ENGINEERING
TOMORROW

Danfoss

Leanheat® | COOLFOR™

Cooling demand forcasting for
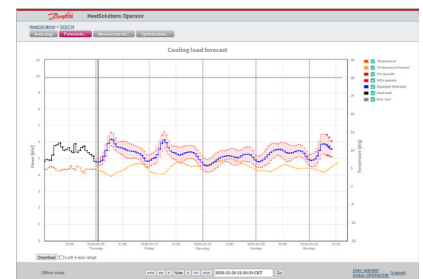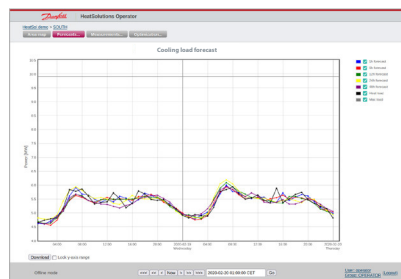# **district cooling networks**

CoolFor™ is a software system for forecasting of cooling demand in district cooling systems. CoolFor™ is a self-learning and self-calibrating system. It is based on machine learning, weather forecasts, historical demand and online measurements in order to automatically produce very accurate cooling demand forecasts.

Why do you need **COOLFOR™**

An accurate cooling demand forecast enables efficient planning and operation of both production and distribution of district cooling. Accurate demand forecasts are essential in order to optimize and plan production and utilize thermal storage units. District cooling network operators can also operate their network more efficiently and reliably by having an accurate cooling demand forecast. The results are that security of supply is increased and costs are reduced at the same time. CoolFor™ automatically forecasts cooling demand and requires minimal effort from the users.

As an additional environmental benefit, CO_2 emissions can also often be reduced by having a more accurate forecast and thereby a more efficient planning and operation of production assets and district cooling network.

CoolFor™ can also be combined with a solutions like Leanheat Network or Leanheat Production with additional advantages as costs reductions and increase of supply security for the consumers.

Key **benefits:**

✓ Automatically and accurately forecasts cooling demand in district cooling networks

✓ Increases security of supply for customers

✓ Easy and inexpensive to install, maintain and operate

✓ Reliable, stable and high availability technology with operational track record of more than 20 years

✓ Low maintenance with minimal interference and interaction required for the client

✓ Highly flexible. Can be configured to various network configurations with and without dependencies between the networks

✓ Can easily be integrated with the Leanheat® Network and Leanheat® Production and provide additional reductions in operational costs

CoolFor™ is an industry leading solution which requires minimal effort from the client and yet yields superior forecast accuracy when compared to competing technologies.

How does **COOLFOR™ work**

CoolFor™ is a self-learning system based on machine learning. On the basis of measurements from the district cooling system, local weather stations and meteorological forecasts, the system is not only able to predict the cooling demand but can also automatically and continuously improve its predictions as it is fed more data. Based on input data CoolFor™ automatically identifies and takes the systematic behavior of consumers into account. This means that CoolFor™ continuously adapts to the actual situation by continuously monitoring the consumption and automatically adapts to changes, such as:

▶ Changes in consumer behavior
▶ Changes in the number of consumers
▶ Changes in the meteorological models
▶ Changes in the thermal characteristics of the buildings
▶ Changes in the district cooling network

The self-learning mechanism has the benefit, that it is not necessary to establish and maintain a complex physical description of the cooling network, which is often time consuming. CoolFor™ will identify the impact of such changes by itself and quickly adapt.

Cooling demand/load forecasting is complicated by the fact that the dynamics of buildings seriously affect the cooling demand on an hourly basis. CoolFor™ system automatically applies an optimal smoothing effect which solves this issue, such that the physical properties of the underlying energy system are modelled correctly.

Ideally (but optionally) CoolFor™ is deployed in combination with MetFor™ (Danfoss Leanheat® service for locally optimized weather forecast) to obtain a more accurate local weather forecast, which will result in superior cooling demand forecast accuracy.

CoolFor™ is provided as an integrated service from the Danfoss Leanheat® software suite which contains a data

collection and validation module. The data collection and validation module collects the necessary data, ensures that the necessary data is available and contains a toolbox for automatic detection and correction of missing and/or erroneous measurements. The module then feed the validated data into the core CoolFor™ module which then provides the forecasts.

Danfoss Leanheat® software suite also provides CoolFor™ with data integration modules through either FTP, SFTP or web-services such that CoolFor™ can be seamlessly integrated with the operational system (SCADA) controlling the district cooling system. System integration is provided by one of the CoolFor™ system integration partners.

CoolFor™ can be installed locally on customer systems or hosted by Danfoss as a service. It is also possible to get a customized support and maintenance agreement from Danfoss or one of the partner companies.

Key **features:**

✅ Self-learning and self-calibrating algorithms for accurate forecasting of cooling demand in district cooling systems

✅ Integrates seamlessly with:
   ▶ SCADA systems for retrieval of cooling production data
   ▶ Local weather measurements
   ▶ Locally optimized weather forecasts (ideally provided by MetFor™)

▶ Leanheat® Network for optimizing operational parameter of district cooling system
▶ Leanheat® Production for optimizing cooling and electricity production

✅ Data integration interfaces based on FTP, SFTP or web-services supporting numerous formats and file types (CSV, XML, SOAP, JSON etc.)

✅ Runs on all commons server platforms (Windows, Linux)

Danfoss Leanheat® is an innovative suite of AI, IoT & Cloud-based software solutions that empower the entire district energy value chain to optimize operational efficiency and reach decarbonization goals while adding ease and comfort to everyday life.