

# Comfort air cooling with graphite ceiling panels



# Radiant ceiling principles

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## How radiant heating and cooling works?

### Heating effect

Radiant panels are heated with warm water. Panels will emit energy into the room space.

Energy will be distributed with low intensity infrared waves, which will heat surfaces not air.

Heating feeling is very similar to sunshine with lower intensity.



### Cooling effect

Cooled water will flow through panels.

People, computers, TVs, machines will heat the air in the room.

Warm air will rise up to the ceiling and hit the cool radiant panel. Heat energy transfers into the panel.

Cooled air will flow down with very slow air speed..



# Radiant ceiling principles

Alternative approach with floor heating - cold air smoothly goes down to create comfortable atmosphere



Require a small difference in temperature between desired indoor air temperature and cooled surface



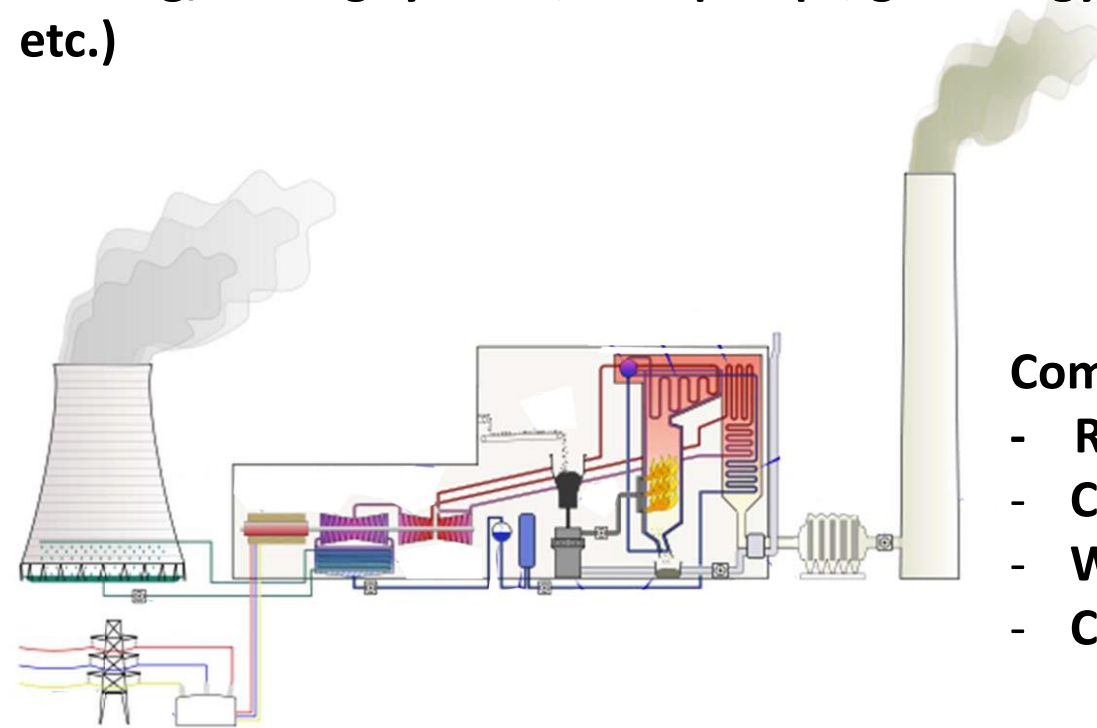
# PANELS AS A PART OF ENERGY SAVING SYSTEMS

**Radiant ceiling panels operate (heat and cool) with circulation of hot and cold water.**

**Suitable for all energy sources (chillers, district heating/cooling systems, heat pumps, geogeneity etc.)**



- Complete air condition system include**
- Radiant ceiling panels
  - Chiller/heat pump or central system
  - Water circulation pipes and fittings
  - Control of temperature and humidity



# Main features

- **Lower energy consumption**  
*(20-30% less than conventional cooling systems)*
- **Healthy environment**  
*(no condensate with bacteria)*
- **No air flows**  
*(unlike fancoils or split-systems)*
- **No noise nor draft (low air speed)**  
*(panels create no noise and have absorbing properties)*
- **Low potential heat and cool sources may be used**  
*( $\Delta T$  2-4°C is enough: cooling with 16-18°C water, heating with 35°C)*

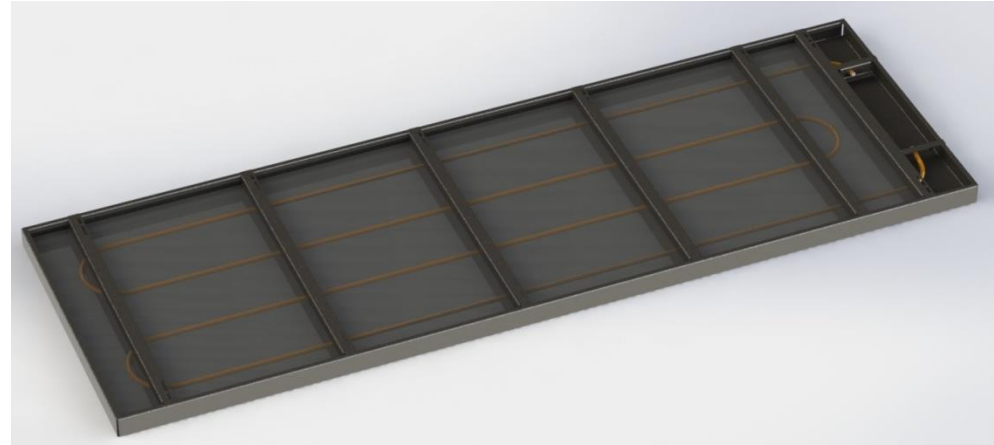




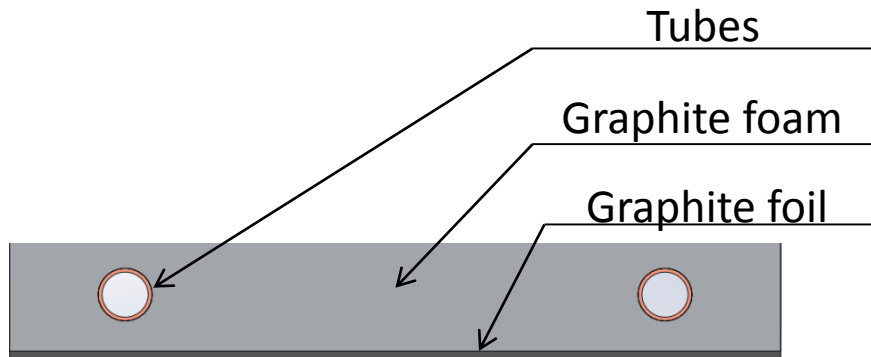
# Second generation panels

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## Metal-graphite suspended ceilings



Designed and produced in Finland  
Core materials produced in Russia



**More than 10000 sq. meters  
sold in Europe in 2013-2014**

CE- certified according  
standards:

EN 14240 for cooling  
EN 14037 for heating



# Second generation panels

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Typical Dimensions:

600X1200 mm

600X1800 mm

600X2400 mm

600X3000 mm



# Installation examples

## Meiramitie Offices and Logistic Centres 10 000 m<sup>2</sup>, Helsinki Vantaa



**Graphite  
panels for  
heating and  
cooling.  
8 pcs of  
600x3000 mm  
panels give  
cooling  
capacity of  
2,2 kW**





# Market estimation and current state of the project

**World market estimation 2-3 bln. usd.**

**Office center of 60000 m<sup>2</sup> require 8000 m<sup>2</sup> of panels for cooling and heating.**

**Cost of 1m<sup>2</sup> panel – starting from 50 up to 200 Euro depending on specification and generation.**

**Currently 20000 m<sup>2</sup> sold in Finland per year by partner of MSU**



# Possible directions for cooperation

1. Trial implementation
2. Technology transfer
3. Joint venture for production (3-rd generation)

