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Title: Energy efficiency and environmental safety of small hydropower plants

Authors: Irina Timofeeva , Elena Bykovskaia , Marina Kustikova, Elena Gnezdilova ,Svetlana Banar

Affiliations: ITMO University

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Irina Timofeeva , Elena Bykovskaia , Marina Kustikova, Elena Gnezdilova ,Svetlana Banar
ITMO University

Keywords:
hydropower plants, waterenergy

Research Objective:

Hydropower is an internationally recognized source of clean and regenerative energy that plays an important role in the world's energy supply. Driven by the ever-increasing demand for energy and global climate change, many countries around the world have chosen to develop hydropower as part of expanding their energy sectors. Small hydropower has a number of unique advantages - it is a mature and cost-effective technology that has a minimal impact on the environment.

At the moment, we can say that interest in small hydropower continues to increase. This is due to the fact that electricity tariffs only increase over time, the construction of new large energy facilities is reduced, and the price of fossil fuel also increases significantly. It should be noted that the problem of global warming sets the trend for the transition to the use of carbon-free energy sources.

Irina Timofeeva , Elena Bykovskaia , Marina Kustikova, Elena Gnezdilova ,Svetlana Banar
ITMO University

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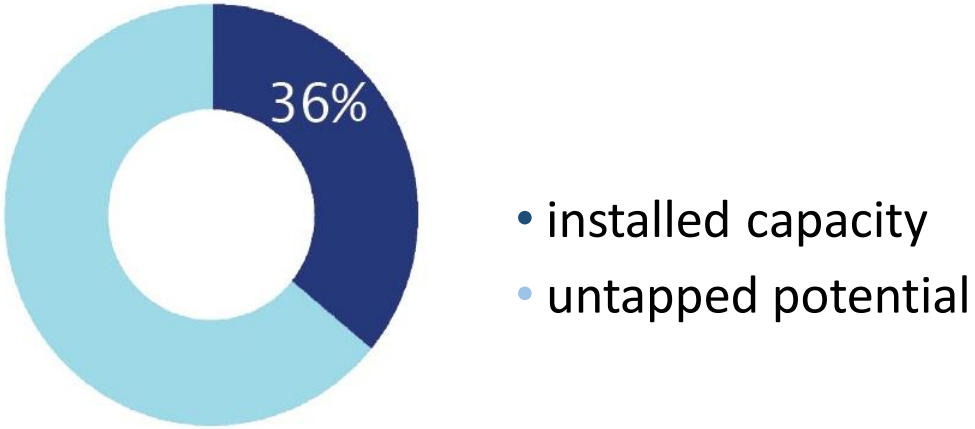
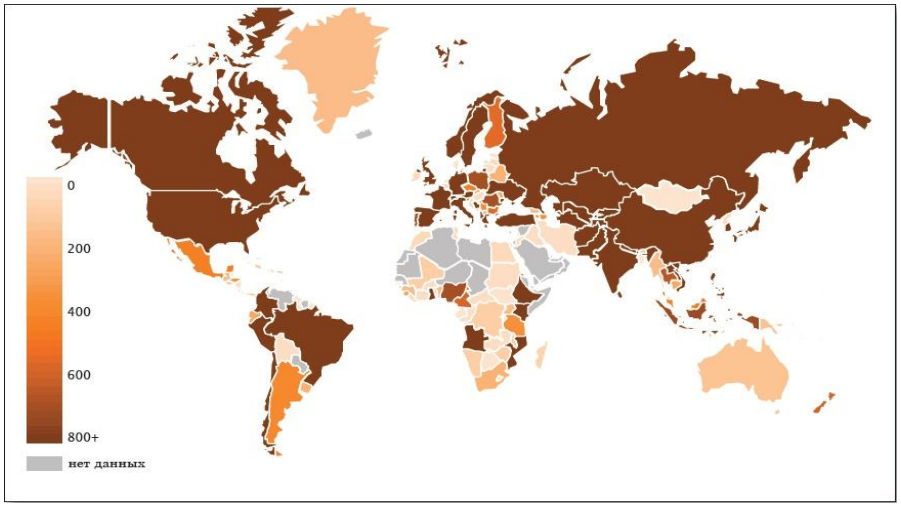
Results:

The advantages of small hydro generation over other types of power generation:

1. Minimal change in the natural landscape and the environment during the construction and operation of stations;
2. Preservation of the natural properties of the water used, the absence of polluting discharges and emissions;
3. Minimal dependence on weather conditions;
4. Low cost of electricity generation and longer service life compared to fossil fuel power plants;
5. Increasing the energy security of the region, ensuring independence from fuel suppliers;
6. Absence of greenhouse gases and environmental pollution by combustion products and toxic waste in the process of electricity generation, which meets the requirements of the Paris Agreement.



Pic.1 - Total installed capacity of small hydropower plant (%)



Pic.2 - Potential of small hydropower plants by country (MW)

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Results:

Nevertheless, as with any technical facility, there are some environmental risks during the construction and operation of small hydroelectric power plants, for example, such as:

1. Construction of a reservoir of a hydroelectric power plant can create physical and chemical pollution of water, and then of soils adjacent to the water area of the reservoir;
2. Flooding of land, leading to degradation of soil and vegetation, as well as property damage to the population;
3. Eutrophication and silting of water bodies in places of water collection, biological pollution of water bodies with bacteria;
4. Salinization of water in reservoirs. On irrigation systems, when irrigated with such waters and their subsequent evaporation, the soils become horticultural and unsuitable for agriculture;
5. Changes in the hydrological regime of rivers, changes in microclimate in reservoir zones, increase in air humidity;
6. Intensification of succession processes and changes in ecosystems;
7. Violation of the habitat of aquatic organisms, changes in the migration routes of fish, reduction of fish stocks;
8. When passing through the turbines of hydroelectric power plants, forage invertebrates and fish can be subject to mechanical stress (collision with flowing elements of the structure), the influence of pressure drops, cavitation, as well as the influence of turbulence and shear stresses arising from a sharp change in the speed and direction of flow. The death or degree of damage to aquatic organisms will depend on various technically influencing factors;
9. Possibility of accidents at hydroelectric power plants with the consequences of floods, etc.

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Conclusions:

1. Interest in small hydropower as a generation that has a minimal impact on the environment has only increased in recent years.
2. Small hydropower plants are energy efficient, since energy losses and consumption for own needs account for about 5% of the total generated energy.
3. Supported by environmental policy and oversight by relevant authorities, small hydropower can be an important renewable energy technology that contributes to rural electrification, inclusive and sustainable industrial development, and the reduction of greenhouse gas emissions.

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Acknowledgement

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Thank you for your attention!

Authors: Irina Timofeeva , Elena Bykovskaia, Marina Kustikova, Elena Gnezdilova ,Svetlana Banar

Affiliations: ITMO University

Contact details: ivtimofeeva@itmo.ru