Renewables Working Together: Case Study of Iceland

- Background on IHA
- Overview of hydropower;
- Synergies between renewable energy sources – case study on Iceland;
- Discussion with participants.

Tracy Lane, Programme Director
International Hydropower Association

China Institute of Water Resources and Hydropower Research (IWHR) – China Three Gorges Corporation (CTG) – EDF CIH – Hydro Equipment Association (HEA) – Itaipu Binacional – JSC RusHydro – Sinohydro Corporation – Statkraft AS – Cemig Geração e Transmissão S.A – Centrais Elétricas do Norte do Brasil S.A CESP – Companhia Hidro Elétrica do São Francisco-Chesf – Construcoes E Comercio Camargo Correa – Construtora Andrade Gutierrez – Construtora Norberto Odebrecht S/A – COPEL – E.ON - EDP Gestao da Producao de Energia SA – Eletrobras – Electrosul Centrais Eletricas S.A. – Entidad Binacional Yaycreta – ESB International – Fortum – Hydro Tasmania – Hydro-Québec – Landsvirkjun – Landsvirkjun –Landsvirkjun – Manitoba Hydro – NHPC Ltd. – Ontario Power Generation – SN Power — Manitoba Hydro – NHPC Ltd. – Ontario Power Generation – SN Power – NHPC Ltd. – Ontario Power Generation Voralberger Illwerke AG – AES Eurasia Enerji Yatırımları LTD. ŞTİ - Brookfield Asset Management Inc. - Changjiang Water Resources Commission (CWRC) - CPFL GERAÇÃO - E-CO Vannkraft AS - Empresas Públicas de Medellín E.S.P. - Endesa - GDF Suez (France) – Hatch – HidroAysén - Hidroeléctrica de Cahora Bassa - Hubei Qingjiang Hydropower Development Co., Ltd - Isagen S.A - Kemijoki Oy - Light Energia S.A. - MWH Global, Inc. - Pacific Hydro - RWE Innogy GmbH - SN Hidroelectrica S.A. - Sarawak Energy Berhad - Snowy Hydro Limited - TAWAG - Tiroler Wasserkraft AG - Volta River Authority - ZESCO Limited - Гидроэнергетика России - Hydraulic Power of Russia - All Ukrainian Association Ukrhydroenergo - AXYS Technologies Inc. - Bhote Koshi Power Company Pvt Ltd - Carpi Tech S.A. - CKD Blansko Engineering a.s. - Dolsar Engineering Limited - DSD Noell GmbH - Enerjisa Power Generation Company - G O Carlson Inc. - Hohai University - Instituto Acende Brasil - KONCAR-KET - Lahmeyer International GmbH - Lunsemfwa Hydro Power Company Ltd - Mighty River Power – Power - NuPlanet (Pty) Ltd - ydro Power

~100 corporate members

active in 80+ countries

1 vision

advancing sustainable hydropower



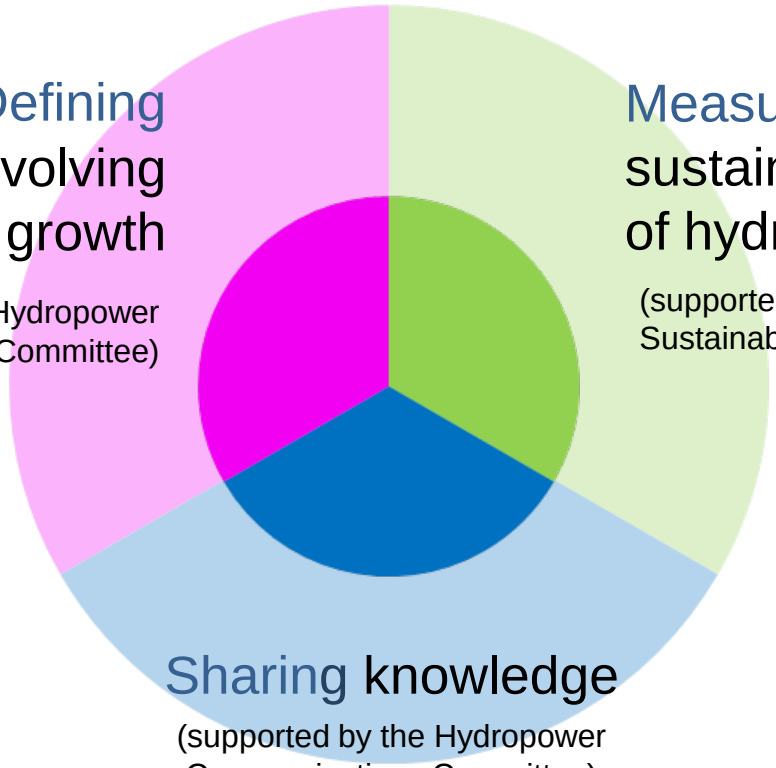
IHA's activities

Defining hydropower's evolving role in green growth

(supported by the Hydropower Development Strategy Committee)

Measuring the sustainability performance of hydropower

(supported by the Hydropower Sustainability Strategy Committee)



Sharing knowledge

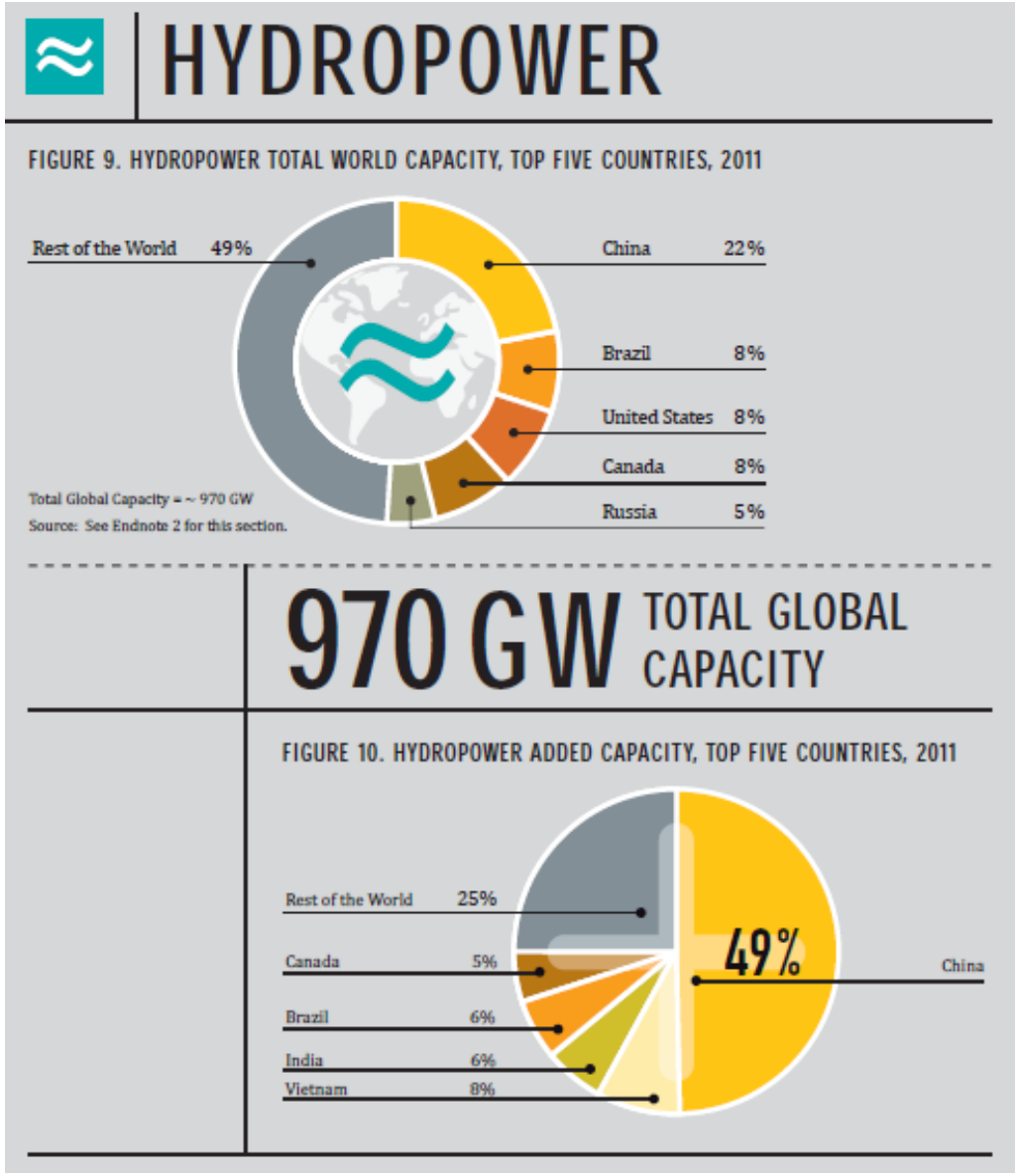
(supported by the Hydropower Communications Committee)

Multiple roles for hydropower in water and energy

- Electricity for heat, power and transport
- Energy storage
- Water storage for
  - Flood pretection/drought adaptation
  - Irrigation
  - Water supply and Sanitation
  - Navigation
  - Downstream flow regime
  - etc.

2011 Deployment

- **970 GW of worldwide capacity**
- **25 GW** of new hydropower **added in 2011**, increasing capacity by nearly 3%
- Globally hydropower **generated 3,400TWh of electricity in 2011**. China alone produced 663TWh followed by Brazil (450TWh)
- **China, Brazil, United States, Canada and Russia** comprise the **top 5** hydropower markets by capacity



Source: REN 21 Global Status Report 2011

Synergies between renewable energy sources

– case study on Iceland

Case study: Iceland

Electricity in Iceland

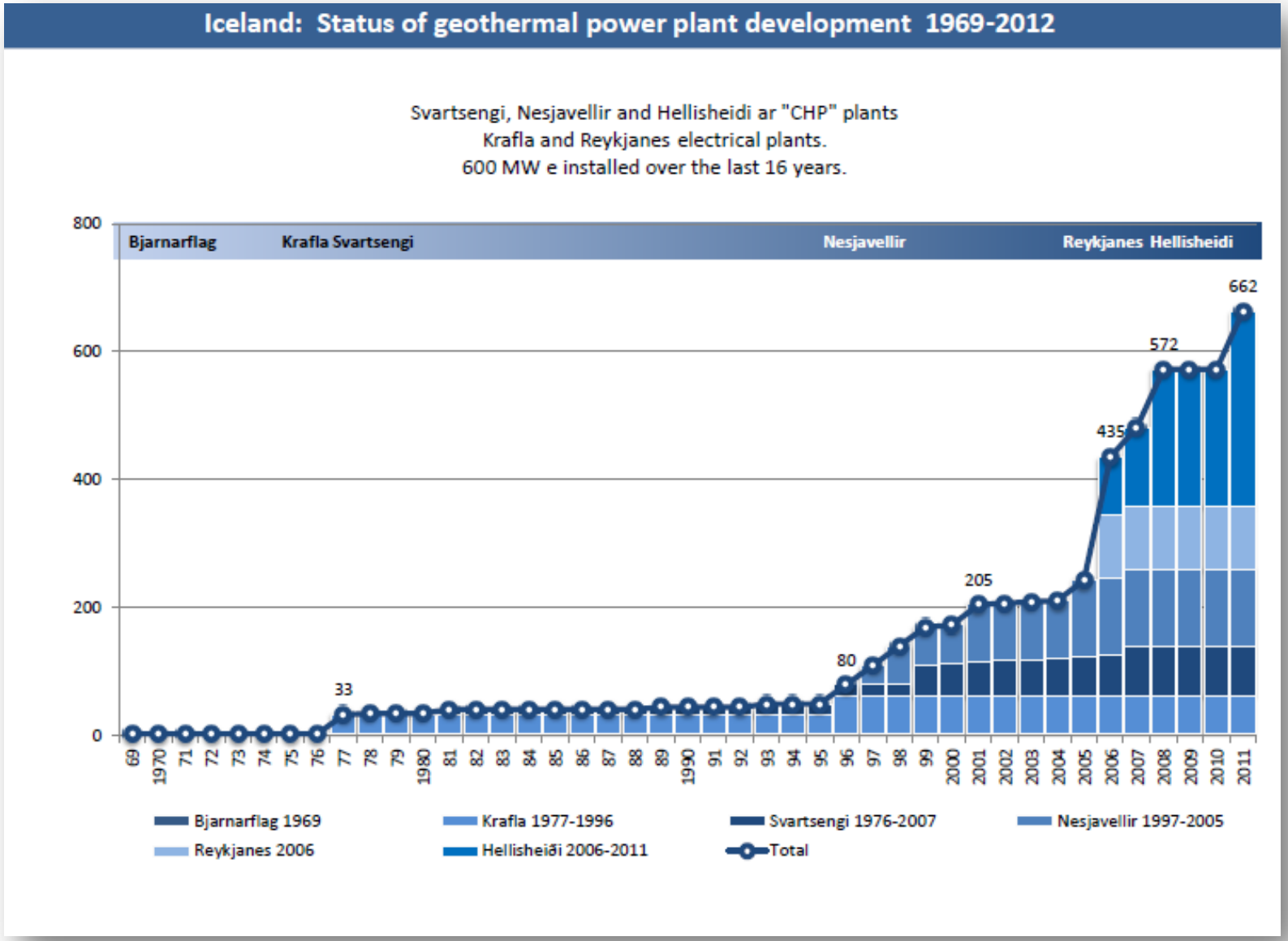
- Iceland has a unique position since virtually all its electricity is generated from renewable sources.
- Total electricity production in 2010 was 17.1 TWh from hydro power and geothermal sources.
- It is estimated that the economically harvestable potential from these sources is somewhere around 30 - 50 TWh annually.
- The domestic market demand was fulfilled years ago and all new projects now sell their output to power intensive industries, typically through long term Power Purchase Agreements (PPA).
- Due to the low cost of electricity compared to the rest of Europe, power intensive industries such as aluminum companies have built plants in Iceland in the past 40 years.
- Power intensive projects in the following industries have been built in Iceland:
  - Primary aluminum production.
  - Ferrosilicon and foundry alloys.
  - Etching of aluminum foils.
  - Data Centers.
- Different types of power intensive industries are being developed in Iceland:
  - Silicon metal and poly silicon.
  - Methanol production.
  - Large scale greenhouse.

Source:			
Hydro Power	12.592	GWh	73,8%
Geothermal Power	4.465	GWh	26,2%
Fossil fuel	2	GWh	0,0%
Total:	**17.059**	**GWh**	**100%**

Uses:			
Domestic market	3.140	GWh	18.4%
Heavy Industries	13.209	GWh	77,4%
Other (losses)	711	GWh	4,1%
Total:	**17.059**	**GWh**	**100%**

Electricity generation and usage in Iceland in 2010, www.os.is

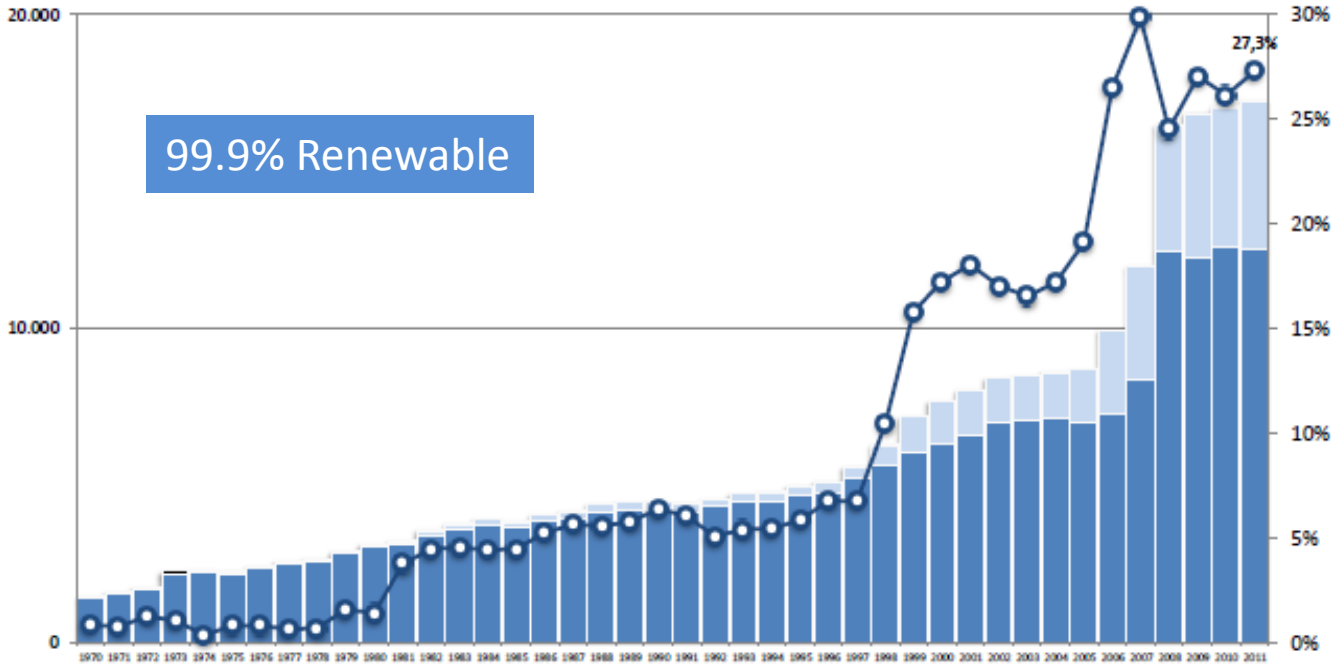
Icelandic geothermal progress



Iceland's geothermal and hydropower

Iceland: Geothermal plant produce 27,3% of the nation´s energy

Electricity generation 2011: 17.210 GWh
Hydro plants 72,7%. Geothermal 27,3% Fossil fuel <0,1%.
WorldWide: Geothermal plants with 0,3% of electricity generation.



Geothermal heating meets the heating and hot water requirements of approximateli 90% of all buildings in Iceland.



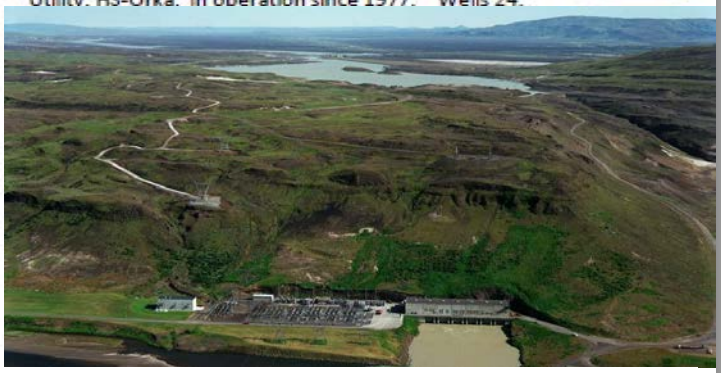
Icelandic hydropower and geothermal - Examples

Iceland: Geothermal power plants

Kárahnjúkar HP plant: 690 MW
In operation since 2009

Hellisheiði CHP plant: 303 MW e. 133 MW th: Future plan +267 MW th.
Utility: Orkuveita Reykjavíkur. In operation since 2006. Wells 71.

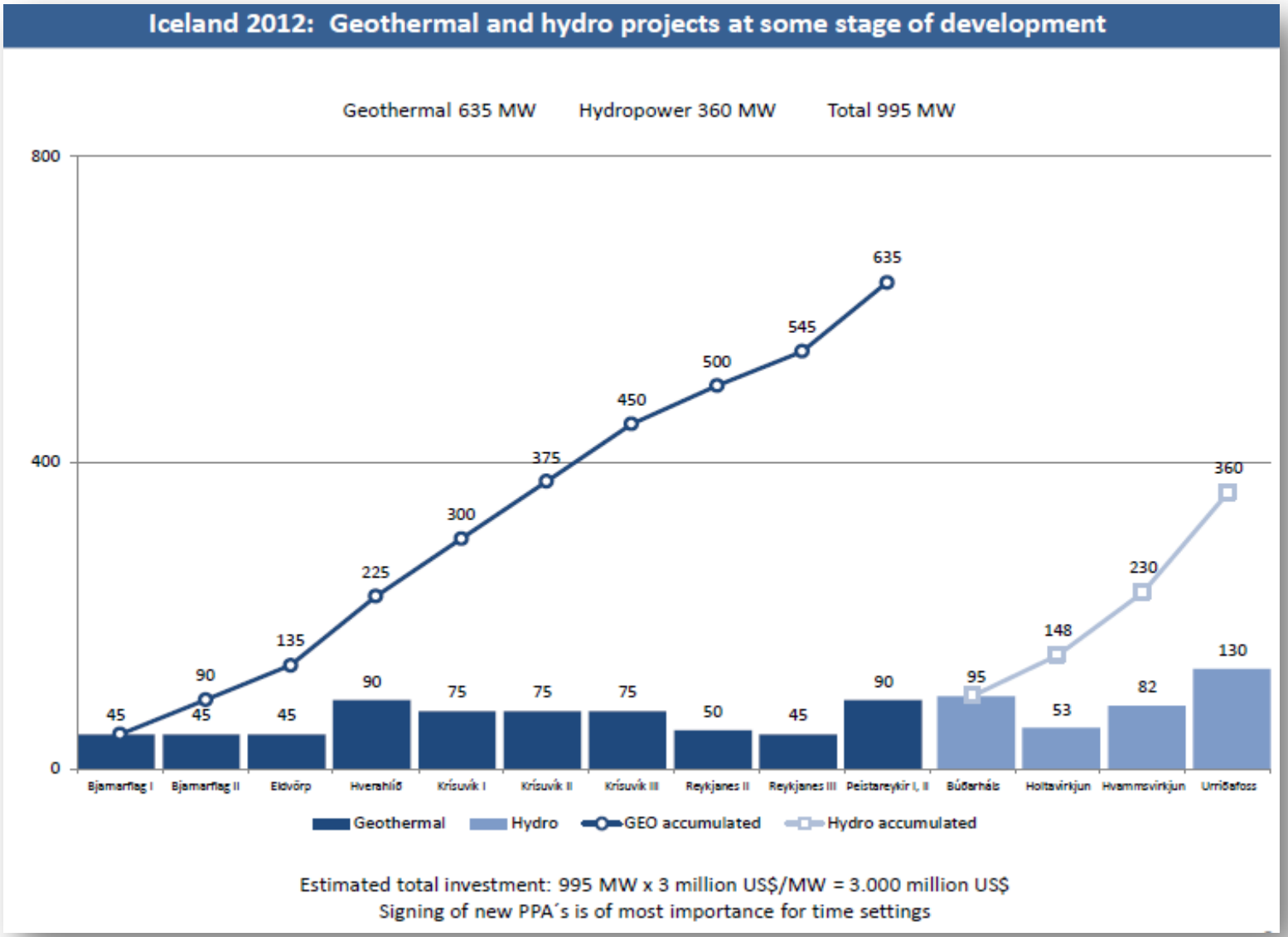
Svartsengi (Blue Lagoon) CHP plant: 76 MW e. 100 MW th.
Utility: HS-Orka. In operation since 1977. Wells 24.



Burfell HP plant: 270 MW
In operation since 1972

Reykjanesvirkjun: 100 MW e.
Utility: HS-Orka. In operation since 2006. Wells 28.

New projects in Iceland

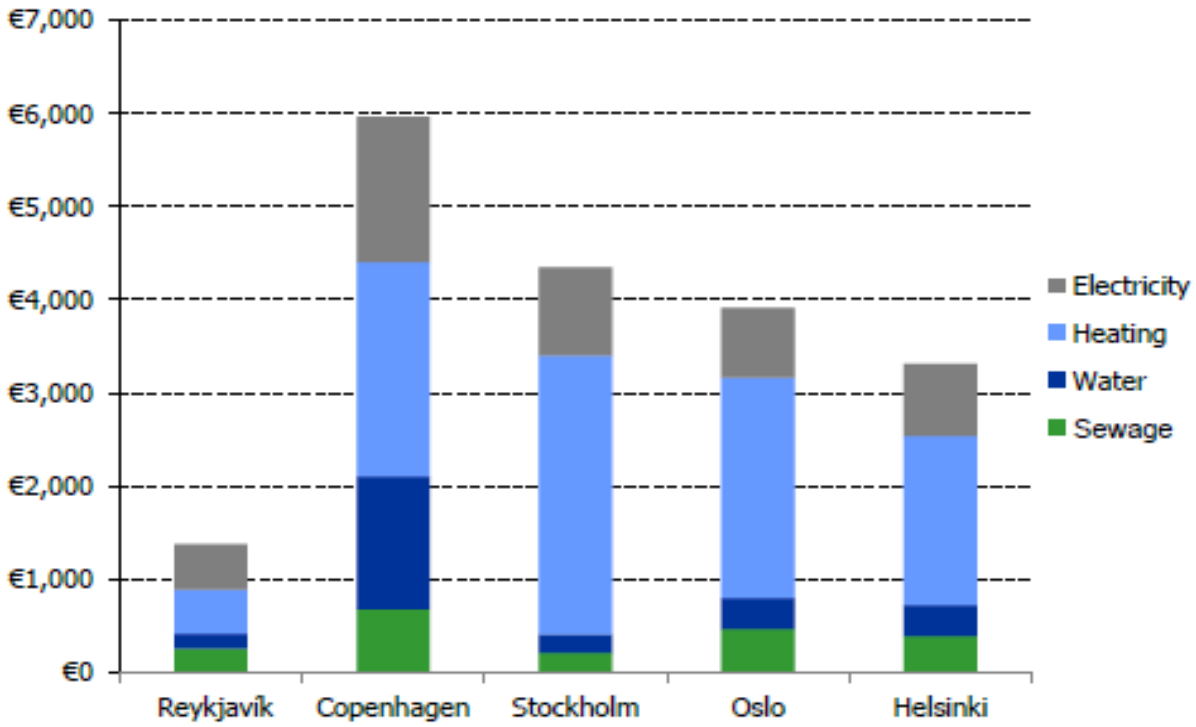


Domestic energy costs in Iceland

Utility cost of households

Comparison of utility cost per year in the Nordic countries

- based on 100 m² apartment, consumption of 4,800 kWh electricity and 240 m³ water



Smart power systems

Image credit: ANDRITZ

Thank you