1) District Cooling Spittelau – cooling from waste

1.1) District cooling situated in Vienna, Austria
1.2) District cooling system fully owned by Fernwärme Wien GmbH,
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2) Specification

District cooling “Spittelau” is, as the name says a district cooling scheme, which is directly situated in the waste incineration plant Spittelau. Currently there are 11 customers connected.

3) Project summary

Wien Energie Fernwärme built a 17 MW district cooling plant at the Spittelau waste to energy plant, including a new build district cooling network. The new facility came into operation in July 2009, and is now providing cooling for the customers.

The special feature of the project is the use of existing resources to provide cooling services – by harnessing the power and heat generated by waste incineration. Due to the use of waste heat in absorption systems and the high efficiency of the central cooling plant, this approach delivers $C0_2$ savings of about 79% as compared to conventional building air-conditioning systems. The cooling is delivered to customers via district cooling pipelines with only minor losses. In addition to the benefits of an eco-friendly cooling supply, customers no longer need their own cooling plants. In winter 2010 and 2011 we could contract the last possible customer for the installed capacity, what proves the high attraction of district cooling to the customers. Therefore this district cooling scheme is the starting point for district cooling in Vienna. It is planned to install further capacity in Spittelau and also to build up new schemes in other parts of Vienna. The target is to implement up to 200 MW cooling till 2020.

4) Detailed project description

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Fernwärme Wien started to think about district cooling in 2005 due to upcoming projects bringing extra otherwise wasted heat specially in summer like a new geothermal plant, a new waste incineration and a biomass chp. The solution of not wasting the heat is the use of absorption chillers for providing cooling. TownTown was the first “learning” district cooling project and lead to the first bigger district cooling plant Spittelau.

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A 7 MW compression chiller and two 5 MW absorption chillers were installed in a decommissioned underground tunnel directly adjacent to the Spittelau waste incineration plant. The river Danube is used for the recooling of the chillers. A total of 2,800 metres of new cooling pipelines were installed and a further 2,000 metres of existing district heating pipelines were rehabilitated supply the cooling. There are only minor system losses (< 3%) from the network. The construction work on the central cooling plant is completed. The network has been supplying customers since July 2009 and is operating very well. System optimisation and expansion are ongoing. For example a new freecooling heat exchanger was installed this autumn to use the river Danube as freecooling source in winter.

Plans call for the capacity of the central cooling plant will be increased to as much as 50 MW.

Innovations regarding the cooling plant Spittelau:

- a new district cooling plant and district cooling network was constructed in the middle of an existing city.
- the energy for running compression and absorption chillers come from the waste to energy plant.
- due to customer needs the absorption chiller delivers the cool water with 3,5 degrees Celsius outlet temperature. This is very unusual – special when the absoption chiller is not using NH3 but Lithium bromide. A special designed absorption chiller had to be constructed to achieve this low temperature.
- The capacity of the cooling plant Spittelau was sold out in less than 2 and a half years after going into operation.
- District cooling and the use of absorption refrigeration technology on this scale is unique in Austria. The Spittelau central cooling plant is aimed at commercialising district cooling in Vienna, thereby delivering environmental benefits. Spittelau is the starting project for an expected district cooling growth in Vienna for another 180 MW capacity.

District cooling is mostly competitive to conventional air-conditioning in economic terms, provided that the full costs of the systems compared are taken into account (comparisons are only possible if own energy use is known). Full cost accounting should also include soft factors such as space freed up, the absence of operating, maintenance and repair costs, and transference of the investment and operating risk to Wien Energie Fernwärme.

The project cost for the cooling plant and the district cooling network was fully financed by Fernwärme Wien GmbH.

The project asks for subsidies out of the district heating and cooling subsidy scheme, but till now there is no decision met, due to low fundings of the subsidy scheme.

Benefits of district cooling Spittelau

In addition to enjoying the benefits of an environmentally friendly cooling supply, customers no longer have to invest in air-conditioning systems for their own buildings. District cooling is a completely new product – and one that delivers peace of mind for facility managers.

Additional customer benefits

Space savings: Space no longer has to be given over to cooling towers on the roof and air-conditioning plants in the cellar.

Price certainty: The risk of soaring operating costs due to electricity price increases is greatly reduced.

Risk transference: Wien Energie Fernwärme bears the investment and operating risk. It is the system operator and not the customer that must adjust to changes in the legal and market environment.

Varying the building subsidy, capacity rate and unit rate allows makes it possible to tailor pricing to customer requirements.

Cost transparency: Operating costs are highly transparent as customers do not have to operate refrigeration plant themselves, and are thus not obliged to pay for maintenance, running costs, water treatment agents (chemicals), etc.

Precise billing using calibrated meters to measure the actual amount of cooling energy supplied.

Electricity costs are greatly reduced as compared to conventional air-conditioning, as the power consumption of the building transfer stations is negligible (approx. EUR 200,000 per MW of cooling capacity).

Supply security: Wien Energie Fernwärme guarantees delivery of the agreed volume of water at the agreed infeed temperature. The investor and operator are one and the same.

ENVIRONMENTAL BENEFITS
The use of waste heat for cooling by means of an absorption chiller, instead of electricity to power a compression refrigeration system, reduces the need to despatch thermal power stations (which also operate in summer). This in turn massively reduces emissions of greenhouse gases and other air pollutants.

An additional advantage of absorption refrigeration is that it does not require environmentally harmful refrigerants (FHCs and HFCs), reducing harmful greenhouse gas emissions still further. Absorption is a future proof technology that will be unaffected by stricter regulation of refrigerants.

District cooling gives rise to some **100 kg CO_2** per MWh, compared to **340 kg CO_2** for conventional systems (source for the electricity emission factors: Austrian Energy Agency). Put another way, a district cooling connection cuts greenhouse gas emissions by 79%!

The difference is still greater in the case of the **Spittelau central cooling plant**, as the electricity is generated by waste incineration rather than from fossil fuels. This cuts GHG emissions by a further 40 kg of $C0_2$ **to 60 kg CO_2 per MWh** of cooling.

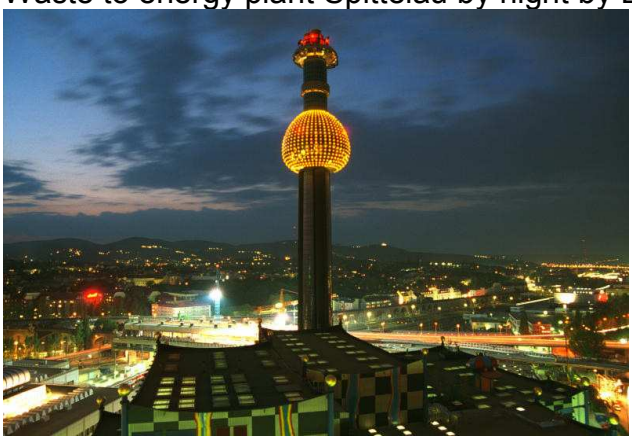
Reasons for the difference:
→ 70% of the cooling comes from waste heat, thereby saving electricity. During the summer months waste heat comes from incineration and electricity generation; in future, geothermal energy will be another source. If this waste heat is not used for district cooling it is simply released into the environment.

→ Cooling at large-scale plants is much more efficient and less resource intensive than in smaller, decentralised units. Optimum refrigeration unit capacities at the central cooling plant allow the equipment to work under ideal operating conditions. Measurements at facilities in Helsinki, Paris and Vienna have yielded average coefficients of performance (COPs) of just 2.2, despite the fact that the rated COPs were 3.9.

For these reasons, Wien Energie Fernwärme has committed itself to expanding its district cooling business. The aim is to bring 200 MW of cooling capacity online by 2020. There are plans to build additional district cooling plants to supply customers locally. The next plant to go online will be at Vienna's new central station, in 2014.

Photos/Graphs:

Waste to energy plant Spittelau by night by Ernst Schauer



Absorption chiller in Spittelau, by Christian Houdek

Absorption process, Airbrush by Spitzer