



Infrastructure

Smart district heating systems

PETROL

Energy for life

We help in the comprehensive and sustainable development of district heating systems

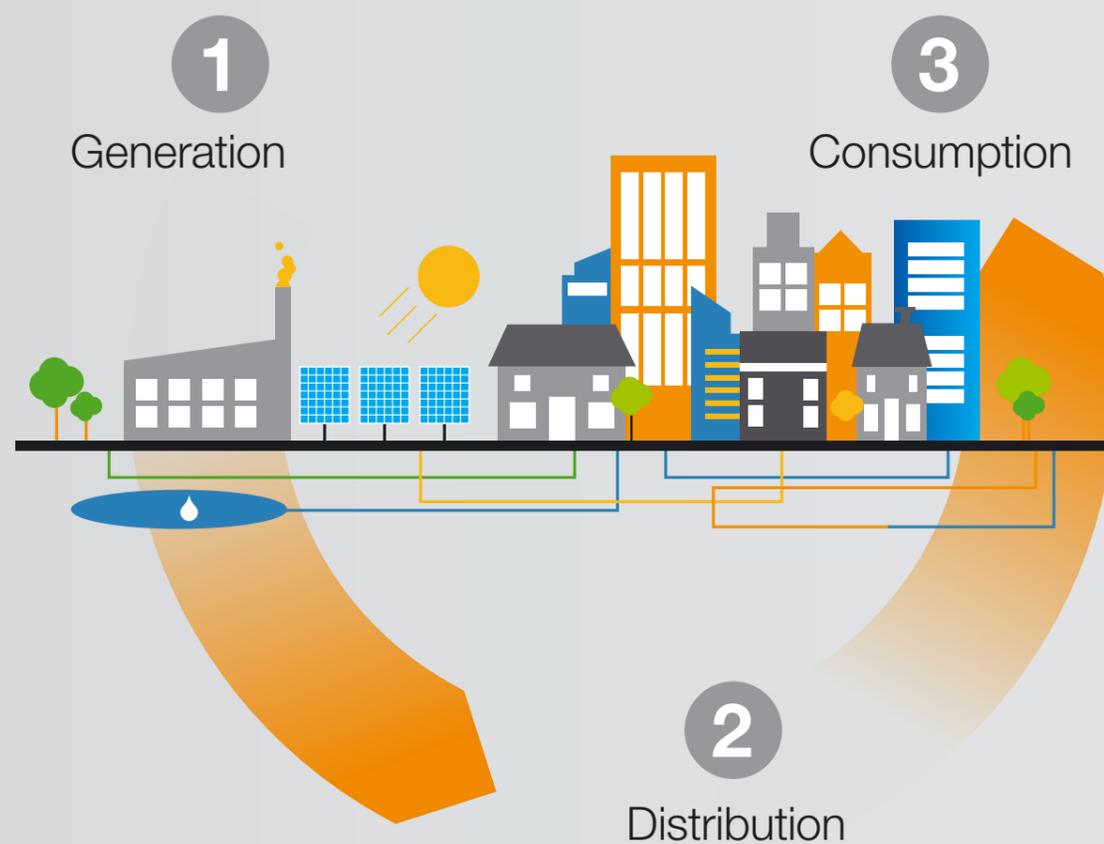


With smart solutions **DISSy (Digital Intelligent Smart Systems)**, we manage the entire district heating process: heat generation, distribution and consumption.

DISSy solutions are used for new and existing district heating systems. They define the measures in **investment optimisation (CapEX)** and **cost optimisation (OpEX)**, while considering all important system requirements, the relevant national and European legislation and international standards.

We help providers achieve the best possible results with the price of generated heat, environmental burden, and unified control of system operations.

A comprehensive district heating and cooling solution as part of the implementation of a sustainable business model and development of smart city infrastructure



- 1 HEAT GENERATION (DISPro)**
We efficiently combine different heat energy sources (traditional and renewable energy sources), based on their availability and market conditions. We can manage storage capacities for heat energy.
- 2 HEAT DISTRIBUTION (DISNet)**
We design new distribution networks for district heating. We monitor operation of existing networks and carry out scenario analyses for balancing flow and pressure, recommending the necessary investments for system optimisation.
- 3 HEAT CONSUMPTION (DISCo)**
We provide optimal solutions in heat energy consumption, considering all characteristics of the entire district heating system and profile heat demand.

We help in transition to cleaner and more available energy systems



In 2016, the European Commission adopted the package of measures "Clean energy for all Europeans", also called the "Winter Package".

It defines the guidelines for energy transition to cleaner and more available energy systems:

- Heating and cooling systems must be smart, efficient and sustainable.
- District heating systems must become the key source of heating in cities.
- National energy and climate plans for promoting investments in the sector should be adopted.
- At least 32% of renewable energy sources and at least 32.5% energy efficiency by 2030.

At Petrol, we develop technological solutions that help achieve the European Commission's goals.

We provide district heating services in over 40 systems, which amount to 15.5 GW of optimised thermal power. For many years, we assist with the development of smart district heating systems.

300% increase of heating consumers using district heating by 2030

400% increase of heating consumers using district heating by 2050

Increase of heating using waste heat and renewable energy sources

Sustainable, green and smart society is part of our vision. We know that smart management of sources is essential for future generations; that is why we're investing in energy efficiency and renewable energy sources projects as the driving force of development, and guarantee energy savings. We are committed to achieving reduced energy consumption, which is important from the economical perspective and the perspective of preservation of nature and environment.

Inclusion of alternative and renewable energy sources and re-use of waste heat.

Linking of data and business systems for optimal process operation.

Optimal network dimensions for new and existing systems.

Transition to low-temperature networks.

Development of services for end users.

Optimal revenues with heat and power cogeneration.

Balancing production sources with heat consumption needs.

Automation of network and devices and integration of all data in one location.

Managing peak needs and heat energy storage needs.

Energy savings in accordance with legislation, as well as reduced water loss.

Providing quality heat energy.

Production and heat energy distribution cost optimisation.

District heating system management is supported by the modern information solution Tango, to ensure efficient (near) real-time management.

Using DISPro services, we optimise investments and operating costs for cogeneration of heat and electrical power



DISPro (Digital Intelligent Smart Production) are comprehensive solutions for cogeneration of heat and electrical power, from planning completely new production sources to implementation of measures for improving existing production sources and electrical power generation.

Particularities of the local market for primary energy, legislative regulation and availability of renewable sources determine the design of a new district heating system or the development of the existing system. This is particularly important for cities and district heating system operators, as they have to ensure sustainable operation while ensuring thermal comfort and favourable prices for end users.

Selecting the optimal combination of clean energy sources

We take on modern energy challenges by including various clean energy sources, which contribute to the transition to a more sustainable energy system. Selecting the optimal energy solution includes appropriate dimensioning of production sources for economical operation and optimal management with the lowest costs and high system stability, reliability and quality.

Solutions for investments and optimisation of heat generation costs

- Preparation of studies on including renewable sources for heating.
- Preparation of solutions for optimal selection of production sources and plans for including additional heating sources, such as thermal storage.
- Remote control and management of production sources.
- Preparation of optimal production schedules.
- Using the Tango information system, we convert data into key information.



Using DISNet services, we optimise investments and operating costs for distribution of heat energy

DISNet services (Digital Intelligent Smart Networks) are comprehensive solutions in heat energy distribution for optimising investments and operating costs, as well as reducing heat loss. DISNet enables design of new distribution networks, analyses and proposals of investments in existing distribution networks, and constant monitoring of system operation using scenario analyses for balancing flow and pressure.

Solutions for investments and optimisation of heat distribution costs

- Automation of heat exchange stations.
- Optimisation of heat distribution using expert thermo-hydraulic tools.
- Preparation of scenarios for connecting or utilising the distribution network for improving the efficiency of supplied heat.
- Implementation of solutions for remote control and management.
- Implementation of solutions for reducing heat loss.
- Implementation of control tools for improving investment, operational and maintenance processes for investment planning, management of distribution network and performance of maintenance work.
- Implementation of expert (near) real-time control tools, such as SCADA, Schneider Electric Termis, and Tango for improving and automating management processes.



With DISCo services, we provide optimal solutions in heat energy consumption

With DISCo services (**Digital Intelligent Smart Consumers**), we provide optimal solutions in heat energy consumption, considering all characteristics of the entire district heating system.

Solutions for investments and optimisation of heat consumption costs

- Planning and executing the transition from direct to indirect heat supply system.
- Design and replacement of large heat exchange stations with smaller ones.
- Profiling power consumption and thermal needs.
- Hydraulic balancing of secondary power.
- Automation of heat exchange stations at end users.
- Optimal and long-term investments into consumption control and energy consumption readings, based on regulation of heat exchange stations, both on the primary and secondary heating loop.
- Capture of consumption data and use of heat energy in the Tango system for connecting with other business systems (ERP) and automatic monitoring of KPIs.

HEAT LOSS

Primary consumption
7.9
million GWh

End user consumption
6.35
million GWh

LOSSES FROM PLANT TO USER EQUAL

20 %
of generated energy,

which, considering average production costs of **€50 per MWh**, represents **€80 billion loss for distribution network**

THIS PRESENTS AN ENVIRONMENT BURDEN

225,5 million tonnes of CO₂

We achieve the best possible results on the price of generated heat, environmental burden, and unified control of district heating system operations

Tuzla, Bosnia and Herzegovina: Systems optimisation and preparation of new required heating curve

Company Centralno grijanje Tuzla is the heat energy distributor in the city of Tuzla, supplying almost 24,000 households. At Petrol, we optimised their existing production, distribution, and consumption of heat, thereby improving the strategic management of the district heating system.

Key project achievements:

- Savings of 450,000 MWh of heat because of optimisation of heat distribution in (near) real-time.
- Implementation of 92 (near) real-time system measurement points.

» In Tuzla, we wanted to reduce environmental pollution and to ensure a more sustainable heating supply for our 23,500 users, or 1,700,000 m² of heating areas, and have therefore contacted Petrol. Together with Petrol, we optimised the operation of the entire district heating system (implementation of Termis tools and measures for thermal exchange station optimisation by selecting the optimal secondary heating regime), thereby reducing the quantity of delivered heat by 25%.«

*Nevres Arnautović,
director general*



DISSy SERVICES ARE USED

- on 44 district heating systems
- in 9 countries in Europe
- optimising over 15.5 GW of thermal power

WHILE

- analysing, controlling, optimising and developing 4,500 kilometres of distribution network
- providing reliable and economical supply for 30,000 buildings (apartment buildings, public and commercial facilities, industry, etc.)

Bolzano, Italy: Systems optimisation and excellent user experience

The Italian city of Bolzano concluded a contract with Petrol for the technical and economical optimisation of their full district heating system in the city. We achieved a 5% loss reduction on the district heating distribution system, as well as a 1% to 1.5% reduced use of primary energy product, thereby significantly reducing CO₂ emissions in the city. The project was co-financed by the EU as part of the "SINFONIA – Bolzano Smart City" project, whose goal was to set in Bolzano an example of a smart city, as a model of best practice for further development of smart cities in Europe.

THEREBY

- reducing annual use of primary energy product by 74 GWh or €3.7 million
- reducing inflow temperature, preparing new heating schedules with an optimal heating regime
- reduced emissions by at least 19,102 tonnes of CO₂

* Considering average production costs of €50 per MWh.

Belgrade, Serbia: Savings of almost €800,000 in use of primary energy product for district heating

The public municipal company Beogradske elektrane provides heating for 330,000 end users. Petrol experts help them optimise investments, and also ensure continued optimisation of operating costs using an expert control tool. We help to ensure over 17,000 MWh of annual savings in produced heat, which represents savings of almost €800,000 in use of primary energy product and reduced emissions by 2,400 tonnes of CO₂ – the equivalent to 3,030 cars.

Novi Sad, Serbia: Transition to an economically efficient development of district heating systems

The public utility company in Novi Sad wanted to reduce the final price of heat for their end users. This could be achieved only by reducing the costs of heat generation using technical and economic optimisation and use of DISNet solution for optimising production and heat energy distribution.

Key project achievements:

- Automation of heat exchange stations.
- Increased supply reliability for end users.
- Reduced heat consumption by 12% with unchanged supply for end users.

Sofia, Bulgaria: Transition to modern system management by digitalising the district heating network

Toplifikacia Sofia is the second largest district heating system in Europe, where we implemented a thermo-hydraulic model as the basis for optimisation of investment costs.

» At Toplofikacia Sofia EAD, we manage the oldest distribution network in Bulgaria. It is the second largest district heating system in Europe, with a power output of 4,300 MW. Network digitisation introduced many improvements, that is why we are truly satisfied to have decided to collaborate with Petrol.«

*Sašo Petrov Čakalski,
director general*

We take advantage of industrial waste heat and use it to provide heating in Ravne na Koroškem

Project of useful utilisation of waste heat from the steel industry in Ravne na Koroškem for purposes of district heating is an example of best practice in Slovenia and wider international region. With this pilot project, we have demonstrated in practice that industrial and energy-intensive commercial areas can develop in synergy with the local community and contribute to environmental protection.

Heat and power cogeneration

In the wider economic region of Ravne na Koroškem, heat and power cogeneration has many years of tradition. With the two latest production modules, we annually produce 21.4 GWh of power and 20.2 GWh of heat.

Utilisation of waste heat of metallurgic processes for district heating

In 2015, the heat and power cogeneration was expanded with the utilisation of waste heat generated by metallurgic processes for district heating in Ravne na Koroškem.

Before the project, the waste heat generated in cooling of the electric arc furnace at company SIJ Metal Ravne was emitted into the environment through cooling towers. During the annual furnace refit, we installed a 4.2 MW heat exchanger into the conduit, as well as two heat exchangers and all necessary measurement and regulating equipment.

In 2016, we thus used 3,917 MWh of waste heat, 5,491 MWh in 2017, and 6,992 MWh in 2018. In 2020, we will use 8,252 MWh of waste heat for the purposes of district heating, which represents 26% of total heating needs for the wider economic area and the city of Ravne.

We help you find new market opportunities with the optimal business model for increased added value of your service

Petrol district heating is the right solution for all partners that wish to simply connect to the system, reduce energy supply costs, and at the same time act in an environment-friendly manner. For cities and distribution system operators, we offer a transition to an economically efficient development of district heating systems. With optimal operation and network development, you will ensure a competitive supply for residents, while maintaining control of the infrastructure.

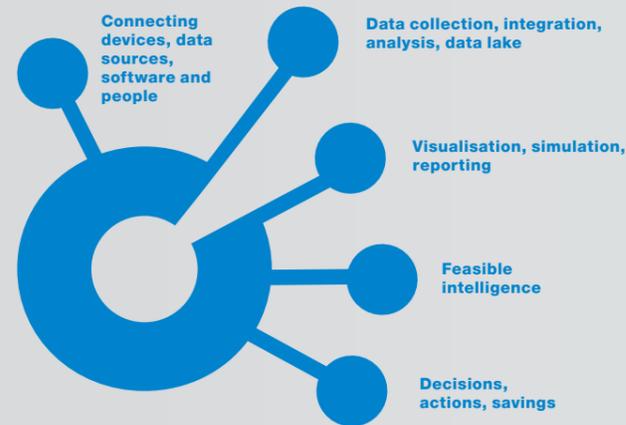
Business models for investments in technological upgrades and optimisation

- **Energy contracting**, as part of which we provide planning, constructions, and operations support with a performance guarantee.
- Combination of construction with **non-refundable and refundable funds** from the EU and European development banks.
- Regular **contractual collaboration**.
- **Contractual supply of heat**, where the investment is made by a contractual partner, and the public partner sells the heat at pre-agreed prices. The public partner thereby saves investment funds, which can be used elsewhere.

In addition to comprehensive solutions in district heating systems, we also operate a **public utility service for remote heating and supply of heat**, using joint boiler rooms, remote heating systems, and heat and power cogeneration systems.



We ensure economical planning, effective control and district heating systems management using the modern IT solution Tango



Tango is an **advanced operational technology (OT) / IoT platform** that solves the challenges of modern business, with real-time monitoring of changes, helping users to **respond to changes with quick and better decisions**. Allows remote control, data aggregation and implementation of key performance indicators. Using **advance algorithms**, it monitors processes, detects operational irregularities, and economically optimises them using optimisation algorithms.

Tango is used as a central control platform that can at any time access a smart device to check system operations parameters. It represents a reliable technological solution that, based on validated source data, ensures **simple control over processes and provides information tailored to users in one location**. For operators, Tango displays the required information and allows a review of their key performance indicators. Information is also grouped into dashboards for various user levels.

With its adjustable content and intuitive visualisations, **Tango is fully configurable to meet your needs**. Monitored parameters are determined by the user, based on built-in measuring equipment, while other parameters – such as laboratory measurements and operational monitoring – can be added manually.

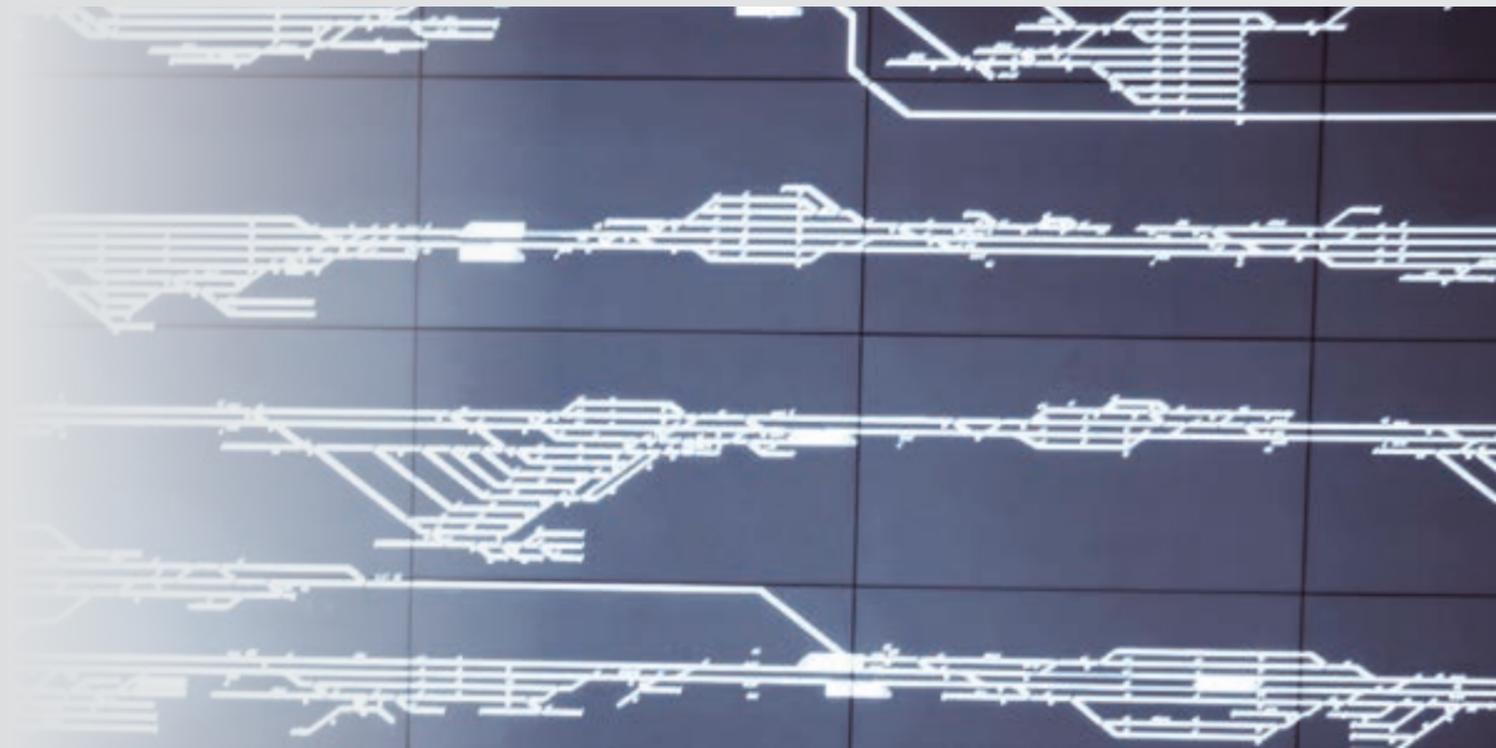
Tango enables effective and efficient monitoring and action on the entire district heating system, based on validated information. Simple time aggregation allows monitoring of operational and management trends, on levels from management to process engineering, and information is always available on all types of smart devices.

Aggregation of various data sources in one location allows the data to be upgraded to information, information to knowledge, and knowledge to decisions.

Company Energetika Maribor, a producer and distributor for district heating and power, decided to implement the Tango information system to optimise purchasing prices and increase their profitability. Tango implements and collects in one location all key technical data for improving the heat and power generation process, while it is also used to forecast input energy product consumption.

Why work with us?

- Diverse knowledge and abundant expertise
- Competencies and technological equipment
- Environment-friendly solutions
- Unique software Tango
- Financing and assuming risk
- Comprehensive solutions for energy and environmental systems
- 400+ energy experts
- State-of-the-art software tools
- Practical experience in past projects
- Many years of market experience
- Performance guarantee with contractual financial instruments
- All required investments for the project, without risks



PETROL PROJECTS POWERING SMART CITIES
 Our smart solutions have been implemented in 80 cities in the region.



CITIES IN SLOVENIA

- Bled, Celje, Črnomelj, Hoče - Slivnica, Hrastnik, Hrušica, Ivančna Gorica, Jesenice, Kamnik, Kidričevo, Koper, Kranj, Kranjska Gora, Ljubljana, Maribor, Metlika, Mojstrana, Murska Sobota, Oplotnica, Piran, Postojna, Ravne na Koroškem, Ribnica, Sladki Vrh, Trbovlje, Velenje
- Idrija, Kranj, Ljubljana, Maribor, Murska Sobota, Novo mesto, Postojna, Ptuj, Trbovlje, Velenje
- Bled, Bohinjska Bistrica, Brda – Dobrovo, Celje, Cerklje, Črnomelj, Destnik, Hrastnik, Hrvatini, Jesenice, Kamnik, Kidričevo, Kojsko, Koper, Košana, Kranj, Kranjska gora, Krško, Ljubljana, Ljutomer, Majšperk, Maribor, Medvode, Metlika, Novo mesto, Piran, Poljčane, Postojna, Sečovelje, Slovenska Bistrica, Sv. Peter, Sv. Trojica, Šmarje pri Jelšah, Trnovska vas
- Ankaran, Bled, Brda – Dobrovo, Črnomelj, Gorje, Hoče - Slivnica, Hrastnik, Ivančna Gorica, Koper, Litija, Mengeš, Miren - Kostanjevica, Piran, Poljčane, Postojna, Radlje ob Dravi

- Smart district heating systems
- Smart water distribution systems
- Smart buildings
- Smart public lighting

Petrol d.d., Ljubljana
 Dunajska cesta 50
 1000 Ljubljana,
 Slovenia

T +386 (0)1 471 47 08
 eios@petrol.si
 www.petrol.eu