewable energy share are required to do so; and that reduced negative externalities outweigh the investment costs of achieving a global energy transformation. IRENA's analysis also shows that the renewable energy share of the EU energy mix could double to 34% in cost effective fashion by 2030.
- IRENA's **costing analysis** which shows that photovoltaic generation costs fell 80% from 2010 to 2016, while concentrating solar power costs also fell sharply. Auction data also indicates a dramatic cost drop for offshore wind installations to be completed between 2018 and 2022.
- IRENA's **FlexTool,** developed in cooperation with VTT Technical Research Centre of Finland Ltd., which incorporates information on a variety of flexibility options for transmission, thermal generation, hydropower generation, demand side management, power grid management, and energy storage systems, which can operate together in synergistic fashion to boost RE generating share.
- IRENA's **Sustainable Energy Marketplace** facilitates information exchange to bring together project owners, investors and financiers, host countries, and service and technology providers. IRENA's **Project Navigator** provides comprehensive tools and information through a free on-line platform to assist in development of bankable renewable energy projects. The **IRENA-ADFD project facility** provides concessional loans for innovative and replicable renewable energy projects in developing countries through the Abu Dhabi Fund for Development (ADFD). IRENA's **Entrepreneurship Support Facility** assists small and medium enterprises with RE projects.
- IRENA's **bioenergy activities** which are centered on three pillars of sustainable feedstock supply, cost-effective conversion technology, and successful scaleup strategies, designed to help overcome the challenges bioenergy faces in economic competitiveness and sustainable sourcing. Together with IEA Bioenergy and the Food and Agriculture Organization of the United Nations (FAO), IRENA has developed a brief on *Bioenergy for Sustainable Development*. In

partnership with the Swedish Energy Agency and Swedish Bioenergy Association (Svebio), IRENA is preparing a report on sustainable forestry. This report will complement the study of *Bioenergy from Finnish Forests: Sustainable, efficient, modern use of wood*, recently published in partnership with VTT. Scale-up projects will look at wood in Southeast Europe and sugarcane in Africa and Caribbean.

- IRENA's comprehensive analysis for the *Technology Innovation Outlook for Advanced Liquid Biofuels* and **technology briefs** on biomass for heat and power, biofuels for aviation, biogas for road transport, and biogas cookstoves. New briefs are being prepared on biomass logistics, smart electric vehicle charging, and thermal energy storage. The technology briefs identify technology, industry and policy challenges to overcome and breakthroughs required.
- IRENA will host its second **Innovation Week** on 5-7 September 2018 in Bonn. A wide range of innovations will be highlighted, and 250 participants are expected. Finnish official and experts who wish to be invited should contact innovationweek@irena.org.

Finnish industry representatives described their activities and expertise in the renewable energy field.

- **Indufor** discussed the key factors affecting access to **sufficient biomass feedstock supply** at an affordable price, including understanding the resource base, understanding the competition, designing the correct supply chain, developing a supply model and partnerships, understanding costs behind the delivered price of biomass, and developing market access for products.
- **Raumaster Group** presented its **material handling systems** for fuel yards and wood processing, highlighting the Vartaverket in Stockholm for biofuel which features a storage faciility 70 metres below the ground in the middle of the capital city, as well as several projects in Finland.
- **WOIMA** explained the advantageous features of its **modular power plants to mitigate waste** disposal issues in developing countries, which reduce landfill requirements, delivers a variety of energy services, and cuts down on waste logistics costs. Containerized wasteWOIMA power plants handle a wide variety of fuels at high efficiency, fit into a small space for off-grid use, can be quickly installed and easily relocated, and provide excellent return on investment.
- **Valmet** highlighted the features of **modular biopower plants** to monetise local biomass, noting how modular design can reduce capital investment needs (CAPEX) by reducing site works, easing transport and installation, and speeding project planning, permitting, construction and startup.
- **Wärtsila** offered perspectives on the **power systems of the future**, noting how power systems are evolving from slow to dynamic generation, from predictable to dynamic loads, from long-term to short-term trade, and from slow and regulated to open and dynamic markets.

A variety of ideas for collaboration were generated in the course of informal conversations that took place between IRENA and businesses present during a networking lunch. For example, Simisol Oy suggested its work on mapping bioenergy production in Pakistan and Vietnam could contribute to IRENA's Global Atlas, Syfco Oy expressed interest in IRENA's work in the MENA region, and AskKauko's Platform for Driving Sustainable Change may relate to IRENA's Coalition of Action and REmade index.

Annex B: Summary of the Seminar at the Aalto University School of Business (26th April)

A seminar was organized at Aalto University on "how to manage seasonality in the renewable energy system during the cold and dark winter weeks, with contributions by leading Finnish researchers:

- Armi Temmes (Professor of Practice, Corporate Sustainability, Aalto University School of Business) introduced the seminar with thoughts on how Finland can contribute to the global energy transition and benefit from it. She suggested that key aspects of the transition include sharply reduced combustion of wood and fossil fuels, sharply increased use of intermittent energy, greater use of energy storage and demand response, and more dynamic district heating systems. She also pointed to the need for better linkages between innovation, energy and environmental policies to enable business based on clean energy technologies.
- Francisco Reda (VTT Technical Research Centre of Finland Ltd.) presented work in collaboration with Karolina Auvinen of Aalto University on how to manage seasonality and variability in clean district heating systems. He especially emphasized the role that high temperature heat pumps can play in reducing fossil fuel use and carbon emissions, citing cases in Germany and Norway. He also pointed to the potential for combined heat and power using syngas manufactured from biomass such as municipal and agricultural waste to back up heat supply in cold winter periods. He then described solar district heating systems combined with various seasonal heat storage technologies in Canada, Denmark and Germany. Finally, he noted that it is cheaper to store heat than electricity, and thermal storage systems have major economies of scale; size matters.
- Hannele Holttinen of VTT presented work in collaboration with colleague Niina Helistö in which simulations show that shares of wind and solar energy on power grids can feasibly exceed 60%. Another key finding is that models do not do a good job of representing needs to strengthen transmission networks, ensuring voltage stability when generation is far from consumption, or ensuring frequency stability on the gird with non-synchronous generation.
- Dolf Gielen, Director of the IRENA Innovation and Technology Centre, highlighted a sectoral roadmap on renewable energy for district heating and cooling, which examines 21 DHC projects in 9 countries accounting for 40% of DHC globally. While renewables provided just 5% of DHC in 2014, they could potentially provide up to three-quarters of district heating in the countries studied. But this will require a ten-fold increase in investment to USD 20 billion per annum. He noted that Finland has great expertise on DHC from which other countries could benefit. He also noted a study underway at IRENA on thermal energy storage for renewable energy integration, including underground and tank thermal storage for managing seasonality.
- A panel discussion followed on How to resolve the intermittency and seasonality challenges in Finland? What are the roles of new business solutions, smart grids and the users? How could Finland contribute to global clean energy transition?

Annex C: "Global Energy Transition, Finnish Responses," Ministry of Foreign Affairs (27th April)

The Seminar was opened by Matti Anttonen (Permanent State Secretary, Ministry for Foreign Affairs). IRENA (Sakari Oksanen, Deputy Director General; Dolf Gielen, Director of Innovation and Technology) summarized its programme of work and its recent analysis of the Global Energy Transformation. Several speakers then presented on various aspects of the Finnish responses to the energy transition:

- Petteri Kuuva, (Deputy Director General, Ministry of Economic Affairs and Employment) presented on "Energy Transition in Finland." He noted that a successful transition to carbon-free energy will require well-functioning markets, both long- and short-term, both European and regional. The power grid can be made more flexible through demand response, energy storage, and integration with district heating and electric vehicles. Such approaches can help to cope with seasonal variation in renewable energy output, with solar generation typically highest in summer and wind typically highest in winter. Biomass, from forest industry logging and processing residues, is key to decarbonizing district heating systems and transport. Renewable energy will play an essential role, particularly after Finland bans the use of coal in energy generation from 2029.
- Tiina Koljonen (Research Team Leader, VTT Technical Research Centre of Finland) spoke on "Growth by integrating bioeconomy and low-carbon economy in Finland." She highlighted the report that VTT had prepared in cooperation with IRENA, which presents three case studies of innovative, large-scale bioenergy plants: the Metsä fibre bioproduct mill at Äänekoski; the high-efficiency multifuel CHP plant at Järvenpää; and the CHP plant with bio-oil production at Joensuu. She noted that forest wood will play a key role in meeting Finland's targets for 50% RE from energy consumption by 2030. New products can double the value added of the forest and agricultural sector and stimulate economic growth.
- Professor Armi Temmes, Aalto University, spoke about the Smart Energy Transition and how it can benefit Finland. Demand Response (DR) has been facilitated by roll-out of smart meters and acceptance of loads in reserve markets, but incentives are needed to engage more customers, and standardized interfaces and guidelines are required to enhance automation. Since only half of wind and solar investment and a third of heat pump investment is for components that are manufactured outside of Finland, renewable energy offers major business opportunities.
- Helena Sarén *(*Program Director, Energy Growth Program, Business Finland) spoke about the Business Finland Smart Energy Program and its benefits for Finnish businesses and consumers.
- Satu Santala (Director General, Department for Development Policy, Ministry for Foreign Affairs) outlined Finnish development programmes to promote transition. Clean energy access is the top priority. Energy and environmental partnerships, to become a multi-donor trust fund in 2018, support projects for solar home systems, minigrids, clean cookstoves (which use wood efficiently), bioenergy and biofuels; they have so far funded 225 projects with € 57 million in 13 Sub-Saharan African countries. A blended finance climate fund, established by Finland and IFC in 2017 with €114 million, emphasizes energy access for the most vulnerable through public investment with development impact, including waste-to-energy projects and efficient heating and cooling systems. The Public-sector Investment Facility (PIF) provides € 5-30 million per year of mixed credit financing for projects to develop electric grid infrastructure and waste to energy, heating and cooling, and solar photovoltaic systems. The BEAM (Business with Impact) programme promotes innovative technologies that can deliver development results.