R&D on cooling in the Asia Pacific region

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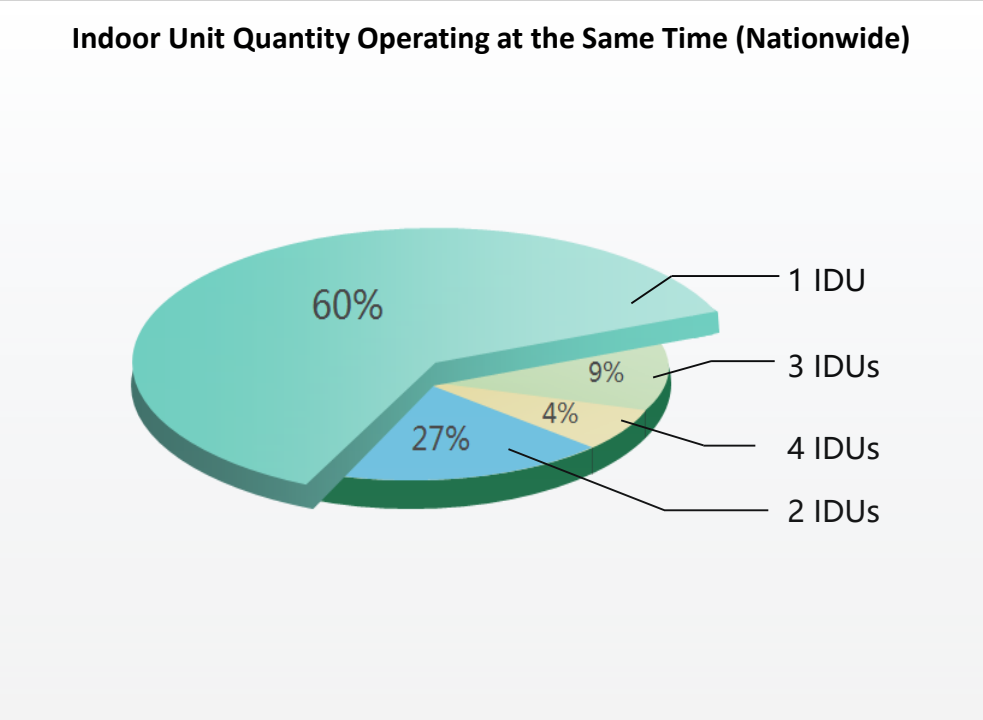
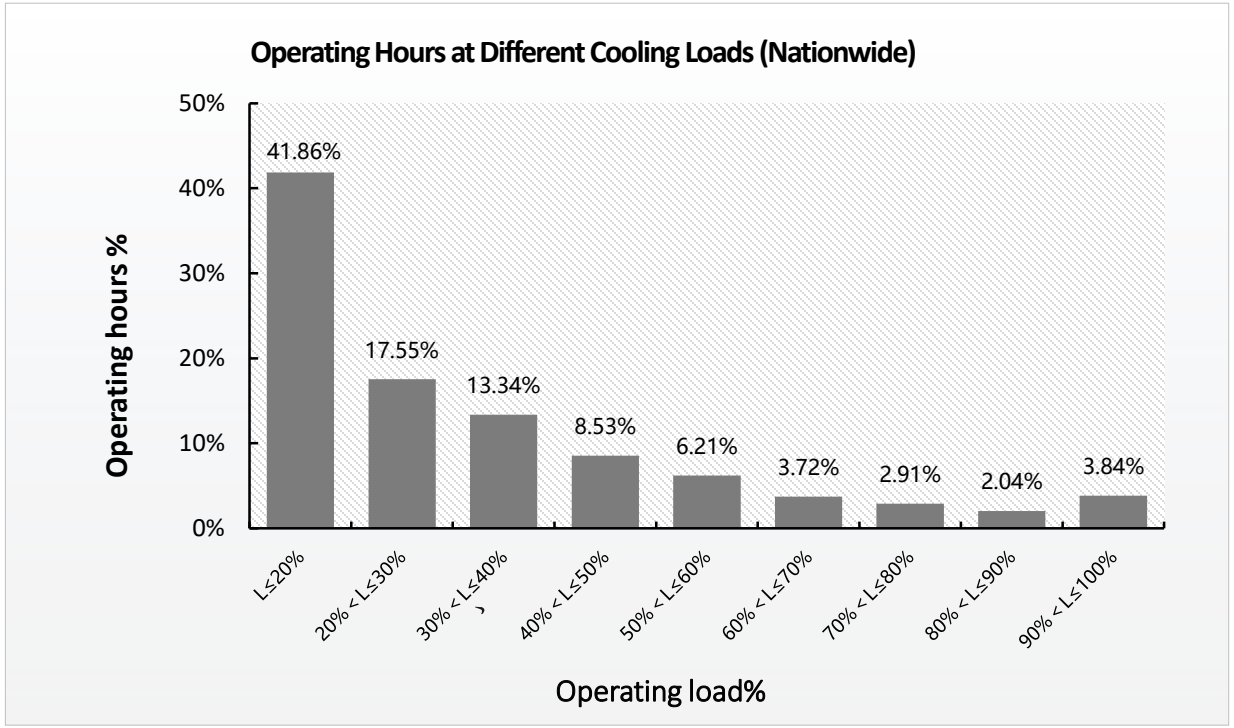
Key features of cooling in civil building – part time part space

Realities for residential VRFs in China:

- **Running quantity:** only one indoor unit running during 60% operating hours.
- **Operating Load:** load lower than 30% during 60% operating hours.
- Common habit for most Chinese users: minimize family living expense.

R&D for terminal cooling devices, such as VRFs, should meet part time and part space using mode.





Data source: based on operation data of ***200,000*** *VRF samples*

High efficiency cooling source— Indirect Evaporative cooling

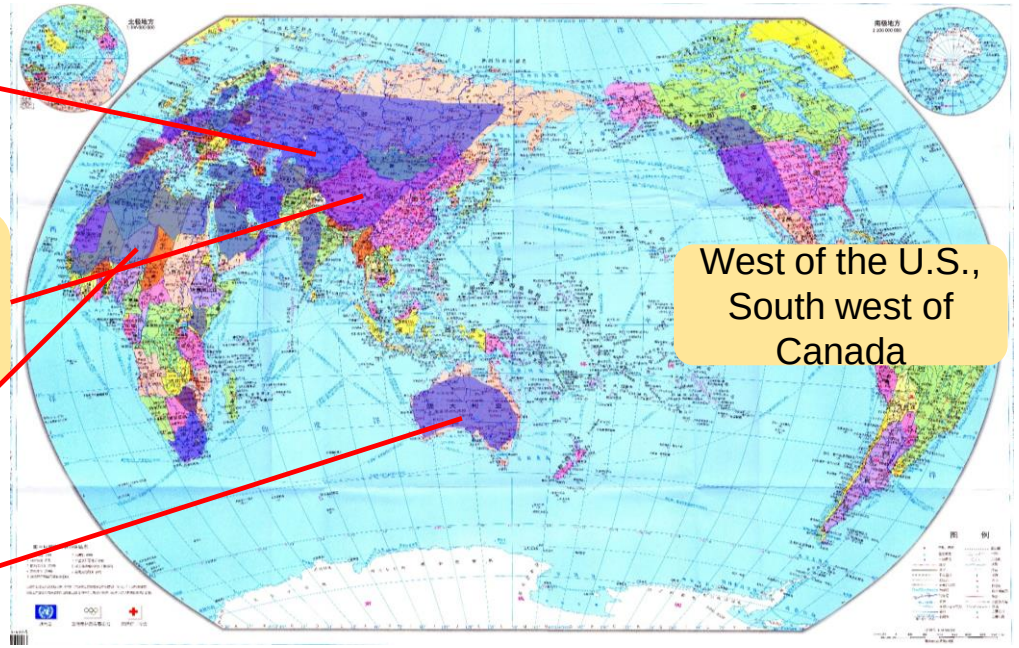
- **Substitute mechanical refrigeration, suitable for dry regions, no refrigerants, no CFCs.**

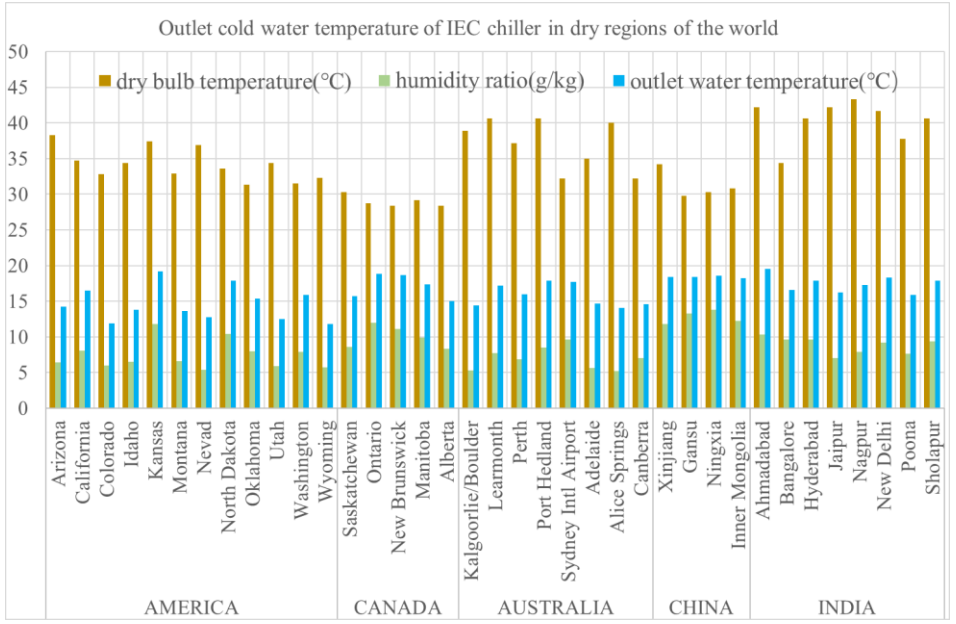
Countries in Europe: North France, Germany, Holland, most part in Russia

Asia: North west of China, Mongolia, Saudi Arabia, Kazakhstan, middle of india

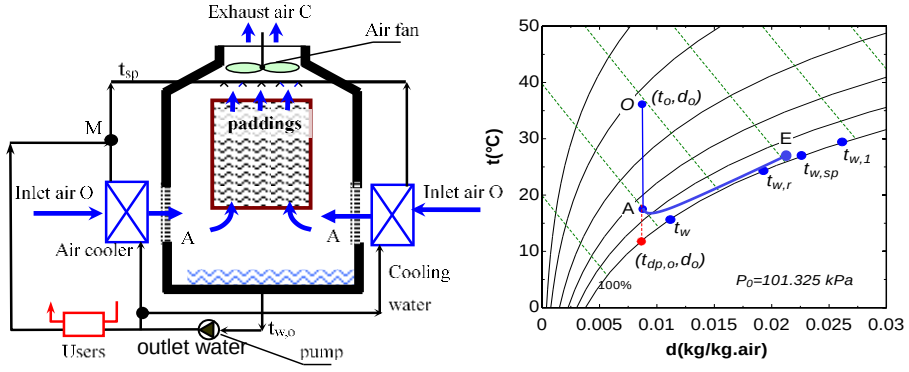
North of Africa

Australia

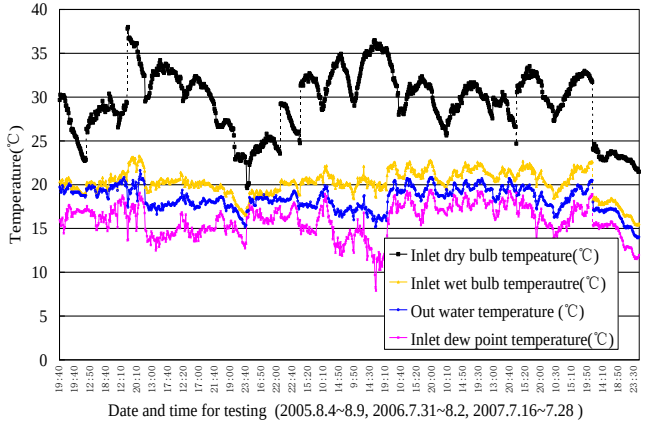




R&D on Indirect Evaporative cooling devices, such as Indirect Evaporative chillers, to produce cold water with temperature lower than inlet wet bulb temperature, and limit to inlet dew point temperature.



Indirect Evaporative chiller process



Developed Indirect Evaporative chiller

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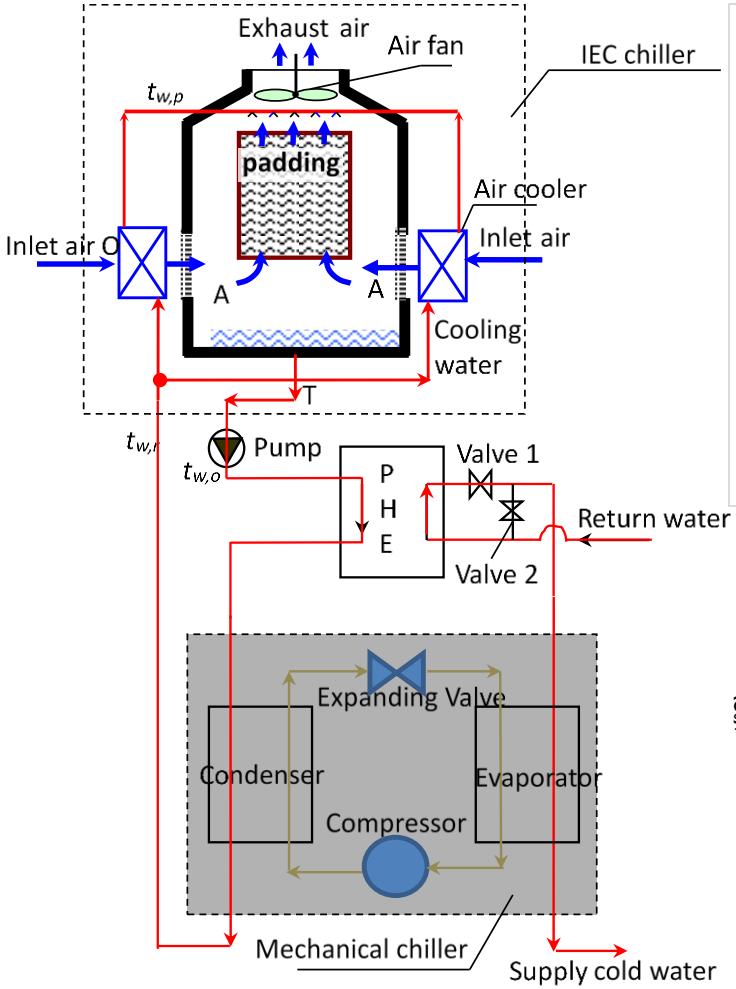
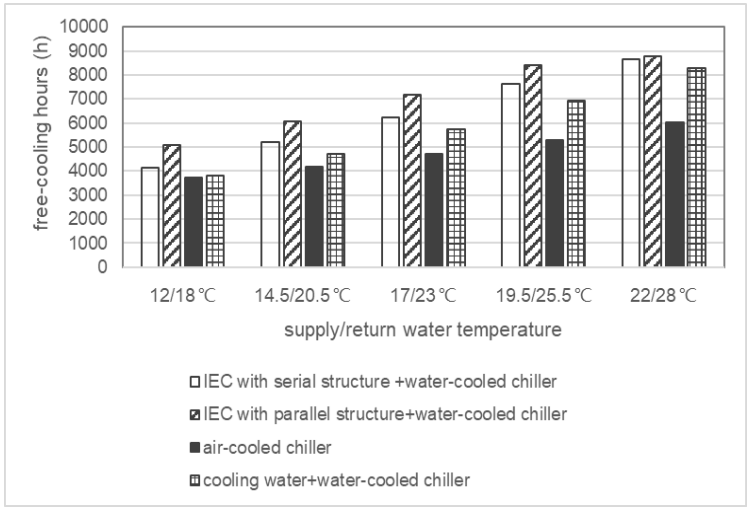
For all year industry cooling, such as data center cooling, to increase free cooling hours:

- Indirect Evaporative chillers for all year free cooling, with design of high temperature cold water;
- Indirect Evaporative Chillers combined with mechanical chillers, with design of low temperature cold water;
- In very cold winters, using Indirect Evaporative Chillers to realize zero freezing.

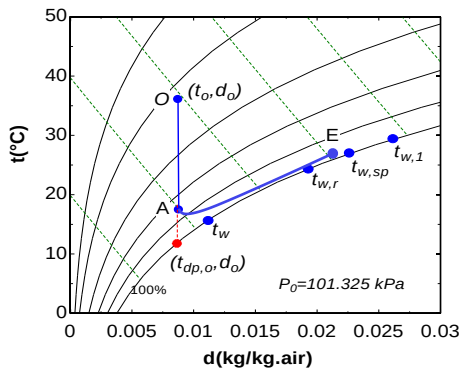




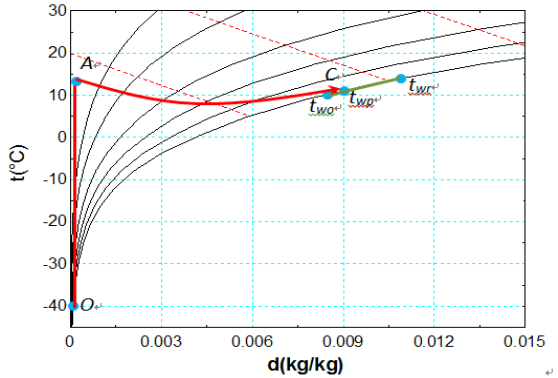
Free cooling hours of different systems

Freezing of common cooling towers

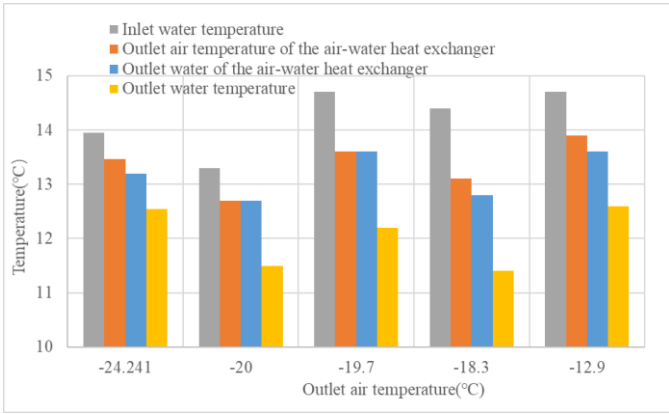
Indirect Evaporative cooling towers



Summer condition process



winter anti freezing process



Real testing of no freezing process