

# Researching and prototyping of semiconductor thin film devices with selective contacts to couple heat and electrical current

## Summary

Profile type	Company's country	POD reference
<b>Technology request</b>	<b>Austria</b>	<b>TRAT20240205020</b>
Profile status	Type of partnership	Targeted countries
<b>PUBLISHED</b>	<b>Research and development cooperation agreement</b> <b>Commercial agreement with technical assistance</b>	<b>• World</b>
Contact Person	Term of validity	Last update
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## General Information

### Short summary

An Austrian heat pump manufacturer wants to build the next generation of heat pumps based on semiconductor devices. Such devices could transport heat to work as cost-effective, scalable, and silent heat pump for any purpose. Based on commercial agreements, the company is seeking partners in semiconductors research and manufacturing to (1) evaluate the feasibility of the idea to use semiconductors as heat pumps, (2) form a consortium to research and build prototypes.

### Full description

An innovative Austrian manufacturer of air heat pumps has developed high efficient systems using a novel approach to improve the heat transport on the system level. The current market includes heating systems in the power range between 8 kW and 20 kW.

The company is seeking partners to research and develop the next generation heat pump based on semiconductor devices. This next generation heat pump is completely silent, scalable and can be very cost effective. The semiconductor devices have a similar mode of operation to solar cells, but instead of light, heat is converted into electricity and can be easily transported thus working as a heat pump.

The main problems to be solved are the design and manufacturing of the selective contacts, the detailed choice of the materials and the material stack, and the large scale manufacturing of large area devices similar to solar cells,

but with different materials.

The necessary expertise or know-how are the understanding of large area semiconductor devices (dimensions similar to solar cells), contacts (oxide and metal layers), in the best case including simulations, and the manufacturing.

The company is seeking commercial and research partners to collaborate on:

- designing and simulating semiconductor devices with dimensions similar to solar cells,
- designing and simulating the selective contacts with similar properties to hot carrier solar cells
- manufacturing semiconductor devices with dimensions similar to solar cells but different materials

The partnerships may include

- Commercial agreement with technical assistance
- Research and development cooperation agreement

At the moment the company is not looking for investment agreements.

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#### Advantages and innovations

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#### Technical specification or expertise sought

The company expects offers to collaborate on the design of semiconductor layer stacks, if possible including the selective contacts. Separate offers for the layer stack and the contacts are also welcomed but not preferential. Further the company expects offers to collaborate with partners to manufacture the layer stacks and contacts, starting at prototypes of lab scale with a viable path to pilot manufacturing.

Offers without collaboration in the research and development area can not be accepted for the first evaluation step.

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#### Stage of development

**Concept stage**

#### Sustainable Development goals

- **Goal 7: Affordable and Clean Energy**
- **Goal 11: Sustainable Cities and Communities**
- **Goal 12: Responsible Consumption and Production**
- **Goal 13: Climate Action**

#### IPR Status

**No IPR applied**

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## Partner Sought

#### Expected role of the partner

The partner should be able to do research in the field of semiconductor and semiconductor manufacturing also with

non-silicon materials, regardless of academy, research organisation, or industry. The partner should understand the role of contacts, especially selective contacts in the field of power generating semiconductor devices like solar cells and should be interested in bringing this know-how into the field of heat, heat pumps, and co-generation of electricity. The ideal partner should be active in the research and manufacturing of materials stacks, preferable large area material stacks similar to solar cells, but with different materials, especially small band gap materials. A well established know-how to form very thin layers for tunnelling purposes would be of advantage. A working know-how of scaling possibilities of the manufacturing processes and cost awareness would also be of advantage.

Tasks to be performed will include discussions about material properties, material stacks and properties of contacts, especially how to build selective contacts for high current devices with low thermal resistances. The partner or partners should be able to manufacture and measure prototype devices (electrical and thermal properties).

#### Type of partnership

**Research and development cooperation agreement**

**Commercial agreement with technical assistance**

#### Type and size of the partner

- **SME 11-49**
- **Big company**
- **University**
- **R&D Institution**
- **SME 50 - 249**
- **SME <=10**

## Dissemination

#### Technology keywords

- **04005005 - Solar/Thermal energy**
- **04002007 - Heat pump**
- **02002016 - Microengineering and nanoengineering**
- **04002010 - Combined heat and power (CHP) engines**

#### Targeted countries

- **World**

#### Market keywords

- **06006003 - Heat recovery**
- **03001001 - Semiconductors**
- **06003001 - Solar/thermal energy**
- **03001002 - Customised semiconductors**
- **06003006 - Combined heat and power (co-generation)**

#### Sector groups involved