

CREATIV

Research-based innovation for energy efficiency

KMB project managed by
SINTEF Energy Research

The scope of CREATIV

- Technical research and development that forms the basis for and may lead up to demonstration of new environmentally-friendly technologies for energy efficiency in industry
- Emphasis is place on energy efficiency by means of heat pumping technology based on natural refrigerants

CREATIV Facts

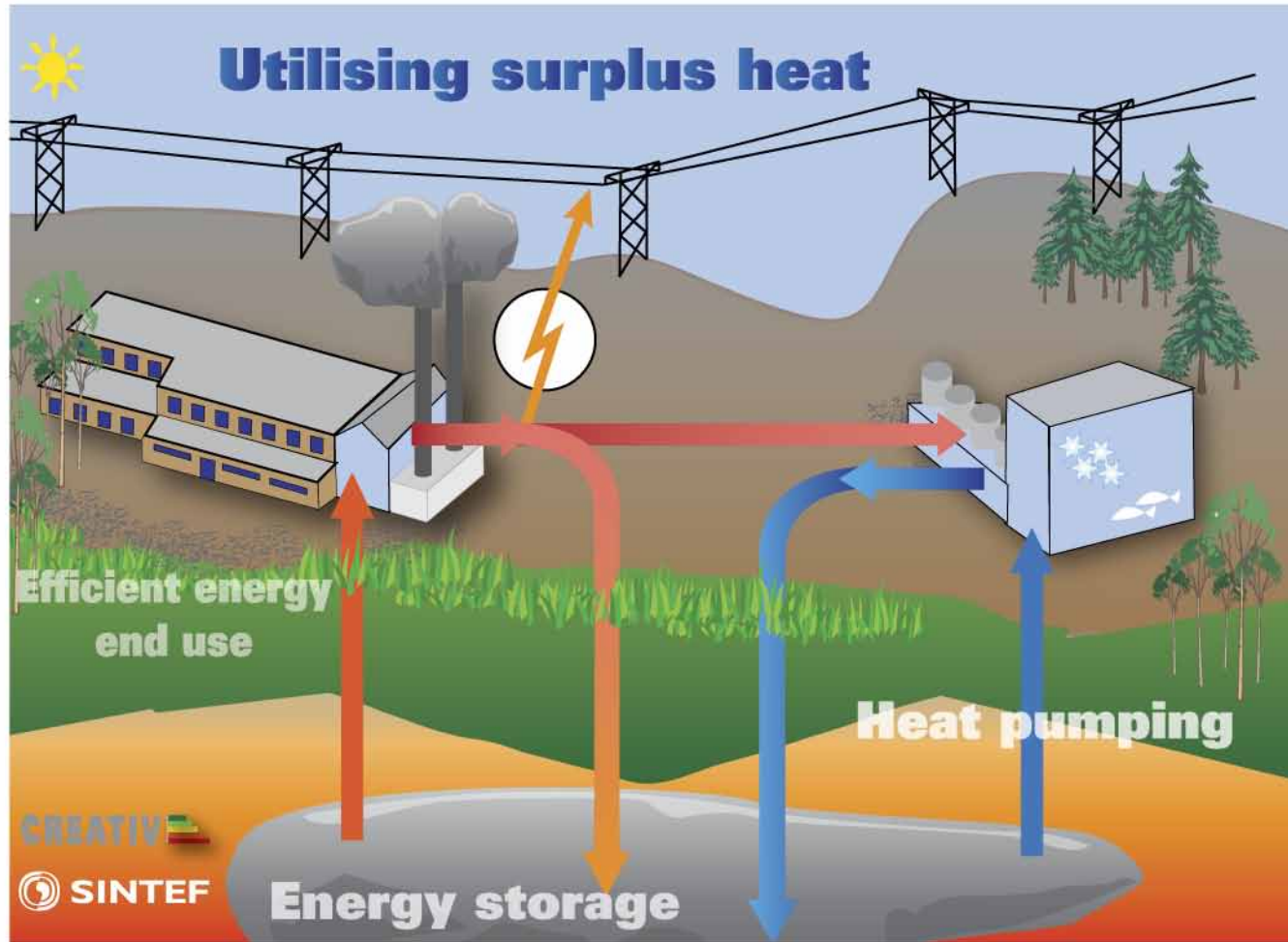


The objective of CREATIV is to demonstrate that more than 1/4 reduction in Norwegian energy consumption and greenhouse gas emissions will be feasible by 2020.

Sub objectives

- Develop innovative knowledge and technology for waste heat recovery and efficient heating and cooling
 - Educate and train specialists in industry energy efficiency
 - Disseminate existing and emerging knowledge
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- Knowledge-building project (KMB) project including industry partners, supported by RCN
 - Total budget 52 MNOK plus 26 MNOK in-kind
 - Project period 2009-2013

CREATIV R&D areas





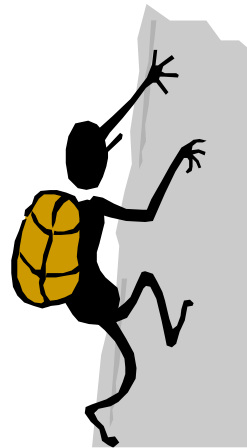
Establishing the research basis for energy efficiency in industry

Energy efficiency by means of heat pumping technology:

- Large amounts of surplus heat
- Need for heating and cooling
- Need for power
- Potentials for more efficient energy use

Scientific challenges:

- Electricity production from surplus heat
- Utilisation of thermal energy
- Industrial air ventilation
- Storage of thermal energy
- Refrigeration
- Thermal processing



Areas of application:

- Metallurgy
- Pulp and paper
- Fishery
- Food production
- Super markets

Approach:

- Theoretical analyses
- Modelling, simulation and optimisation
- Laboratory experiments
- Building prototypes
- Testing at industry sites

CREATIV partners



Industry partners

- Danfoss
- Hydro Aluminium
- John Bean Technology Corporation
- Norske Skog
- Norwegian Seafood Federation
- REMA 1000
- Systemair
- TINE

Research and development

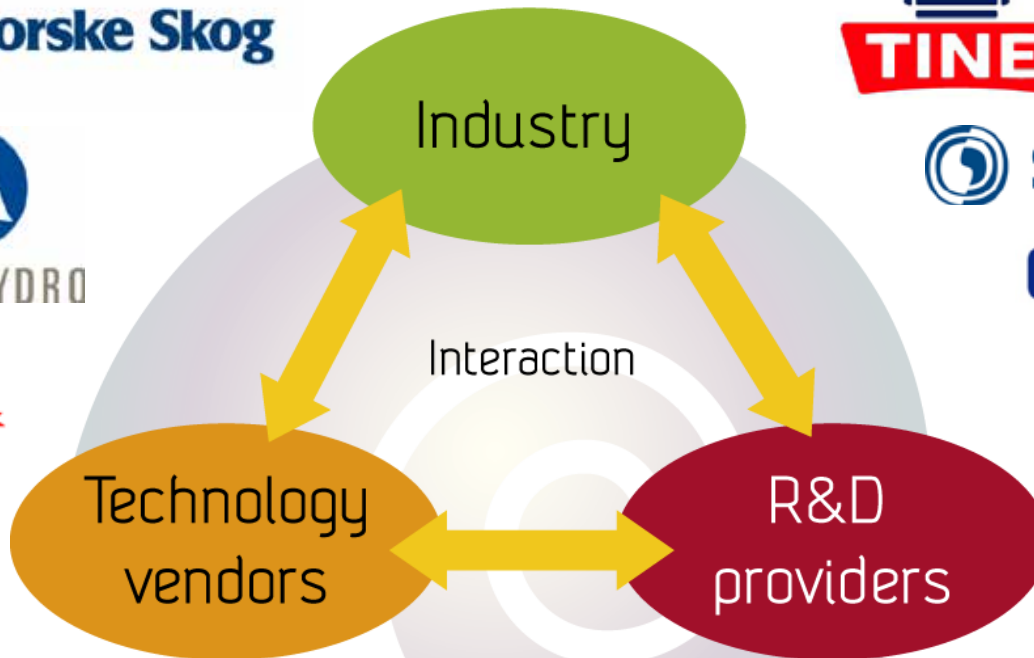
- Doshisha University
- IFE - Institute for Energy Technology
- ITRI - Industrial Technology Research Institute
- KTH Royal Institute of Technology
- NGI Norwegian Geotechnical Institute
- NTNU and NTNU Social Research
- Obrist Engineering
- Shanghai Jiao Tong University
- SINTEF
- TLK-Thermo



The Research Council of Norway provides financial support together with the industry partners

The key to success

REMA 1000



ITRI



Technology innovation and exploitation of results (SP1)



Electricity production from surplus heat (SP2)



Utilisation of thermal energy (SP3)



Education program (SP5)



Efficient heating and cooling (SP4)



SP1

Technology innovation and exploitation of results

To safeguard the scientific and technological innovation of **CREATIV** and to ensure the relevance and performance of the research

- Define and facilitate the innovation process in **CREATIV** and investigate and pursue opportunities for innovation
- Coordinate evaluation and selection of relevant case studies among the industry processes represented in the project
- Evaluate the potential of emerging technologies



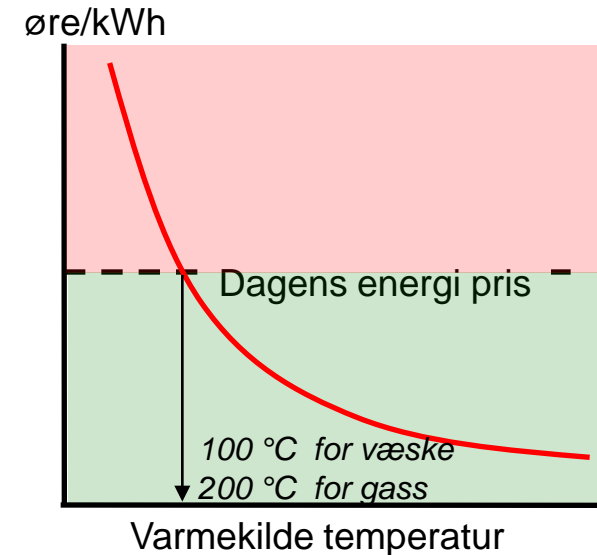
SP2 Electricity production from surplus heat

Provide profitable and sustainable solutions for power production from low temperature surplus heat



- Improve component and cycle efficiency with 20 % compared to existing technology for $T < 200\text{ °C}$
- Natural working media
- Develop and test components critical to the expansion machinery at the heart of the power production system.

- Reduce capital costs by enabling compact systems with significant size reduction
- Improved integration with the primary process and more optimal design
- Establish basis for pilot industrial plant to be pursued as a spin-off from the project



SP3 Utilisation of thermal energy

Efficient utilisation of LT heat for industrial purposes



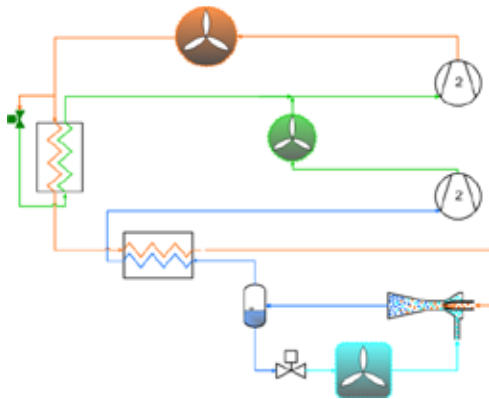
- New concepts for producing cold and heat from surplus heat
- Provide updated knowledge on heat and cold requirements in industry
- New solutions for LT heat utilisation within industries and among industries (clusters).
- Develop new knowledge on fundamental properties of relevant working media
- Feasibility study for cold accumulation based on CO₂ ice slurry
- Energy analyses of several industry processes
- Select industry sites and/or processes to be pursued in case studies
- Interaction with the industry partners

SP4 Efficient heating and cooling

Develop more energy efficient end-user technology for heating and cooling*



- Novel refrigeration and heat pumping systems enabling reduced energy consumption and GHG emissions
- Component and system design with natural refrigerants
- Optimal system integration and control.
- Development and testing of oil-free compressors and heat exchanger concepts.
- Concepts for
 - Preservation and drying, balancing the requirement of reduced energy use and improved product quality
 - Energy efficient chilling and freezing
 - air room distribution and demand control of fans
- Basic research on heat and mass transfer in the product and equipment



* 15 % of the electricity production world wide is used in heat-pumping systems for refrigeration, air conditioning and heat pumps.

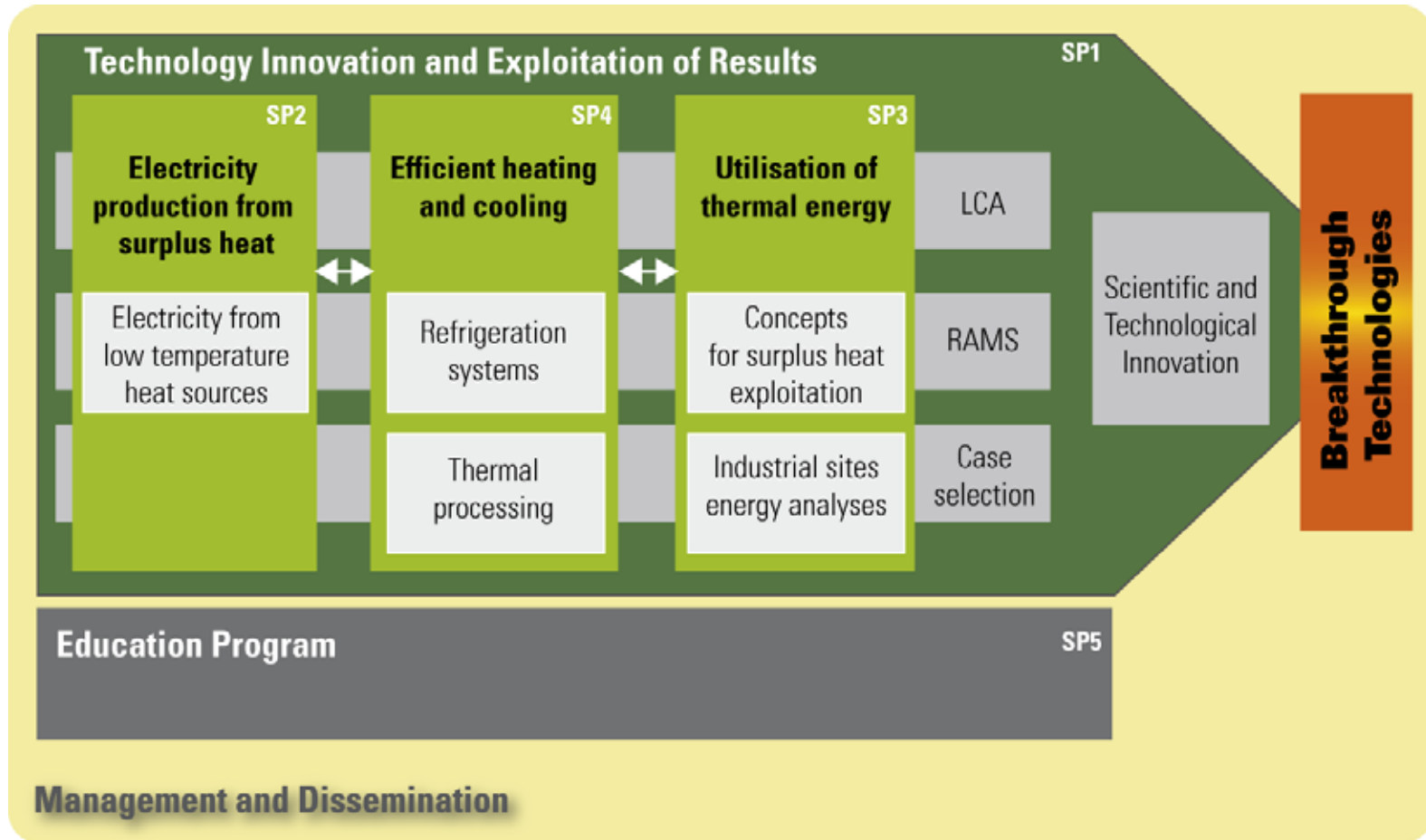
SP5 Education program

Bring forward new knowledge on energy efficient system for end-use with low emissions and to educate candidates with expertise on industry energy efficiency

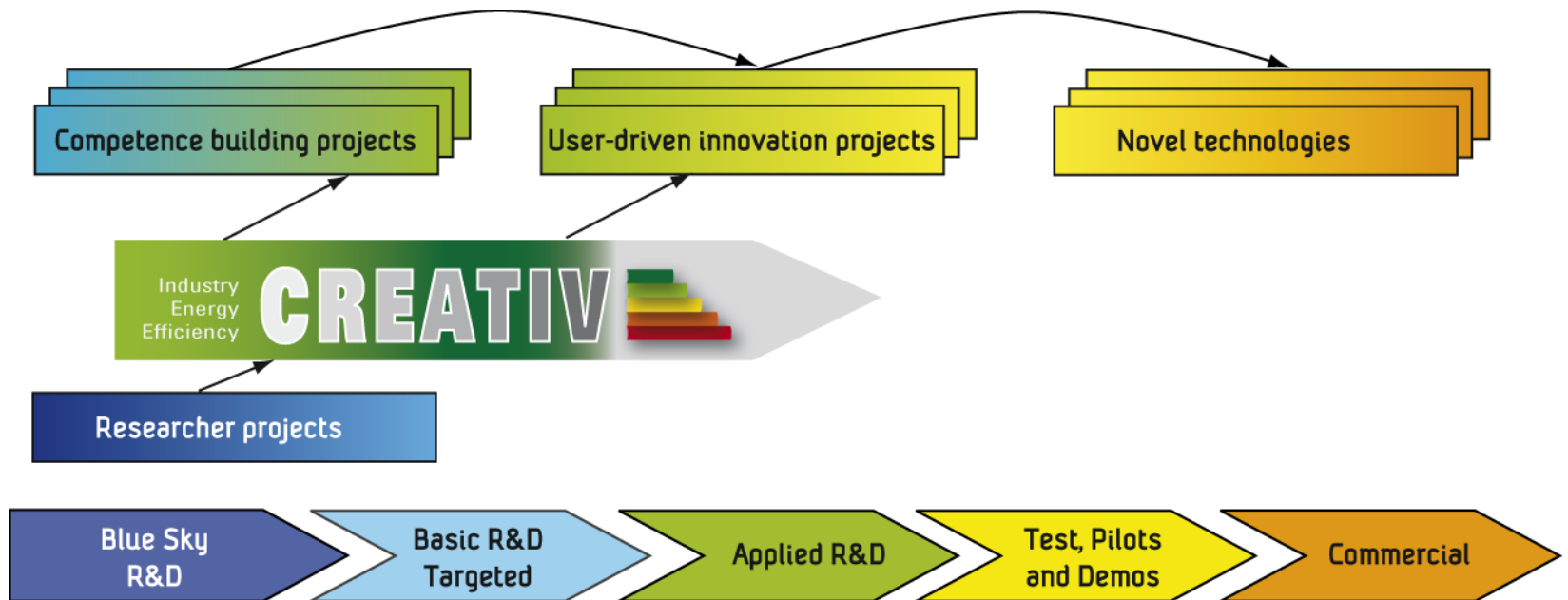


- Educate 4 PhDs and 2 postdocs within the topics covered by CREATIV
- Engage master students to carry out student projects and thesis in collaboration with the research and the industry partners
- Organise special lectures, courses, workshops, and seminars
- Publish results in national and international journals and present results at relevant conferences and meetings

CREATIV project structure



The position and role of CREATIV in the innovation process



 SINTEF

Summary

- Identified potential for improved energy efficiency
- Expected results of CREATIV
 - New knowledge for R&D partners and industry partners
 - Technology and solutions serving as basis for energy efficient processes and products
 - Published scientific results
 - Competent personnel from the Education Program (4 PhDs, 2 postdocs and several MSc) and from participation in research activities
 - Draw attention to the area of energy efficiency to attract and recruit talents
 - Pave the way for other R&D and technology projects focusing on industry energy efficiency
- Collaboration is required to release the full potential



Acknowledgement

This presentation forms a part of the CREATIV project, performed under the strategic Norwegian research program RENERGI. The author acknowledges the Research Council of Norway (195182/S60) and the industry partners Bitzer, Danfoss, Hydro Aluminium, John Bean Technology Corporation, Norske Skog, the Norwegian Seafood Federation (FHL), REMA 1000, Systemair and TINE for their support.

Additional slides

CREATIV Web page

Industry
Energy
Efficiency

CREATIV



Objective

Project structure

Publications

Consortium

Events

Links

Internal pages

Search

CREATIV represents a platform for research and development with focus on energy efficiency in industry.

It aims to boost development and deployment of energy efficient technology in industry and will promote innovation and value creation based on research of high scientific quality.

Contacts:

Coordinator:

[Anne Karin T. Hemmingsen](#)

Project manager:

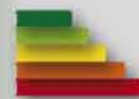
[Grethe Tangen](#)

CREATIV fully responds to:

- The Norwegian Research Council call on energy efficiency within the RENERGI program (2009) and to the Norwegian 'climate agreement' (2008)
- The IEA report World Energy Outlook (2008) stating that the potential reduction of greenhouse gas emissions from energy efficiency exceeds the combined effect of all other actions, including CCS, renewable, nuclear and bio-fuels.

Facts:

- The project period is 2009 - 2013



CREATIV is a
**Knowledge-building Project with User
Involvement (KMB)**

- **Objective:**
To contribute to long-term industry-oriented researcher training and competence building in Norwegian research communities, within topics that are crucial to the development of business and industry in Norway.
- Minimum 20% industry funding,
maximum 80% public funding

Project organisation

