UA-GRIDEX: Lessons from renewable energy planning for a municipal water utility

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Photo: Maksym Tymchyk

When energy resilience becomes service resilience

When electricity fails, this is not simply an energy problem. It becomes a municipal services problem.

WATER	HEATING	HEALTH	EDUCATION
Pumping & treatment	Buildings & district systems	Hospitals & care	Schools & connectivity

UA-GRIDEX starting point: protect the essential service first — then design the energy system.

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The UA-GRIDEX case: keeping water flowing

Municipal water station in central Ukraine • exact location anonymised for security reasons

400,000+	55.2 MWh	2.82 MW	8,712 m²
people served	electricity demand / day	peak electrical load	available site area

We modelled electricity and heat options against real demand, available space, weather conditions and existing infrastructure.

Question: which decentralised energy investments actually improve resilience here?

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Three principles behind the analysis

1 Plan before investing

Energy-system planning helps direct scarce public and reconstruction funding to solutions that fit the service need.

2 Diversify supply

Resilience comes from combining complementary sources and reducing dependence on a single point of failure.

3 Build resilience cleanly

Decentralised renewables and storage can strengthen energy security while supporting long-term decarbonisation.

The modelling assessed PV, wind, battery storage and grid supply for electricity and heating. The feasibility of each solution was then evaluated against the specific characteristics and constraints of the site.

The technically best option was not the feasible one

WIND + BATTERY

Strong technical and economic performance in the broader system model

≈170,100 m² indicative area needed for one 2 MW turbine

→ **Not physically viable on the station site**

ON-SITE SOLAR PV

Available land and rooftops limit solar PV to ~1.8 MW.

1.83 MW theoretical maximum on-site PV capacity

→ **Covers only about 9% of annual demand**

Modelling identifies the options; site constraints determine what is feasible.

The realistic solution is hybrid (not fully off-grid)

Two feasible configurations for the site

PV + GRID

€2.41m upfront CAPEX

1.827 MW PV • No battery

Lifetime cost: €39.8m

LCOE: €0.113/kWh

PV + BATTERY + GRID

€2.96m upfront CAPEX

1.769 MW PV • 4.2 MWh battery

Lifetime cost: €40.4m

LCOE: €0.114/kWh

Battery case: ~1 hour 50 minutes of battery backup at full load.

In practice, the duration could be longer if demand were reduced to critical loads only or solar were simultaneously producing electricity. And shorter, if the battery were not fully charged.

Storage adds ~1.5% to lifetime system cost, while providing short-term backup and operational flexibility.

Financing: a large project for a municipality, a small one for an IFI

€2.5–3.5m
estimated renewable investment need for the water station examined in UA-Gridex

€4–20m
typical EIB municipal water financing

€7–25m
typical EBRD municipal loans

€460k
E5P grant example

The financing challenge must be approached through finding the right financing structure.

Concessional loan + **Grant** + **Technical assistance** → **Bankable project**

Another route: bundle several municipal resilience investments into a larger package that better matches IFI financing scales.

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Three lessons for municipalities

1

Start with the service, not the technology

Define what must keep working and the minimum energy needed to maintain it.

2

Design for actual local conditions

Demand, available space, infrastructure, storage and grid interaction are key factors in identifying the optimal solution.

3

Strengthen resilience through municipal exchange

Sharing practical experience between Ukrainian and other European municipalities can strengthen resilience on both sides.

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Energy resilience begins with understanding community needs and building a diversified energy system that keeps essential services running.

Thank you!

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