



# Strategy for harnessing small hydro potential in Norway

Erik Juliussen

Norwegian Water Resources and Energy Directorate



# NVE-Norwegian Water Resources and Energy Directorate

- Subordinated to the Ministry of Petroleum and Energy and is responsible for the administration of Norway's water and energy resources.

...among other duties:

- Energy market regulator
- Licensing of energy and power grid projects:
  - Delegated authority to give license to small hydro power plants





# The Strategy for Small Hydro

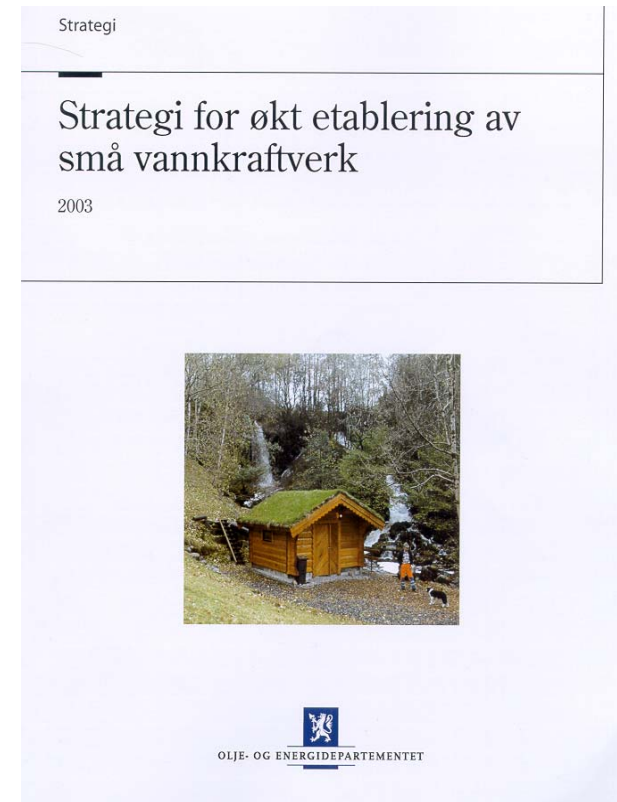
- Why?
  - Need to improve Norway's Power Balance
  - Generate more electricity from renewable resources
  - Option for Local Industrial Development
  - Enhance economic growth in rural Norway





# The Strategy for Small Hydro

- Tasks
  - Improve licensing procedures
  - Competency building
  - Information
  - Guidebooks from NVE
  - Pilot projects in selected municipalities
  - Evaluate option for an electricity certificate market or other support systems
- Instruments
  - Strategic budgets in NVE for information and R&D projects
  - Tax relief





# NVEs budget for information, resource mapping and technology improvements

- 0.37 mill € in 2002 and 2003
  - 0.75 mill € in 2004, 2005 and 2006
  - 0.75 mill € estimate for 2007
- *NVE supports R&D projects with 10-50% of total cost*



# NVE's small hydro R&D activities

- In total 54 projects from 2002 to 2006
  - Environment 5 projects
  - Hydrology 6 projects
  - Technology development 19 projects
  - Information and guidance 15 projects
  - Resource mapping 6 projects
  - Refurbishment and enlarging 3 projects
- Several still ongoing





# NVE Objectives

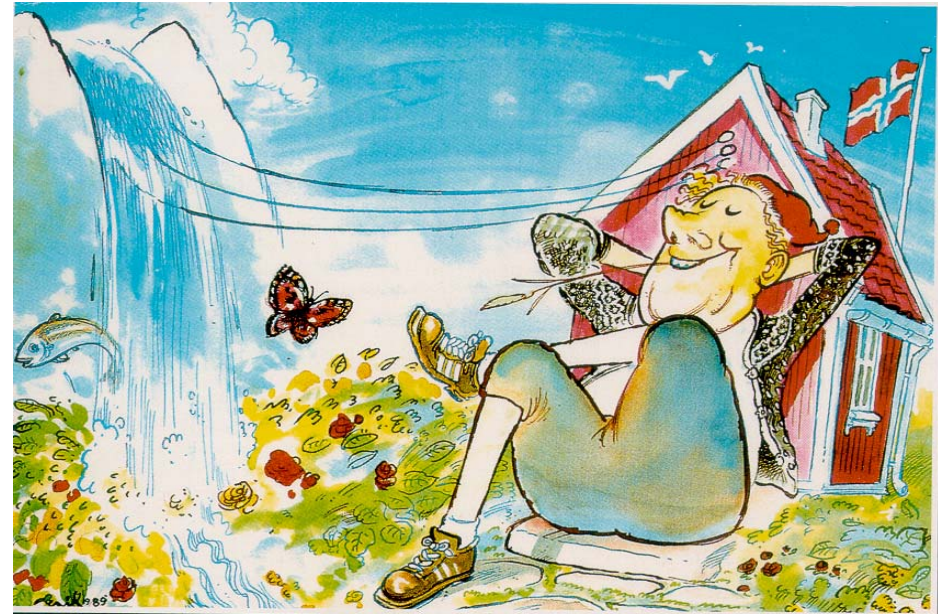
- Improve the Government's background for understanding the small hydropower potential
- Disseminate information to achieve good licence applications
- Clear the way for small hydro
  - Cheaper projects - Lower investments
  - Improved quality – Less maintenance, longer lifetime
  - New methods and technology – facilitate more projects
- Rural sustainability
  - Methods for co-operation
  - Methods for financing





# Focus on the small owner

- Land and waterways owned by small farmers
- Typical developer: farmer, small group of farmers
- Goal
  - Rural development
  - Preservation of cultivated landscape







# Information to Stakeholders

- NVE has produced a guidebook for the inexperienced hydro developer guiding him from the initial planning, the licensing, financing, construction and operation phase.

- NVE carried out 17 seminars in 2004 and 7 in 2005 highlighting small hydro options and constraints. Total 2500 participants





# NVEs guidebook

- Initial planning
- Detailed planning
- Licensing
- Financing
- Contracts for supplier
- Contracts for the electricity market
- Operation





# Economic Support Systems

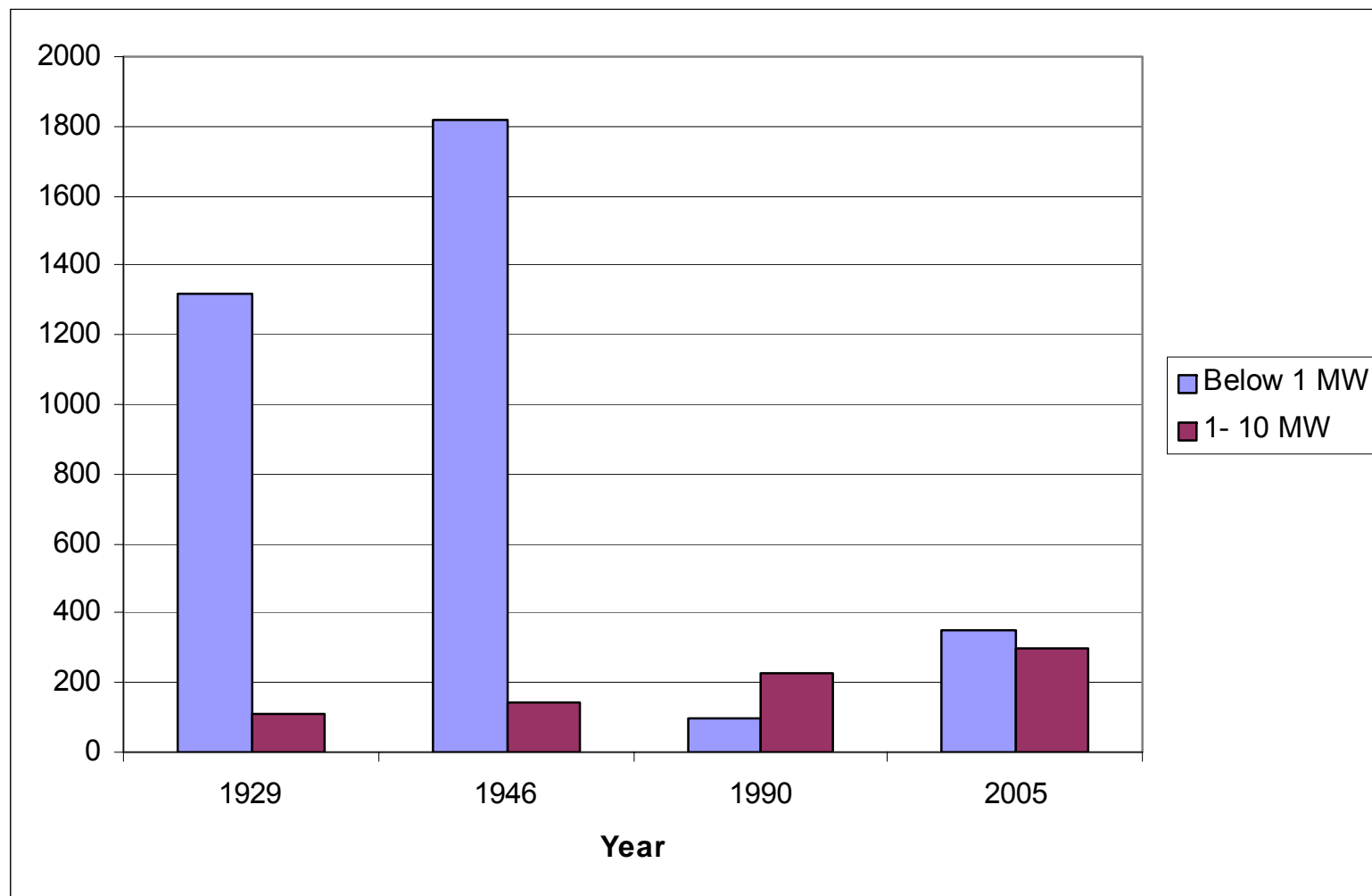
- Option for an electricity certificate market from 1<sup>st</sup> January 2007 was reviewed, but not implemented.
- Option for other support mechanisms for renewable energy.







## Number of small hydropower plants in Norway





# Effective licensing work.

Good applications reduce constraints with difficult balanced decisions





# Small versus large hydro

- 500 GWh could be produced by one large hydro scheme
- 500 GWh can be produced by one hundred 1 MW schemes
- The sum of many small schemes may have more severe environmental impacts than one large one

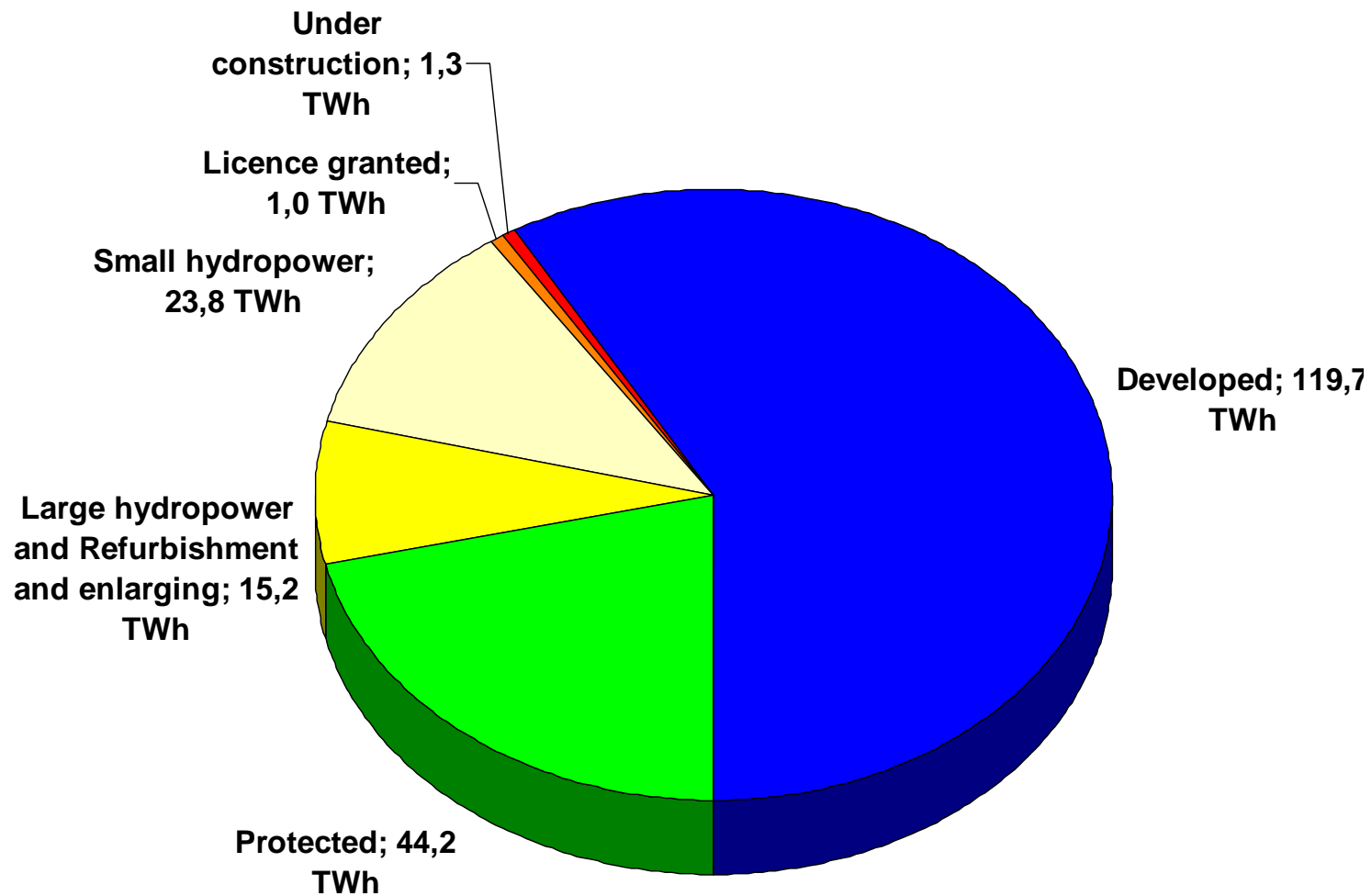






# Hydropower potential as of 31.12.2005

Mean annual production 205,2 TWh  
(Reference period 1970-99, Investment limit 3 NOK/kWh)







Thank you for your attention

Erik Juliussen [ēju@nve.no](mailto:ēju@nve.no)



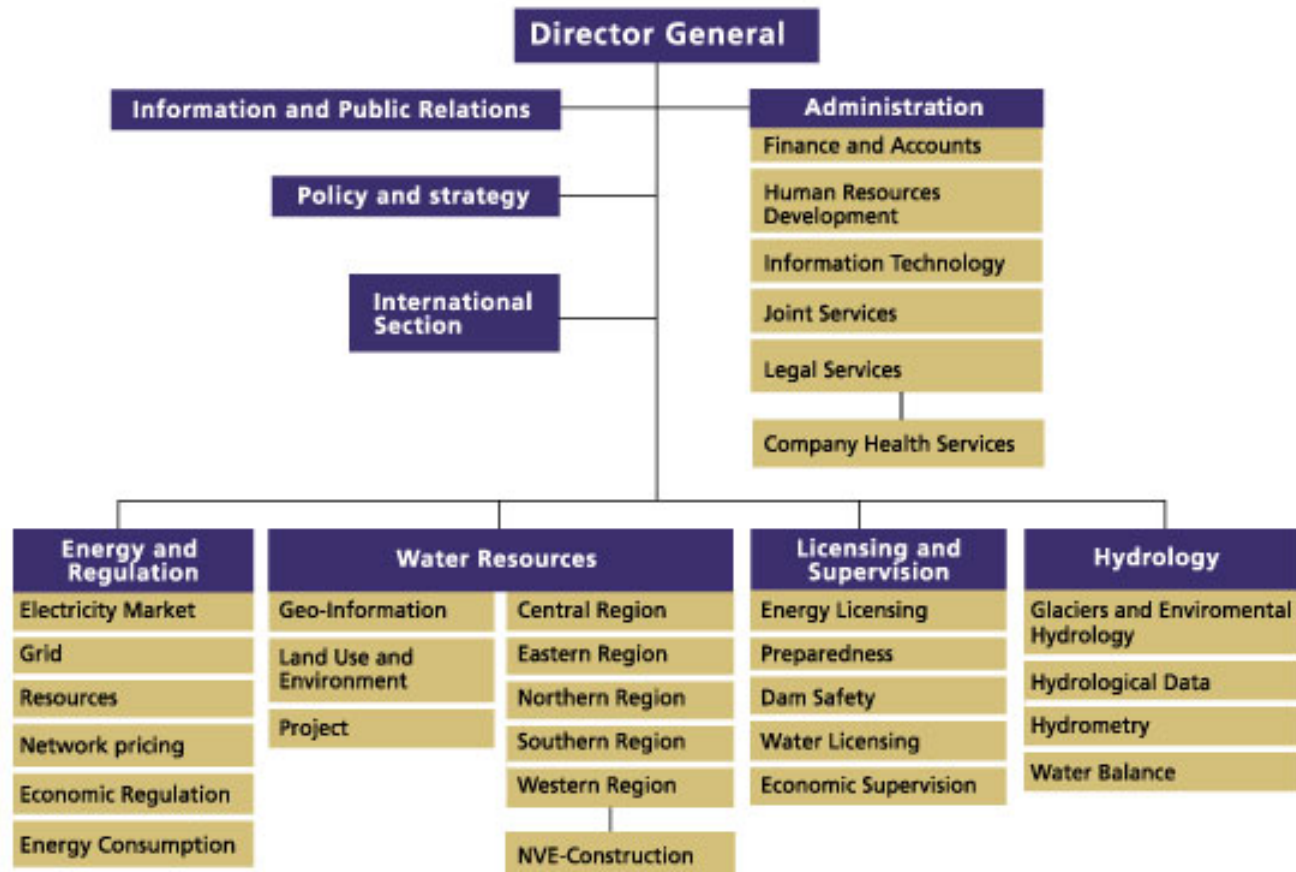


Extra slides





# NVEs organisation





# Small Hydro less 10 MW

- Total potential 25 TWh with Investment cost less NOK 3/kWh
- Constraints for environment, water fall rights, transmission capacity, local acceptance are serious barriers that will hamper harnessing the potential
- 5 TWh could be developed the next decade







# Environment

- The landscape







# Small hydro enhance the economy in rural Norway

- Being an owner of a small hydropower plant where state of the art are used in planning, construction and machinery, the farmer can still have time for farming and operate the electricity generating plant by his cell phone
- Help conserve the landscape we like to see as tourists





# Small Hydro Definitions

- Micro hydro less than 100 kW
- Mini hydro 100 - 1000 kW
- Small hydro 1MW - 10 MW
  
- Picture:
  - Mini hydropower plant, 300 kW.
  - The heat from the generator is used in the farm house.
  - The Electricity is fed into the grid.

