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**District heating and cooling**

Except for Karachi, Pakistan has extreme cold and hot weather in the respective seasons. With rising standards among the higher economic classes, comfort requirements are also increasing.

In Pakistan, power demand goes down to as low as 8000 MW in the winter and goes up to 25000 MW in the summer. Similarly, other than Karachi, gas demand is doubled or tripled in winters. This has serious implications for infrastructural planning and the economics of supply. What are the reasons for the high gas demand for heating in the winter and high electricity demand for cooling in the summer? District heating and cooling (DHC) can play some role in dealing with this imbalance.

District heating has been there for more than a century and continues especially in Europe. Over the years, technology has changed and improved. District heating or cooling means separating the point of production and the point of use. Hot or cold water is produced at a central nearby point and is circulated through pipelines to the user buildings or facilities. The user is not required to install his/her own heating or cooling facilities except internal piping, distribution and circulating fans. The domain of the DHC system can be as small as a business district with 20-25 high rises or it can be as large as a city such as Stockholm which is almost fully covered by a heating network.

District heating and cooling has a great role in peakshaving; 50 percent or more of the electrical demand comes in the peak period. This peak can be flattened due to hot or cold water storage possibilities, thus much lesser investment by government or its generation utilities, higher utilization and lesser fixed cost and even subsidy and circular debt. Besides, district heating and cooling is 40 percent more efficient. It can relieve expensive commercial space and full floors in a high-rise building. It has a 40 percent lower carbon print as well. Above all, it simplifies commercial buildings construction and maintenance, and the lead time is reduced for completing large building projects.

In Europe, the tradition of district heating has been around since 1880. Coal-fired boilers were used to make steam and circulated at 100 degrees plus in the networks. It used to be highly inefficient, due to unnecessarily high temperatures of the steam that was used in the pipes. Gradually, temperatures have gone down with increase in efficiency and reduction in cost.

These days, mostly waste heat from various sources such as power plants, waste incineration plants, industrial heat and other sources are utilized instead of virgin heat production. District heating needs have probably been a driver for MSW incineration plants, especially in Scandinavia. Promotion and mandatory targets for cogeneration also seemed to fulfill steam or hot water is also stored to balance the demand and supply. And cool river and sea water is used for cooling, although this may not be possible in Pakistan.

Although the main driver of DHC is the utilization of waste heat from fossil plants, there is scope for utilization of renewable energy as well. Often there is curtailment of wind, solar and even hydro in some cases. There is excess supply in the system and for a variety of reasons like transmission constraints, renewable energy cannot be inducted into the main grid. In such cases, extra energy can be diverted to DHC projects. Solar parabolic water heating projects can be installed where space and distance allow.

There are hot water streams in Gilgit-Baltistan which could be utilized where a demand cluster exists. Even in Karachi, there used to be a Manghopir hot stream. In passing, one would want to lament that solar water heaters can be installed on roof tops, which has not been done to a reasonable level. More attention should be paid to this. A large part of excessive gas demand in the northern areas could be met through a rooftop solar water heater.

The concept of district heating and cooling may be viable in posh areas or in business districts containing high-rise buildings. Gated communities are getting increasingly popular. They are wasting the exhaust heat of the generators they have installed. In Pakistan, there are several large cities where DHC can be installed since there is demand density and customers. For example, in Islamabad, from the secretariat and PM House to F-8, Kashmir Road etc. In Karachi, the whole Sharah-e-Faisal and around provides an ample cluster along with Clifton, Defence and I I Chundrigar Road etc.

The global market for district cooling alone has been estimated to be $21.9 billion and expected to double by 2026. The market share of the Middle East has been estimated at 15-25 percent. Tabreed, a DHC provider has installed 1.40 million RT (refrigeration tons) in 86 plants scattered throughout the Gulf countries; Malaysia, Singapore, Hongkong and Thailand are also adopting it. Even in India, there is a DHC project that has been recently completed. The largest functioning cooling market is in the Middle East, although district cooling is expanding in Europe as well as in business buildings where there are heat sources like data centers, office machinery and kitchens. As much as 40 percent of commercial buildings have installed cooling systems, district based or singly, although cool water is drawn from lakes and rivers for this purpose.

Can we do it or should we do it? We are a poor country as the argument may go. This is cheaper than the traditional standalone system, both in terms of energy bills and the capex. It may not be a one-fit solution. As discussed earlier, there are areas and sectors whose energy requirements are almost similar. Room temperatures in many Pakistan offices are much colder than anywhere else. Executives and officials wear suits in the scorching summer.

DHC schemes can be introduced on the IPP model. A DHC policy would be required to give legal cover. DHC areas would have to be identified and auctioned. If it remains voluntary, there may be no need for regulation. If end-user participation is made compulsory for the identified clusters, then regulatory controls would be required. Special night-time electricity tariff may be given to such projects. DHC projects can run their system in the night and store cold water to be distributed in the day. This would increase capacity utilization as well and have a positive impact on electricity cost and tariff.

The challenge would be finding nearby energy generation facilities whose waste heat is to be utilized. In these days of technology and insulation technology, 50-100 kms may not be an issue. Some stranded facilities can be relocated.

DHC may not be a panacea for all our energy problems but it can help fill the natural gas supply-demand gap in the winter. It can improve buildings which are defaced due to the clutters of ACs, and can bring down heating and cooling costs, reduce carbon print and improve thermal efficiency. It will make building and construction simpler and efficient, especially in business districts.

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