Opportunities for Demand Response in Ukrainian Irrigation and Lift Pumping Stations (Scoping Study)

‘

Project Background

Name of applicant	State Enterprise National Power Company ‘Ukrenergo’
Project info/Project name	Opportunities for Demand Response in Ukrainian Irrigation and Lift Pumping Stations (Scoping Study)
Contractor	VTT Technical Research Centre of Finland Ltd
Project duration	April 2021 – October 2022
Contract value	€120,000.00

Project Summary

1 Project Summary

An analysis was conducted into the feasibility of a practical implementation of electrical energy demand response (DR) for water supply and irrigation in Ukraine based on available data and interactions with stakeholders. An analysis of the Ukrainian Integrated Power System (IPS) with regard to flexibility needs and the potential application of DR in water supply and irrigation was carried out. The analysis studied the requirements for IT infrastructure to enable communication between DR services. Possible environmental, economic and social impacts of DR implementation were analysed along with possible legislative, technological and social barriers and required adaptations.

The objectives of the project were:

a. To assess the feasibility of the practical implementation of DR for irrigation and water supply pumping stations or wastewater treatment plants in Ukraine

b. To estimate the electrical capacity of DR that can be used by Ukrenergo

c. To provide recommendations for further development

2 Project Conclusions

The assessment revealed that the feasibility of a practical implementation of DR in Ukrainian irrigation and water supply pumping stations remains limited, although sufficient capacity already exists. The primary limitations include current legislation limiting participation in DR markets, the technological characteristics and capabilities of existing pumping stations and other equipment and monitoring requirements. The available DR capacity was estimated and economic dispatch modelling of DR for water supply and irrigation was performed. Based on the modelling, it was found that DR for water supply is especially economically attractive. However, a variety of technological, social and legislative barriers are likely to limit DR implementation in Ukrainian irrigation and water supply. If the implementation of DR in these sectors is to be advanced, these barriers must be addressed.

Many legislative changes are required to support DR implementation, while there are also knowledge-related challenges to overcome, i.e. better and more focused information sharing is required to convince different stakeholders of the possible benefits. This should be supported by local pilot installations, possibly implementing best practices from localised demonstrations in other countries.

There is a significant challenge in further improving water supply technology. Since the advantages of utilising electricity during night hours, when prices are lower, have already been realised, there is little opportunity for further optimisation. Recommendations on overcoming these barriers and ways to mitigate potential environmental, social and economic impacts were developed based on data provided by Mykolaiv, Rivne and Chernivtsi water utilities and the outcomes of FlexTool modelling. Only once these have been implemented, including changes to software used in electricity markets and technology updates for pumping and water systems, will wider deployment of DR be possible.

According to the analysis, the available electrical capacity of DR from water utilities is about 86 MW for both upward and downward response, depending on the temporal pattern of water demand. For water irrigation facilities, a total of 2,900 MW from installed pumps can be utilised to provide DR service for Ukrainian IPS. However, model simulations suggest a current maximum operational capacity of 375 MW.

3 Impact on Human Rights and the project's Sustainable Development Goals (SDGs)

The implementation of Demand Response in water supply and irrigation would positively impact on human rights by supporting improvements in infrastructure and living standards, ensuring environmental sustainability and energy security and providing access to affordable, reliable and modern energy services for all consumers, including vulnerable groups.

Overall, the project could positively impact the following SDGs:

4 Project Deviations

The study was primarily conducted in 2021, prior to the outbreak of war in Ukraine. The consultant encountered difficulties gathering information from relevant stakeholders, and therefore the project timetable was not kept. Simulations and reporting were conducted during 2022. Given the current situation, including damage to water supply and irrigation infrastructure, displacement of people within and outside Ukraine and the integration of Ukrainian IPS into ENTSO-E, the findings of this study may no longer be applicable or achievable.

Nevertheless, the primary conclusions, highlighting DR as a valuable tool under certain conditions, still hold true.

5 Project Lessons Learnt

Lessons learnt

Many legislative changes are required to support DR implementation. This presents an opportunity for the Ukrainian Transmission System Operator (TSO) to adopt the legal framework of EU TSOs and implement DR. However, this will require rather significant investment, increase energy demand and make energy production more expensive.

In addition, there are knowledge-related challenges, i.e. better and more focused information sharing is required to convince different stakeholders of the possible benefits. This should be supported by local pilot installations, possibly implementing best practices from localised demonstrations in other countries.

Only after these steps, including changes to software used in electricity markets and technology updates for pumping and water systems, will wider deployment be possible.

The war in Ukraine changed power generation within the country. Coal generation, which served a balancing function, is no longer operational and

infrastructure has been severely damaged.

The rise of electricity prices suggests that electricity generation will be more variable in the coming years. Thus, research into DR and electricity generation from renewable sources has become an important topic for TSOs. While the Beneficiary is well aware of the benefits of DR, there is an information gap on the end-user side. Based on the study, the monetary benefits of DR for consumers are not sufficient to boost investment.

Benefits of the project

DR can provide significant benefits to Ukraine's energy system. DR can help to balance supply and demand, reduce peak demand and improve system efficiency. This can lead to lower energy costs, reduced greenhouse gas emissions and improved system reliability and resilience.

DR can also help to address some of the challenges facing the energy system, such as the need to integrate renewable energy sources, improve energy security and modernise energy infrastructure. Additionally, DR can create opportunities for energy savings and efficiency improvements.

However, there are also challenges to implementing DR in Ukraine, including legislative barriers, technological limitations and knowledge gaps among stakeholders. Addressing these challenges will require a coordinated effort from government, industry and other stakeholders to develop policies and regulations that support DR and investment in new technologies and infrastructure, and educate stakeholders about the benefits and opportunities of DR.

Hopefully, this study has contributed to knowledge of DR in Ukraine and will encourage electricity consumers to consider DR in the design phase when it comes to renovating equipment.

Effectiveness of the project

Neither the consultant nor the FUTF team could keep the planned project schedule. However, the project deliverables comply with the FS targets and FUTF objectives, including promoting cooperation between Finland and Ukraine and identifying opportunities for possible projects.