

# KRYVYI RIH

CREATION OF AN ADAPTIVE HEAT SUPPLY  
SYSTEM RESISTANT TO HYDRAULIC SHOCKS  
CAUSED BY BLACKOUTS USING THE  
TECHNOLOGY OF DIGITAL TWINS



Code in the DREAM system:  
DREAM-UA-291024-DC853996



КРИВИЙ РІГ  
МІСТО ДОВЖИНОЮ В ЖИТТЯ



REBUILD  
UKRAINE

4<sup>а</sup> МІЖНАРОДНА ВИСТАВКА І КОНФЕРЕНЦІЯ

CONSTRUCTION & ENERGY



# Challenges



**September 2022**  
Karachuny Dam



**June 2023**  
Kakhovka HPP

1

Primary corrosion due to lack of heat carrier in the networks

2

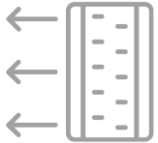
Secondary corrosion due to increased water mineralisation

3

Destruction of networks from water hammer due to blackouts



**Building resilience to water hammers**



**Reduced heat loss**



**Ensuring energy savings**

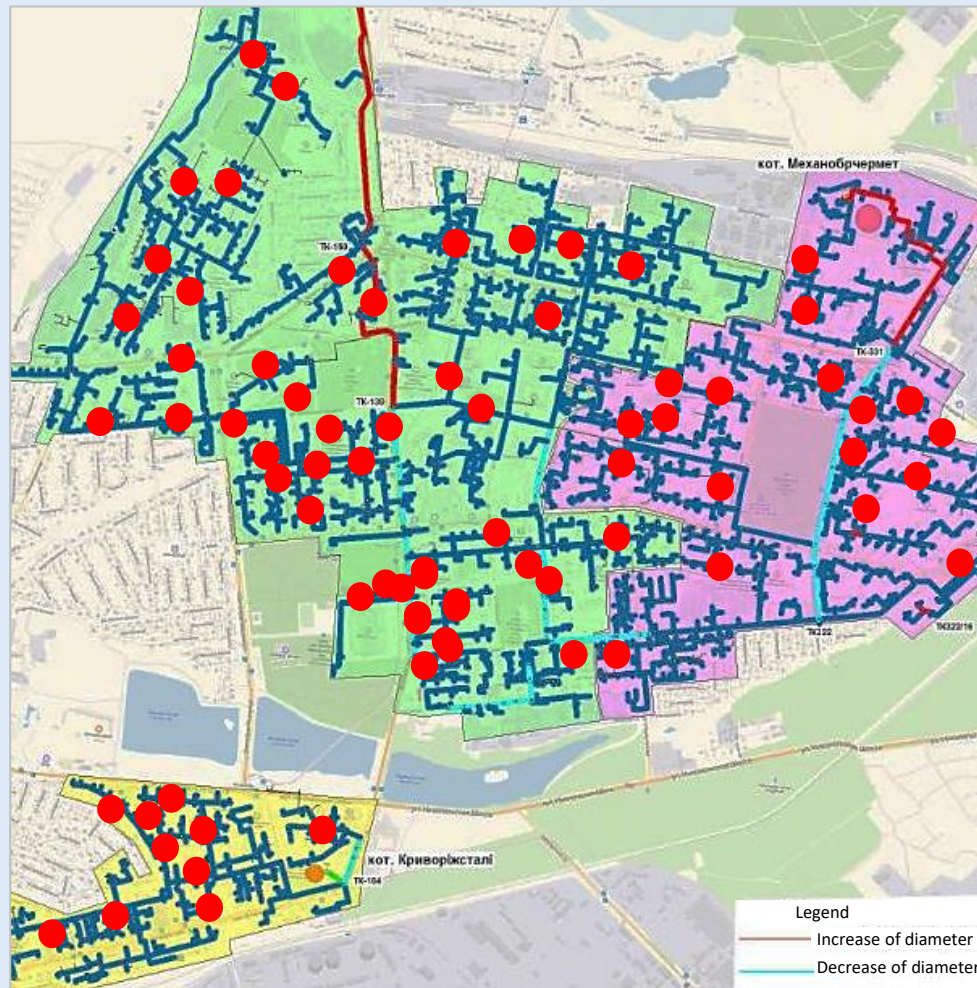


**Improving the quality of heat supply services**



**Modernisation of internal quarter heating networks**

# Creation of an adaptive heat supply system resistant to water hammers



Module for risk management

The most vulnerable areas

Number of accidents over the last 3 years: 487

## Hardware with the IoT sensors:

- pressure sensors with autonomous power supply;
- controllers with GSM/GPRS modules;
- automatic locking devices;
- hydraulic shock compensators and regulating valves;
- backup power supplies;
- servers for data processing.

These components ensure reliable collection and transmission of network status data.

## Software of the DT (digital twins) technology:

The system software consists of a GIS platform with an interactive map of networks, a real-time monitoring system, an analytics and forecasting module, an alert system and a mobile application for staff.

It enables efficient data analysis and operational decision-making.

1

## Monitoring and detection of deviations

The system provides real-time monitoring of the network status and automatic detection of pressure deviations, which allows for a quick response to potential problems.

2

## Forecasting and optimisation

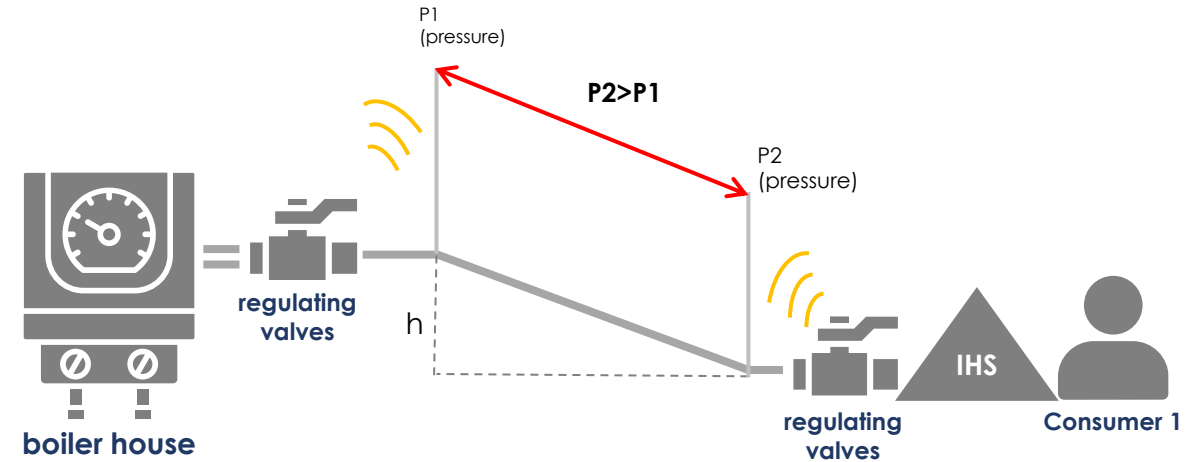
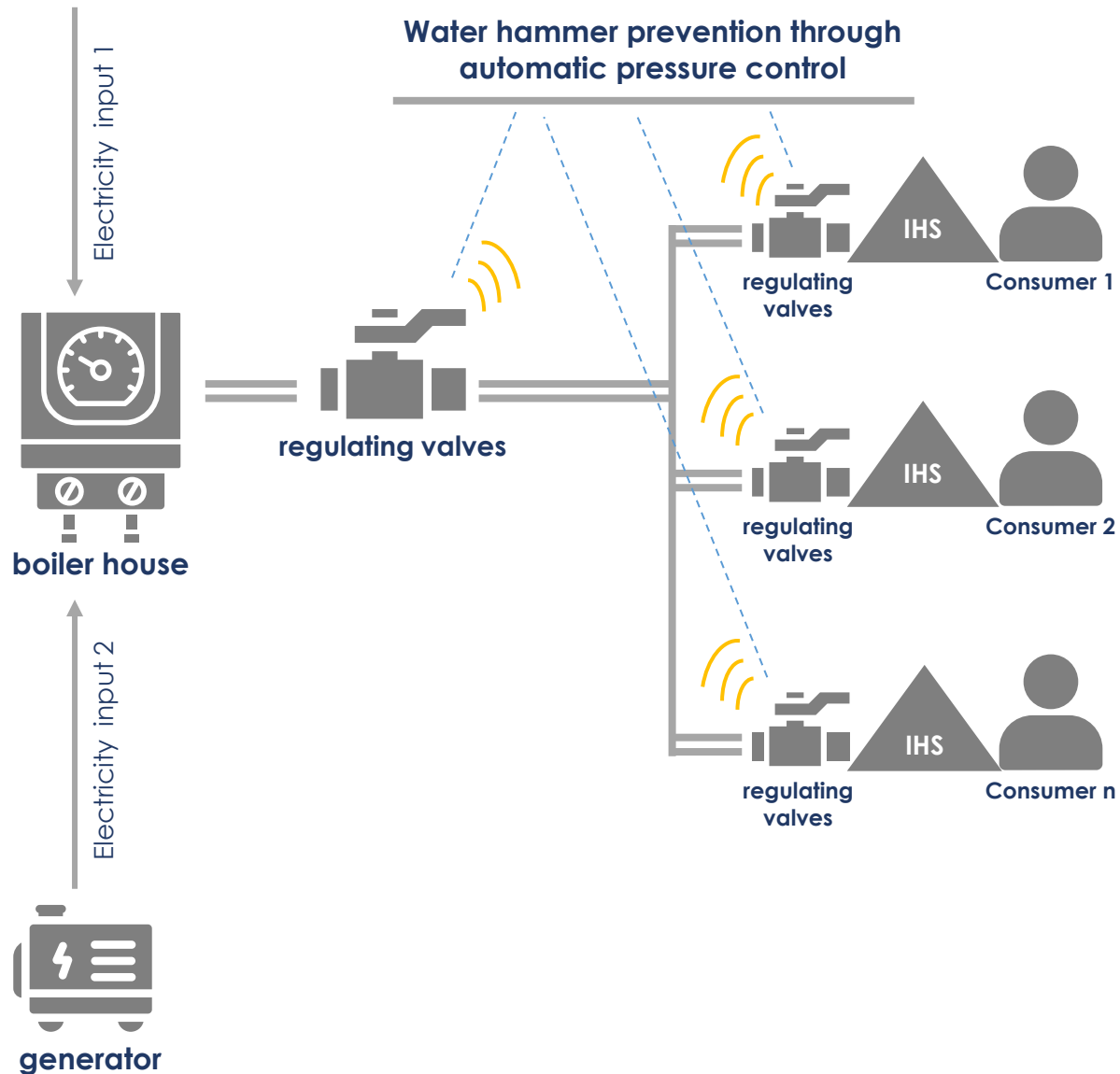
The functionality includes prediction of possible damage locations and determination of optimal locations for the installation of protective equipment, which increases the efficiency of accident prevention.

3

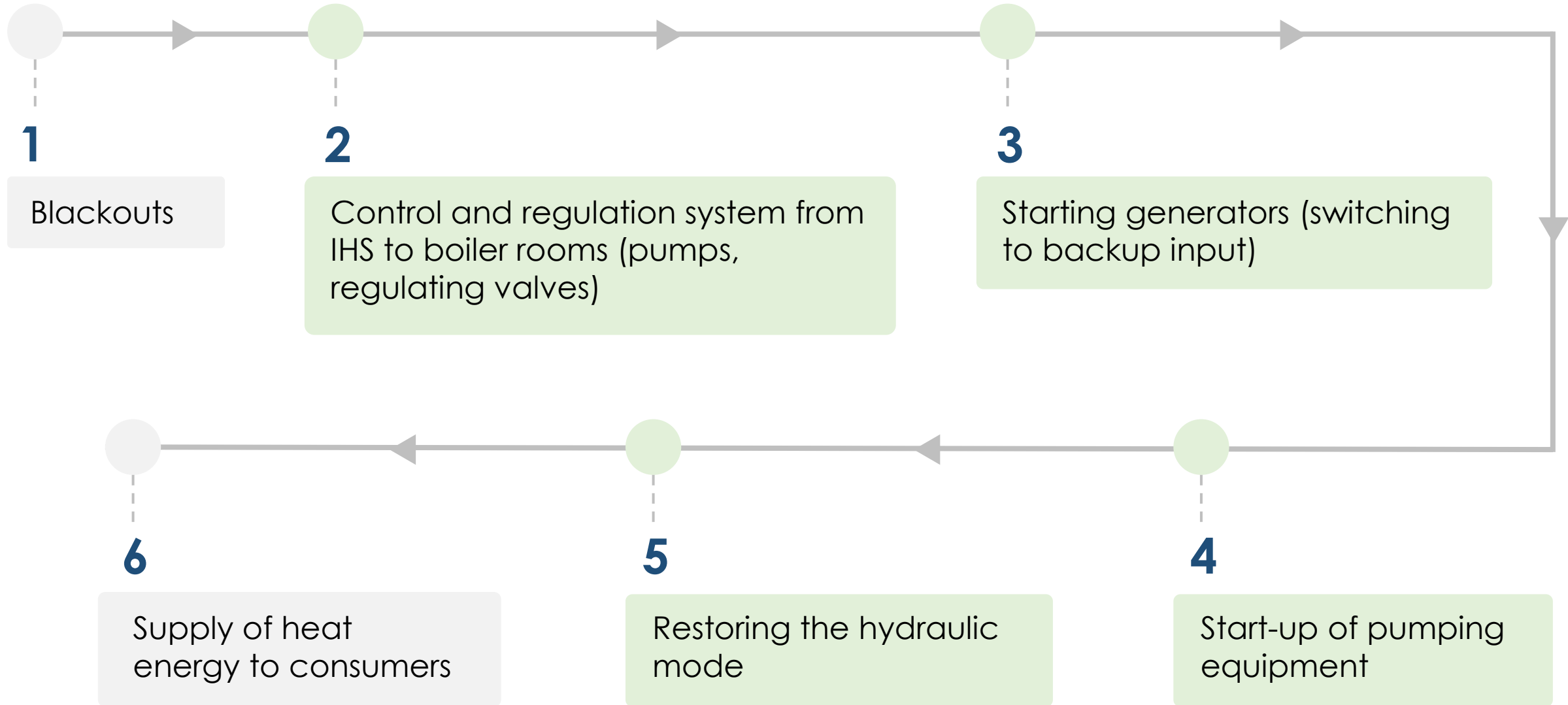
## Emergency management

The system generates routes for emergency crews and maintains a database of accidents and their consequences, which helps to improve emergency response and prevent their recurrence.

# Adaptive system using the technology of digital twins



# Adaptive response system





## The total length of networks to create an adaptive system :

116,856 km

## Current status:

85% of steel pipes in service for more than 30 years

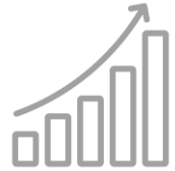
## Planned new pipelines:

- Flexible pre-insulated PE pipes with diameters of 50/100 - 160/200 mm
- Steel pre-insulated pipes with diameters of 219/315 - 273/400 mm



- **Estimated cost of the project:**  
EUR 35,138 thousand
- **Current heat losses:**  
54,288.85 Gcal/year (7.13% of the total amount)
- **Expected reduction in heat loss:**  
35%
- **Estimated payback period of the project:**  
5.6 years

# Expected results



**Improving the quality and reliability of heat supply**



**Reduced number of accidents and repairs**



**Reducing CO<sub>2</sub> emissions into the atmosphere**



**Improving the quality of customer service**

# Projects of Kryvyi Rih restoring access to drinking water



Projects	Implemented	Under implementation	Offer of cooperation
1.1. Emergency aid from international partners <sup>1</sup>			
1.2. National project Karachuny Reservoir - Southern Reservoir			
1.3. Ukraine Fund Programme			
1.4. Strategy 2050 together with AFD (UNICEF, IOM)			
1.5. Solar power plant at the central aeration station (0.8 MW)			DREAM-UA-160824-04DF0570
1.6. Pilot project to optimise energy consumption at Kryvbasvodokanal			DREAM-UA-291024-D01FE8A2
1.7. Creation of an adaptive water supply system resistant to water hammers from blackouts			DREAM-UA-291024-FAC7379F
1.8. Solar power plant, 12 MW			DREAM-UA-160824-030463A3
1.9. Biogas plant, 1 MW of electricity and 1.9 MW of heat			DREAM-UA-140524-7CF05052

<sup>1</sup> (UNICEF, IOM, ACTED, funds from Poland, Spain, Belgium, Austria) assistance in the amount of EUR 14.6 million

# Projects of Kryvyi Rih: restoring heat generation



Projects	Implemented	Under implementation	Offer of cooperation
2.1. Centralised heat supply strategy until 2050 (GIZ)	✓		
2.2. Network Rehabilitation Programme, boiler houses (EBRD)	✓		
<b>2.3. Distributed energy generation:</b>			
Cogeneration units (USAID)	✓		
Cogeneration units (private business)		✓	
2.4. Improving the energy efficiency of boiler houses			✓ <b>DREAM-UA-291024-CEEE8906</b>
2.5. Creation of an adaptive heat supply system resistant to water hammers caused by blackouts			✓ <b>DREAM-UA-291024-DC853996</b>

# Projects of Kryvyi Rih: hospitals



Projects	Implemented	Under implementation	Offer of cooperation
3.1 Autonomous heating 1) GIZ - 4 hospitals 2) UNICEF - 3 hospitals			
3.2. Energy service (UNDP) 8 hospitals			
3.3 Thermal modernisation (GIZ)			
3.4 Rehabilitation of hospitals (Sweden, South Korea)			
3.5. Thermal modernisation of children's hospitals (UkrGasbank)			
3.6. Solar power plants with storage (UNICEF)			
3.7. Internal repairs and equipment			DREAM-UA-301024-CA01341A



# Projects of Kryvyi Rih: schools and kindergartens



Projects	Implemented	Under implementation	Offer of cooperation
4.1 Thermal modernisation (7 sites with the EBRD)	✓		
4.2. Solar heating system (1 object)	✓		
<b>4.3. Autonomous heating of kindergartens:</b>			
1. Heat pumps in 3 kindergartens		✓	
2. Heat pumps in 5 kindergartens		✓	
4.4. Thermal modernisation (29 facilities with the EBRD)		✓	
4.5. SPP (7 kindergartens and schools)		✓	
4.7. Autonomous heating for educational institutions			✓
			DREAM-UA-301024-75E5DB9A

# Projects of Kryvyi Rih: ecology and circular economy



Projects	Implemented	Under implementation	Offer of cooperation
5.1. Kryvyi Rih Innovation and Business Incubator (laboratory, creation of products from production waste) <sup>1</sup>			
5.2. Creating an incubation base for circular economy projects			 DREAM-UA-160824-65462A9A

<sup>1</sup> Swiss Development Agency



# Projects of Kryvyi Rih: support and development of SMEs



Projects	Implemented	Under implementation	Offer of cooperation	
6.1. Kryvbas Industrial Park (status: design and construction of networks)				
6.2. Establishment of the Logistics Terminal IP				DREAM-UA-301024-A41155F7
6.3 Creation of an ecosystem to support small and medium-sized businesses. Digital project platform				DREAM-UA-301024-8440B415

# Projects of Kryvyi Rih: social housing



Projects	Implemented	Under implementation	Offer of cooperation
7.1. Construction of 9 units of nine-storey buildings (750 apartments) (South Korea, EIB)		✓	
7.2. Social housing programme (restoration of 8 objects for 1000 apartments)			✓ <span>DREAM-UA-301024-E9627365</span>



# Thank you for your attention!

## Contacts

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