Swedish Water Act: new legislation
Towards sustainable hydropower

Jakob Granit, Director General
Swedish Agency for Marine and Water Management

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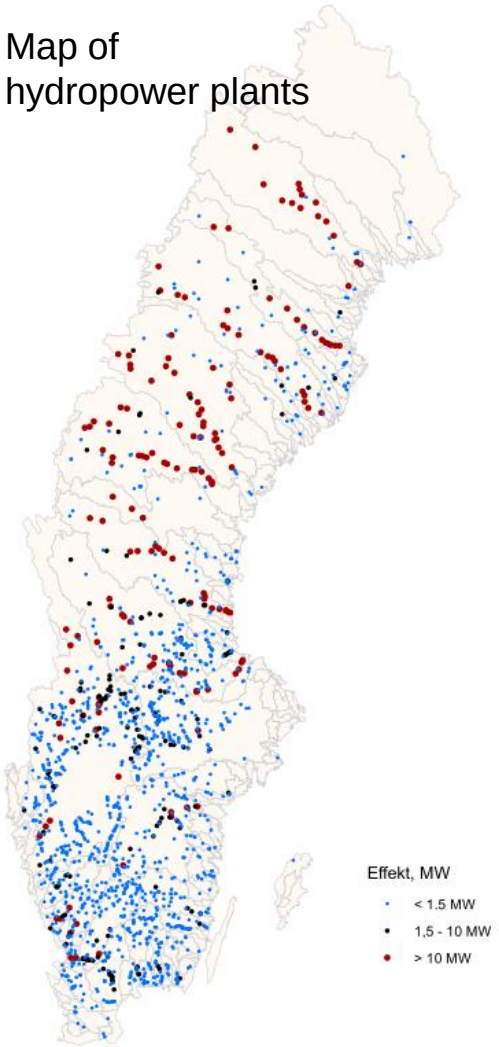
Vaasa

Swedish Agency
for Marine and
Water Management

Swedish hydropower

Installed effect	Percentage of total production	Number of plants
>10 MW	94 %	208
10-1,5 MW	3,9 %	187
1,5 MW till 125 kW	2,1 %	680
< 125 kW	0,5 %	1030

Map of hydropower plants

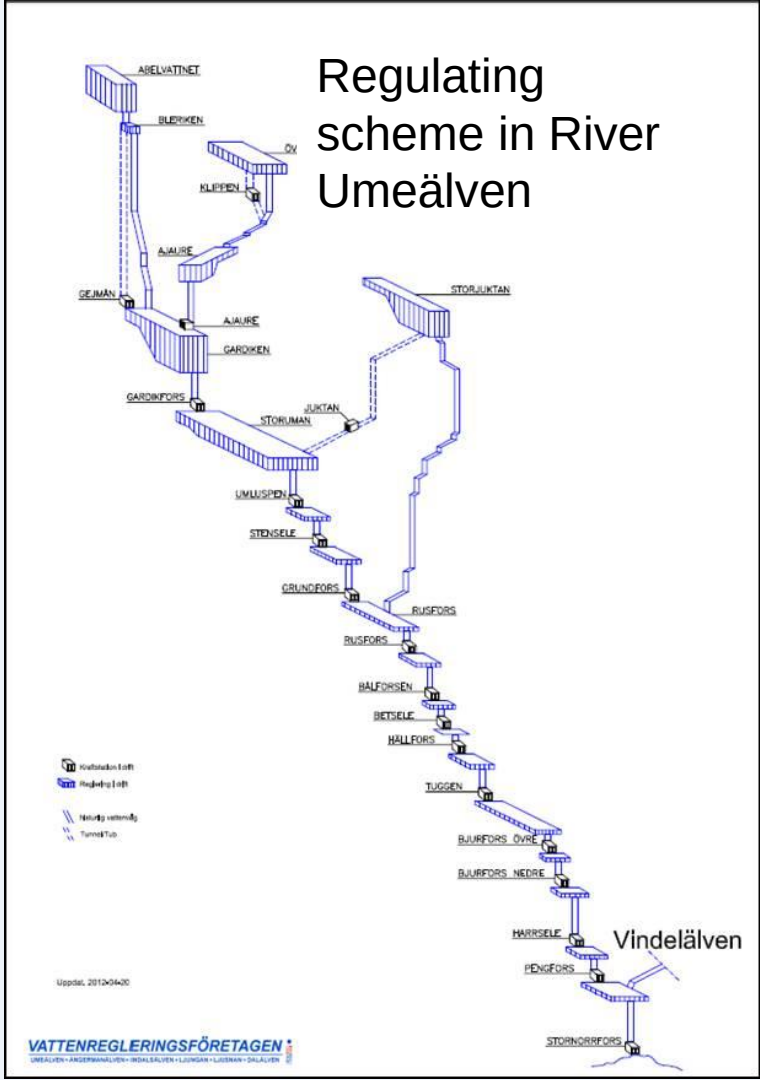


Swedish hydropower

- Total 16 400 MW in 2 000 hydropower plants
- 200 plants > 10 MW
- 1700 plants < 1,5 MW
- Power production production ~ 65 TWh/year
- Major increase of wind power, 17,6 TWh 2018
- Intermittent power sources = need to balance the power grid
- Hydropower is the key regulatory power source in the electric energy system
  - Inter annual regulation
  - Days, hours to seconds

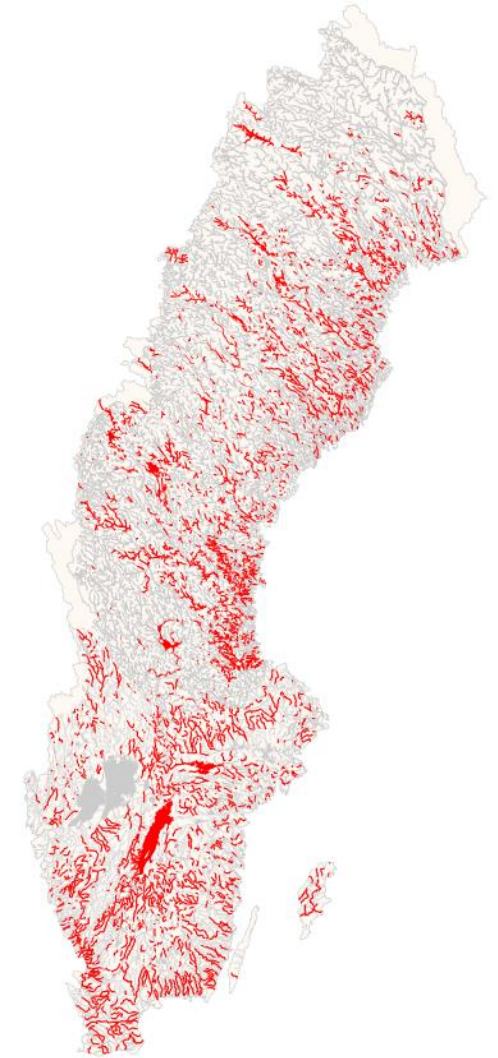
Hydropower > 10 MW

- 208 Hydropower plants produce 94 % of all hydropower
  - most of the regulating power
- Operates in a co-ordinated system in the drainage basin
  - Main regulating dams in the upper part of the catchment
  - 5 – 40 plants provide regulating power in a decreasing scale
  - Environmental flows hard to manage in cascading schemes



Impact of hydropower and dams on ecological continuity

- 4000 rivers and streams are regulated for hydropower production
- 5000 water bodies in the river basins lack continuity for fish migration
- 2000 lakes
- 200 hydropower plants have fish passages, but almost 50 % does not function properly
- Sediment management is limited
- About an additional 10 000 other dams and blockages

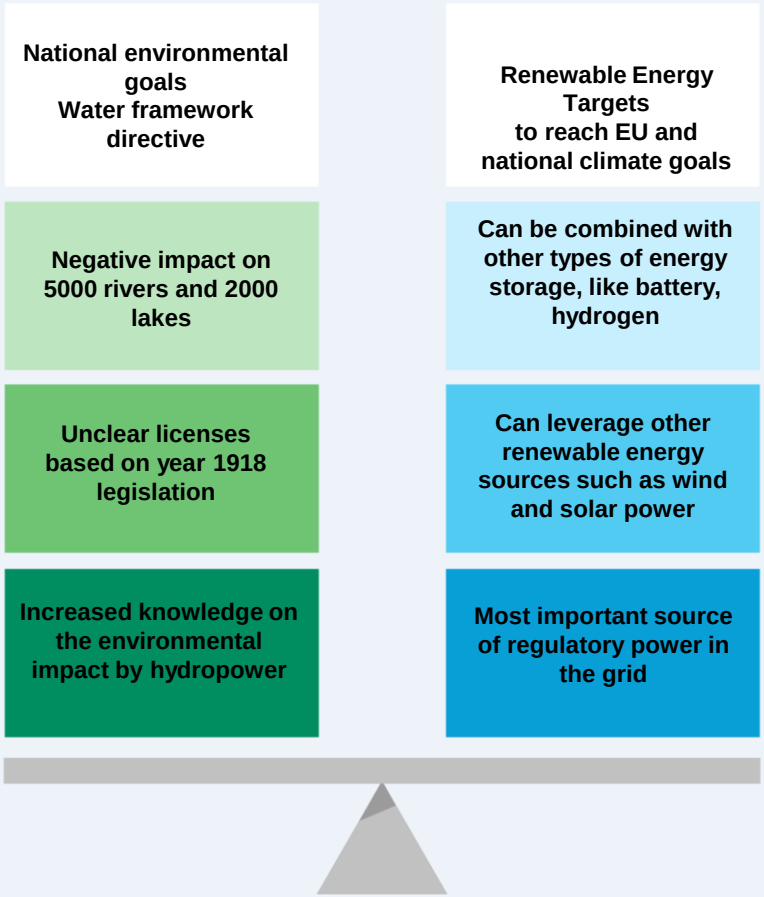


Red = lack of continuity for fish

Stakeholder dialogues

How do we reach 100 % renewable energy and reduced impact on ecosystems at the same time?

- Hydropower is an important energy source to reach national energy and climate targets
- Hydropower provides the most extensive environmental pressure on Swedish lakes and rivers
- Target – 100% renewable electricity production and reduce environmental impact
- Solution - National plan for revision of licences by year 2040
- A trust fund to support the transition managed by the private sector



Swedish multiparty energy agreement 2016

-Hydropower a key renewable energy source

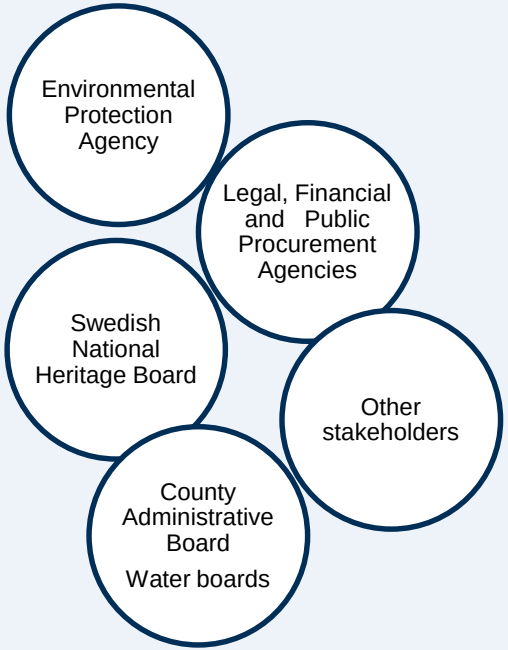
- all hydropower plant should have modern environmental permits within 20 years

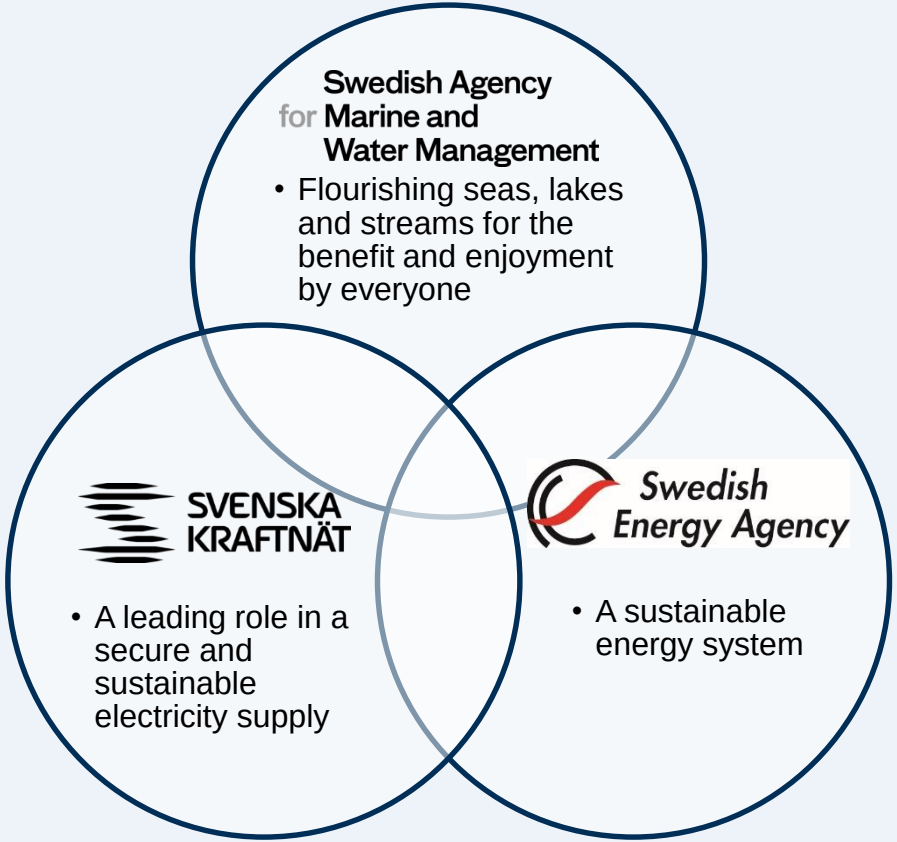
- Manage trade offs

Key issues in the new legislation

- Older licenses
  - Typically limited environmental requirements
  - Fish stocking, water level requirements etc.
  - Minimum flow requirements are limited
- All hydropower licenses to be reviewed within 20 years
- All licenses to be limited in time for a maximum of 40 years.
- Goal to reach environmental objectives
  - Water framework directive
  - Habitat directive
- Exemptions should be used

Partners in developing a National plan for providing hydropower plants with modern environmental conditions





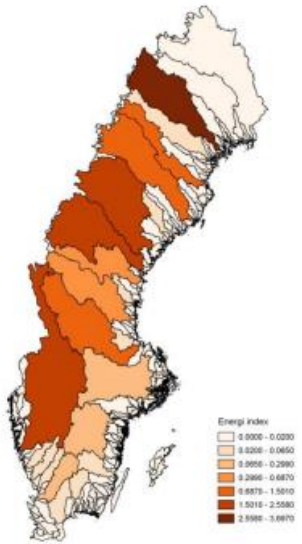
A systematic approach to reviewing licenses

- Sets a plan for 20 years, but will be adaptable if the energy system changes and new environmental knowledge appear
- Provide a time slot for each of the 2 000 hydropower plants in groups at a catchment level
- Link approval process to the Swedish court system availability
- Will require stakeholder dialogues in each catchment to set suitable mitigation goals/measures before court proceedings

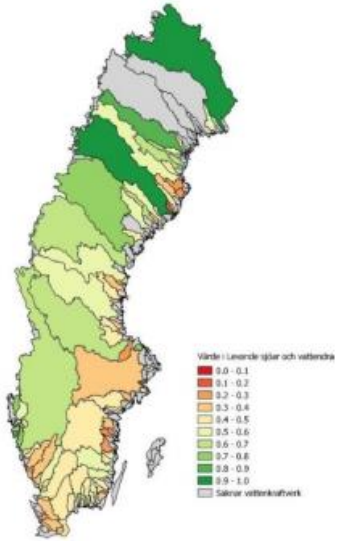
What have we learned from balancing hydropower with environmental goals

- Consider the accumulated effects of all environmental measures from a systems approach
- It is critical to weigh environmental values and ecosystem services at the same scale as energy values
- GIS a good tool for multicriteria analysis
- The master plan is a good tool for stakeholder dialogue a scenario modelling

Energy value

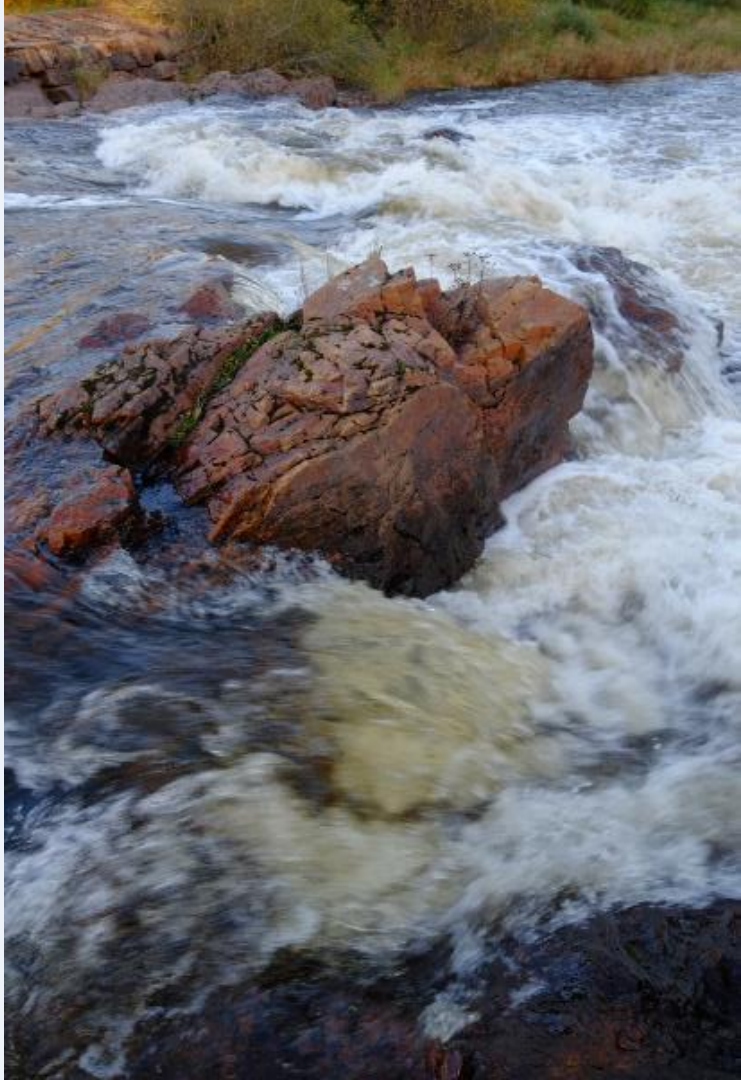


Environmental value

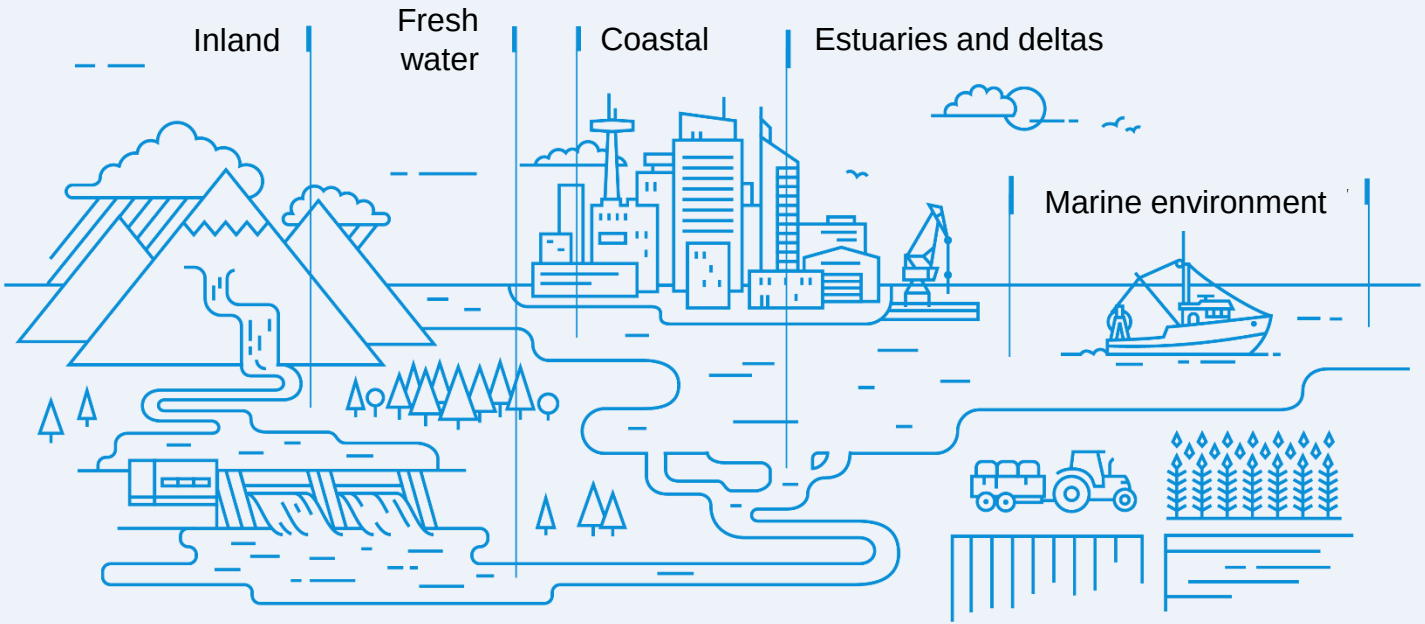


Next steps

- Developing Guidelines for
  - catchment specific programme of measues
  - Eflows, fish passages, other measures
  - Regulatory power issues
  - Guidelines and evaluation on socio-cultural values of hydropower
- Revising guidelines for HMWB and less stringent objectives
- Initiating stakeholder dialogues in each catchment according to the plan
- Increase R&D, environmental measures and system energy planning from a catchment basis
- Communication at all levels



The National plan supports a co-ordinated water resource management approach from source to sea



The National plan supports the transition towards a 100% renewable electric power system

Water is a central component in today's and tomorrow's energy mix

An open Swedish, Nordic and European electricity market

EU Energy Union


Swedish Agency
for Marine and
Water Management