

# ARCTIC R&D

Arctic R&D projects and co-operation possibilities

Kai Rynnänen

Leverage from  
the EU  
2007-2013

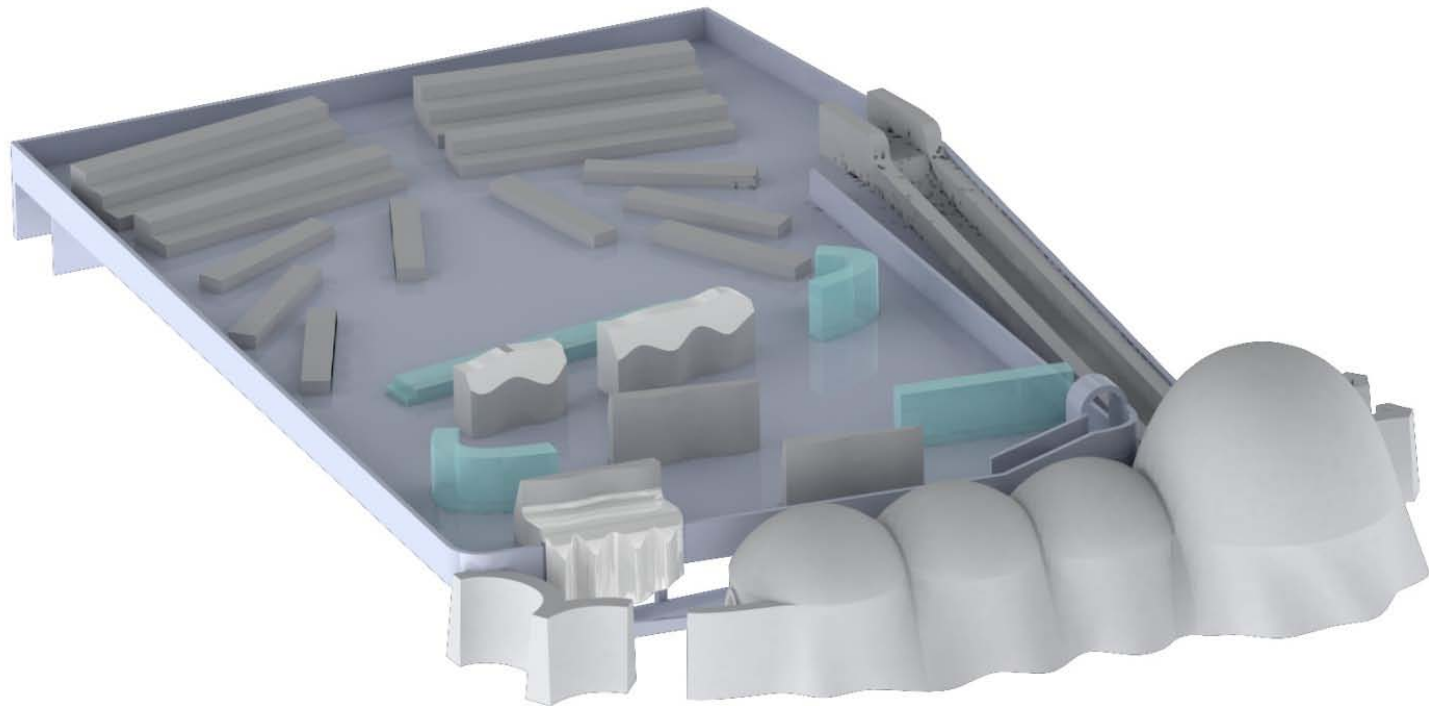


European Union  
European Regional Development Fund

# AGENDA

- ROVANIEMI UNIVERSITY OF APPLIED SCIENCES – RUAS
- ARCTIC POWER
- R&D CASES IN RUAS
- POSSIBILITIES OF R&D IN THEMATIC NETWORK ARCTIC ENGINEERING AND SCIENCE – TN AES

# ROVANIEMI UNIVERISTY OF APPLIED SCIENCES - RUAS



**Rovaniemen  
ammattikorkeakoulu  
University of Applied Sciences**



Rovaniemen  
ammattikorkeakoulu  
University of Applied Sciences

LUC

# Background

- Higher Education of Professional Nature
- The northernmost institution of its kind in the EU
- Located on the Arctic Circle in Finland
- Created in 1996
- Education in Rovaniemi since 1905
- Maintained by Rovaniemi Municipal Federation of Education:
  - City of Rovaniemi, Kittilä Municipality, Ranua Municipality and Sodankylä Municipality
- Activities in the province since 1997

# The Lapland University Consortium (LUC)

is composed of three higher education institutions in the province of Lapland:

- Kemi-Tornio University of Applied Sciences
- The University of Lapland
- Rovaniemi University of Applied Sciences

LUC is a unique form of strategic alliance in Finland, as it comprises a union between a university and two universities of applied sciences.

# The Lapland University Consortium (LUC)

LUC has long and extensive experience in international collaborative research and development. Working in close cooperation with the surrounding society, we focus on user-driven innovation and swift application of research results.

The consortium offers an attractive environment for learning and innovation, also internationally.

# Four Basic Stones of LUC

- No DP competition between Universities
- Common Innovation programme in R & D
- Common Institutes: Tourism and Northern Culture
- Common Supporting Services



# The innovation programme of LUC: Focuses

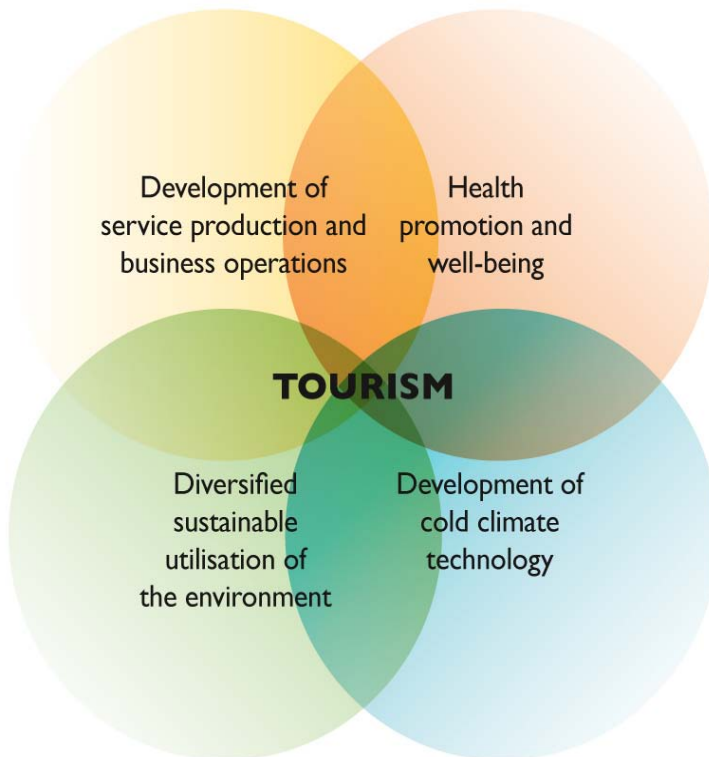
**Lapland** of Experiences, Culture and Tourism

**Lapland** of Natural Resources

**Lapland** of Wellbeing

**Lapland** of Industry

# RAMK Strategy 2020: Northern regional influencer



RAMK functions as an influential multidisciplinary operator in the north by focusing on the development of tourism and conditions that affect tourism.

service production and business operations  
 well-being-related tourism  
 well-being services in tourist areas  
 tourism construction  
 planning land use  
 snow and ice construction

# Core Competence

Expertise in northern environment and cold climate education and research

Focus on international co-operation and business relations

RAMK has passed the audit of its quality assurance system, audited by Finnish Higher Education Evaluation Council

RAMK has received two Finnish Higher Education Evaluation Council nominations

- University of Applied Sciences Centre of Excellence: Influence on regional development 2006–2007
- Quality Unit of Education 2008–2009: Nursing Programme

# Facts and figures

3000 students, 300 staff

Annual intake (year 2012):

700 students (Bachelor's degree programmes)

75 students (Master's degree programmes)

Annual Budget 22 M €

Duration of studies:

Bachelor's degree programmes: 3,5–4 years (210–240 ects credits)

Master's degree programmes: 1–1,5 years (60–90 ects credits)

2,6 first-choice applicants per study place

High employment rate after graduation

# Education

## Bachelor's and Master's degrees

- 14 Bachelor's degree programmes
- 5 Master's degree programmes
- Specialisation studies

## Prerequisites for Bachelor's education:

- Baccalaureate, upper secondary school studies, vocational diploma, or equivalent qualification obtained abroad

## Prerequisites for Master's education:

- Bachelor's degree and at least three years work of experience after graduation

# Campuses

## Rantavitikka Campus

Business and Administration  
Forestry and Rural Industries  
Technology

## Ounasvaara Campus

Health Care and Sports

## Lapland Institute for Tourism Research and Education

Tourism and Hospitality Management

# Degree programmes

## Forestry and Rural Industries

- Forestry (Bachelor of Natural Resources)
- Rural Industries (Bachelor of Natural Resources)
  
- Landscape Management
  - Master of Engineering
  - Master of Natural Resources (Forestry)
  - Master of Natural Resources (Agriculture)

# Degree programmes

## Technology

- Construction Engineering (Bachelor of Engineering)
- Information Technology (Bachelor of Engineering)
- Information Technology in English (Bachelor of Engineering)
- Land Surveying (Bachelor of Engineering)
- Management of Technological Competence (Master of Engineering)



# Degree programmes

## Health Care and Sports

- Nursing and Health Care (Bachelor of Health Care)
- Physiotherapy (Bachelor of Health Care)
- Sports and Leisure Studies (Bachelor of Sports Studies)
  
- Health Promotion
  - Master of Health Care (Nurse)
  - Master of Health Care (Public Health Nurse)
  - Master of Health Care (Physiotherapist)
  - Master of Sports Studies

# Degree programmes

## Business and Administration

- Business Economics (Bachelor of Business Administration)
- Innovative Business Services in English (Bachelor of Business Administration)
- Business Economics (Master of Business Administration)

# Degree programmes

## Tourism and Hospitality Management

- Hotel and Restaurant Management (Bachelor of Hospitality Management)
- Tourism (Bachelor of Hospitality Management)
- Tourism in English (Bachelor of Hospitality Management)
- Tourism (Master of Hospitality Management)

# Education in English

## Selection of courses

(each semester over 100 ects credits)

## Degree programmes

- Tourism (210 ects credits / 3,5 years)
- Information Technology (240 credits / 4 years)
- Innovative Business Services (210 ects credits / 3,5 years)

## Specialisation studies

- International Project Management (60 ects credits / one year)

# International activities

Focus on the North

Development through key and strategic partnerships collaboration

Student and staff mobility

R & D project activities

Curriculum development

International perspective in curricula

Focal areas Barents region, University of the Arctic area, European Union,  
North America and Asia

Strategy span 2010-2020

# Project volume 2000 - 2010

	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>
Number of projects	30	28	35	38	47	40	48	64	48	42	54
Total volume / M€	8,8	12,4	16,7	17,1	21,7	20,7	21,1	18,5	18,2	18	26,4
Volume per year /M€	2	2,4	3	3,2	3,4	3,5	3,1	4,9	1,6	3,1	3,1
Extent of activities / man-year	22	31	36,5	41,9	49,5	48,5	48	68,9	34	48,5	69,9

# ARCTIC POWER

Get to Know Us

Kai Rynnänen  
ARCTIC POWER

Leverage from  
the EU  
2007-2013



European Union  
European Regional Development Fund

# Arctic Power

- Research, development and testing center in Rovaniemi
- Part of Rovaniemi University of Applied Sciences
- Operations started in 2001
- Core competence is in cold and winter technology
- Involved in many significant projects



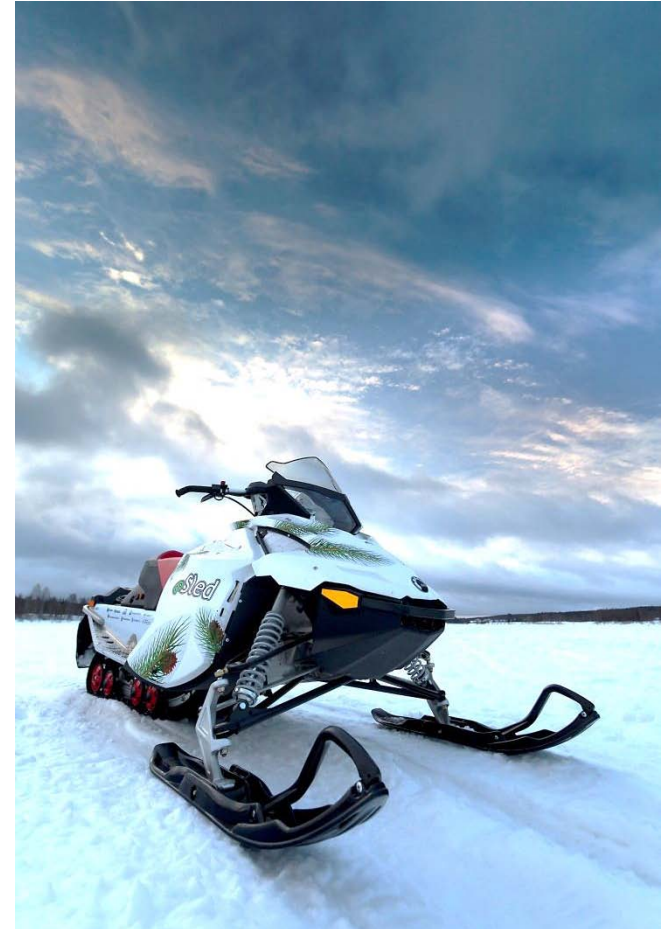
## Strengths

- Surrounded by winter and cold climate
- Experience from testing and R&D
- Simulating possibilities of natural circumstances in laboratory conditions
- High level knowledge of measurement technology engineering
- Experts are available from several fields



## Special areas of expertise

- Winter and cold
- Snow and ice construction
- Testing services
- Research and development
- Project management



## Recent activities

- Thermal manikin "Pena"
- Electric snowmobile, eSled
- Electric snowmobile with hydrogen fuel cell
- The first hydrogen fuelling station to Rovaniemi
- The guidebook for snow and ice construction



## Services

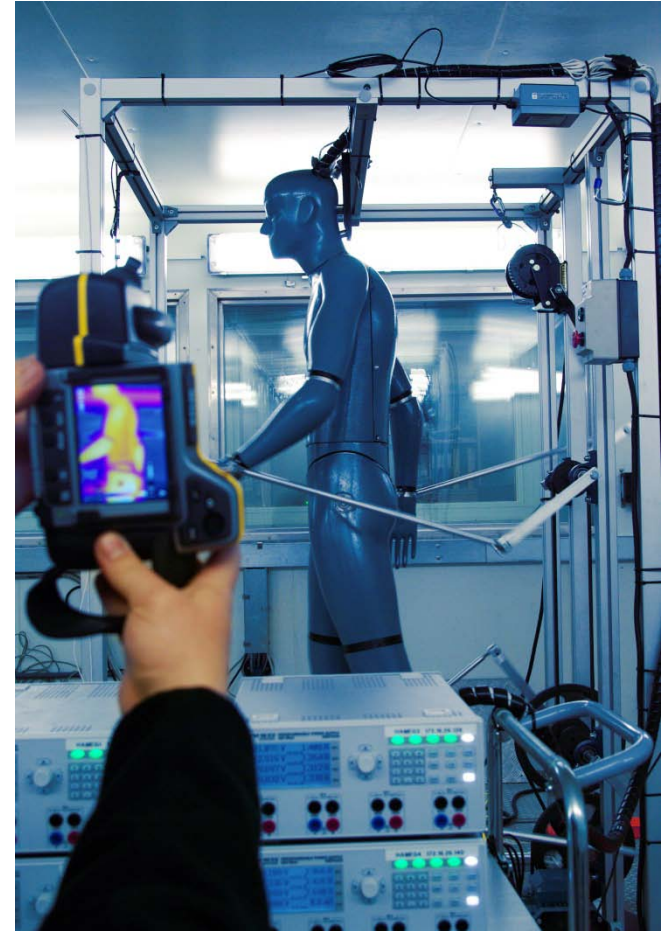
- Apparel testing
- Climate testing
- Engine testing
- Vehicle testing
- High Speed Imaging
- Tailored measuring systems
- Consulting





## Thermal Insulation test for clothing

- Designed for different stages of production development
- Determines apparel thermal insulation
  - Material effects
  - Wash cycles
  - Comparison of standard
- Test is done in Climatic Chamber
- Built by Arctic Power



## Projects in progress

- eSled 1 & 2
- Alternative Fuelling Station
- LaplandSnowDesign
- Proto Design 2
- Energy school of Lapland
- Development Project for the Centre of Expertise in Cold & Winter Technology
- Arctic welfare services and technology
- Intelligent Road

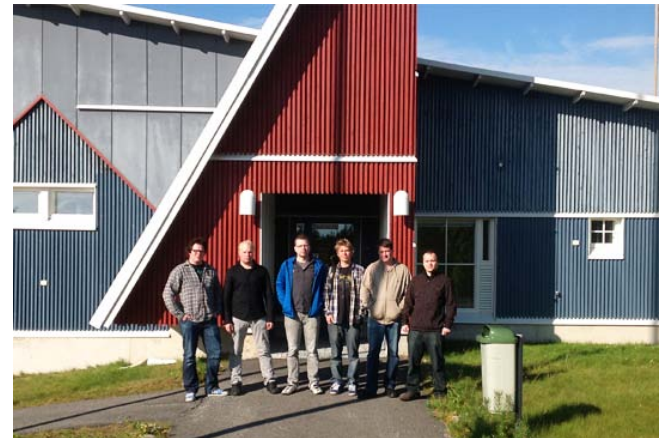


## eSled – Electric Snowmobiles' Demo Fleet

- User need
  - Tourists travel to the Finnish Lapland to experience the nature in it's purest form
  - There is a need for environment friendly solution in snowmobile safaris
- Solution
  - Battery Electric Snowmobile
  - Zero emission application for half-day snowmobiles safaris and for ski resorts
- Benefits
  - low operating costs
  - Silent operation
  - Zero emission
- Users
  - Ski resorts
  - Safari operators
  - Tourists

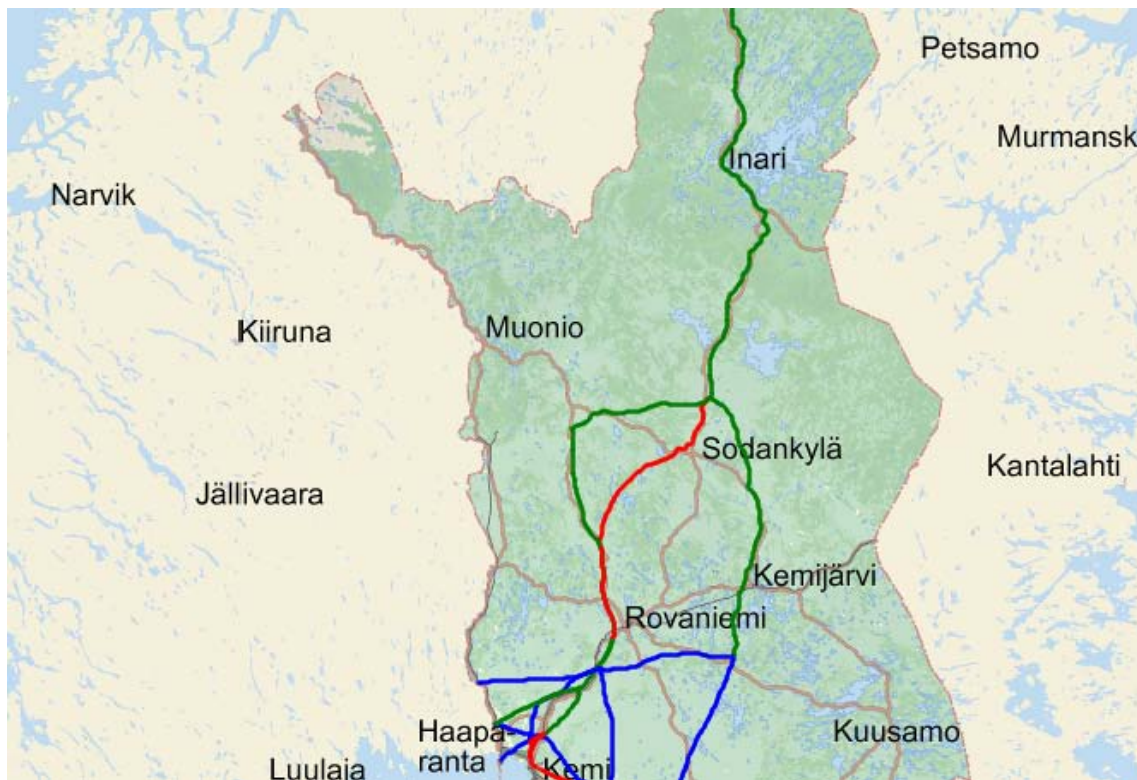
## Education

- Arctic Power offers students:
  - Possibility to participate to the projects through the study modules
  - Themes for the thesis
  - Summer jobs in the projects
  - Complete customers orders as student work





# ENERGY PROJECTS IN RUAS



## *Lapland's energy strategy*

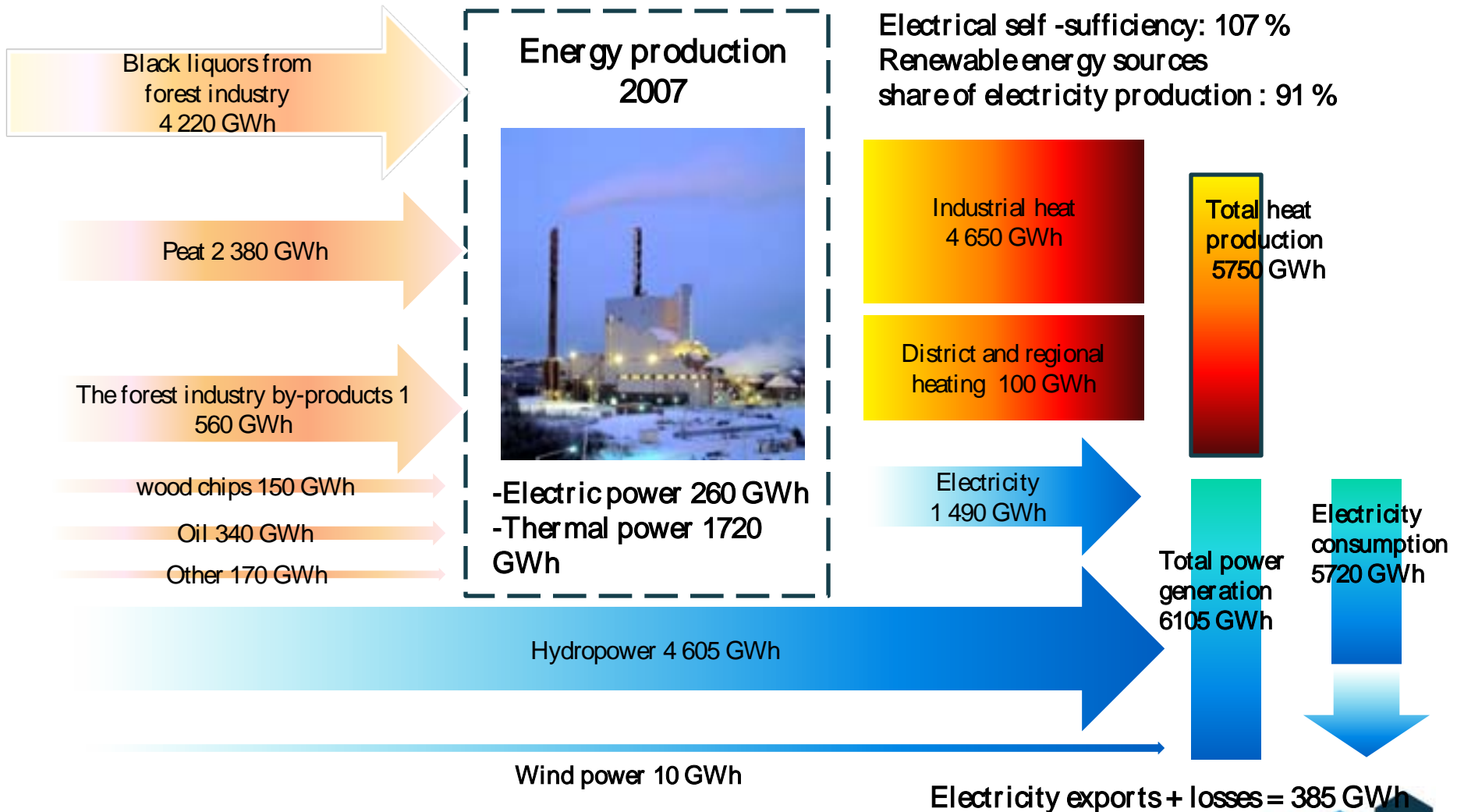
The abundant energy resources of *Lapland* have long enabled it to produce energy for its own needs and for the rest of Finland, too

*Lapland utilizes* a plenty of hydropower, local wood fuels, peat and waste liquor from the forest industry

*Lapland's self-sufficiency* in electricity production is slightly more than it needs, and renewable energy accounts for over 90 % of electricity production

*In industry*, particularly, heat generated is used for its own production and in population centres it is supplied to the district heat networks.

## Energy balance in power and heat production in Lapland in 2007



## Electricity - a necessity for welfare

Electricity plays a central role in the economic development of the industrialized countries. In Finland, the world's most northern industrialized nation, electricity consumption per capita is high. This is caused by the severe climate, **long distances**, the high standard of living and the structure of the industry.

### Problems?

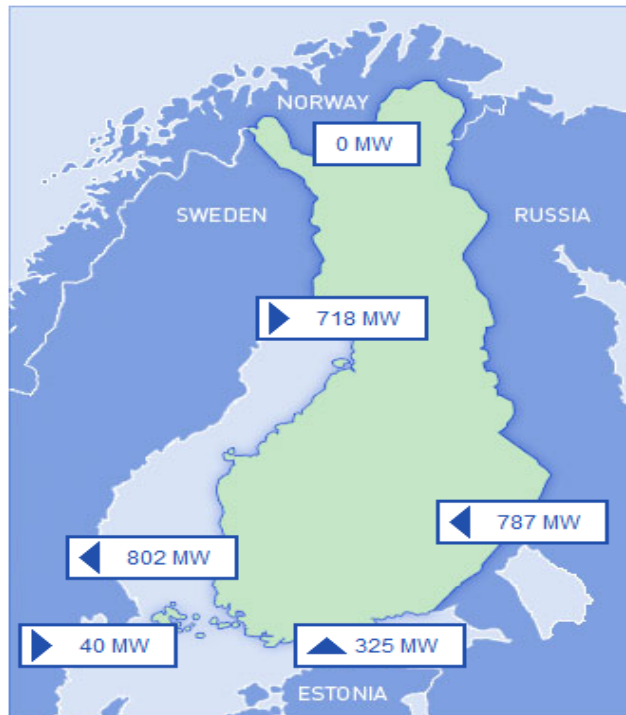
In the North part of Finland problem is the long distance transmission of electricity.

So transmission losses are high.

Solution: - CHP/ Bioenergy



## State of the power system



● Normal power balance

Info

Temperatures:

Helsinki -6 °C, Jyväskylä -7 °C,  
Oulu -21 °C, Rovaniemi -25 °C

Latest update 1/16/2013 2:36 PM

### Consumption and production in Finland

Info

Consumption	12,403 MW
Production	11,374 MW
- Hydro power	2,290 MW
- Nuclear power	2,772 MW
- Condensing power	1,624 MW
- Cogeneration district heating	2,642 MW
- Cogeneration industry	1,863 MW
- Other production (estimate)	184 MW
- Peak load power	0 MW
Net import/export	1,029 MW

### Power balance

Info

Production surplus/deficit in Finland	58 MW
Surplus/deficit, cumulative	84 MWh
Instantaneous freq. measurement	50.01 Hz
Time deviation	11.74 s

### Electricity price in Finland

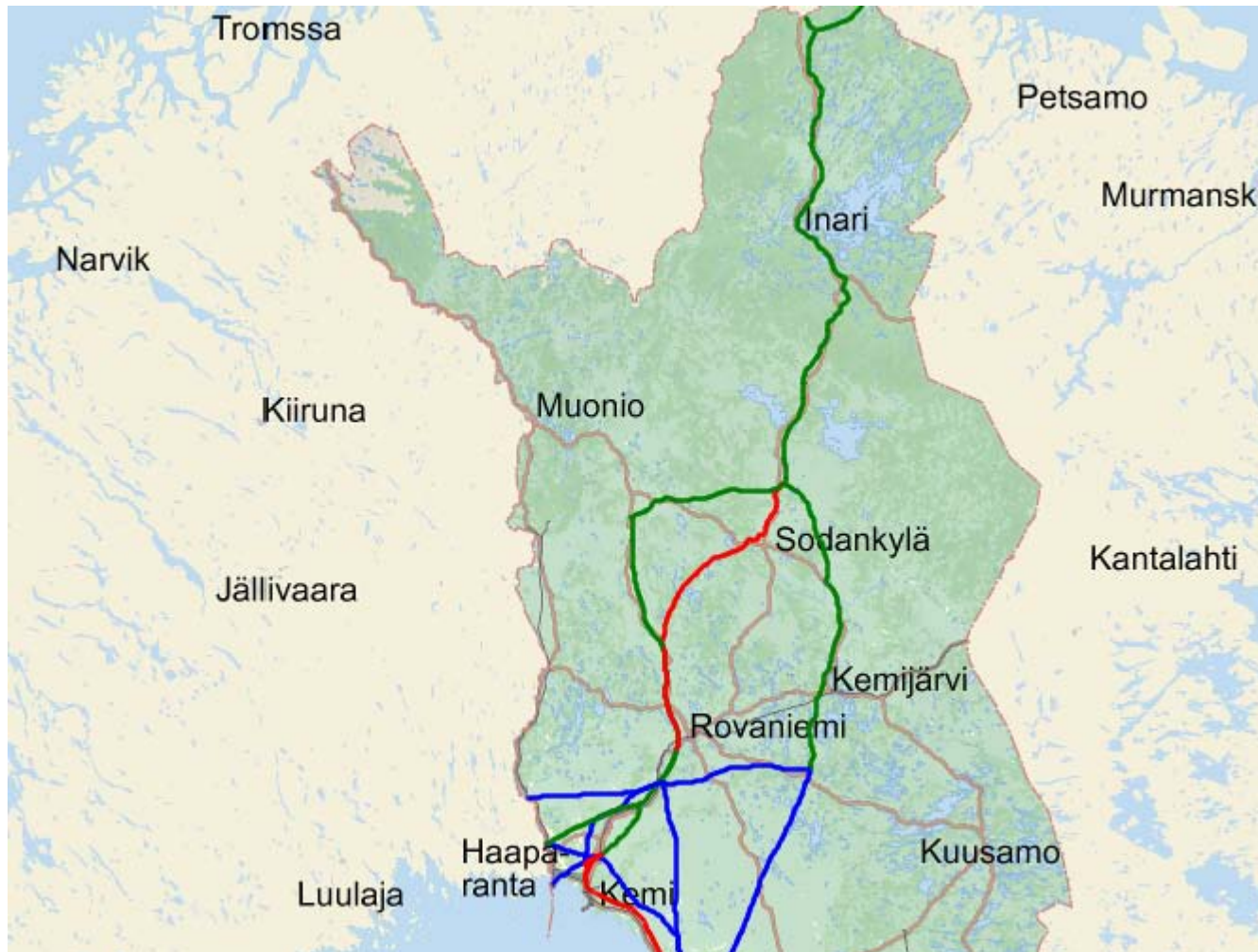
Info

Elsport area price	63.48 EUR/MWh
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Source: www.fingrid.fi



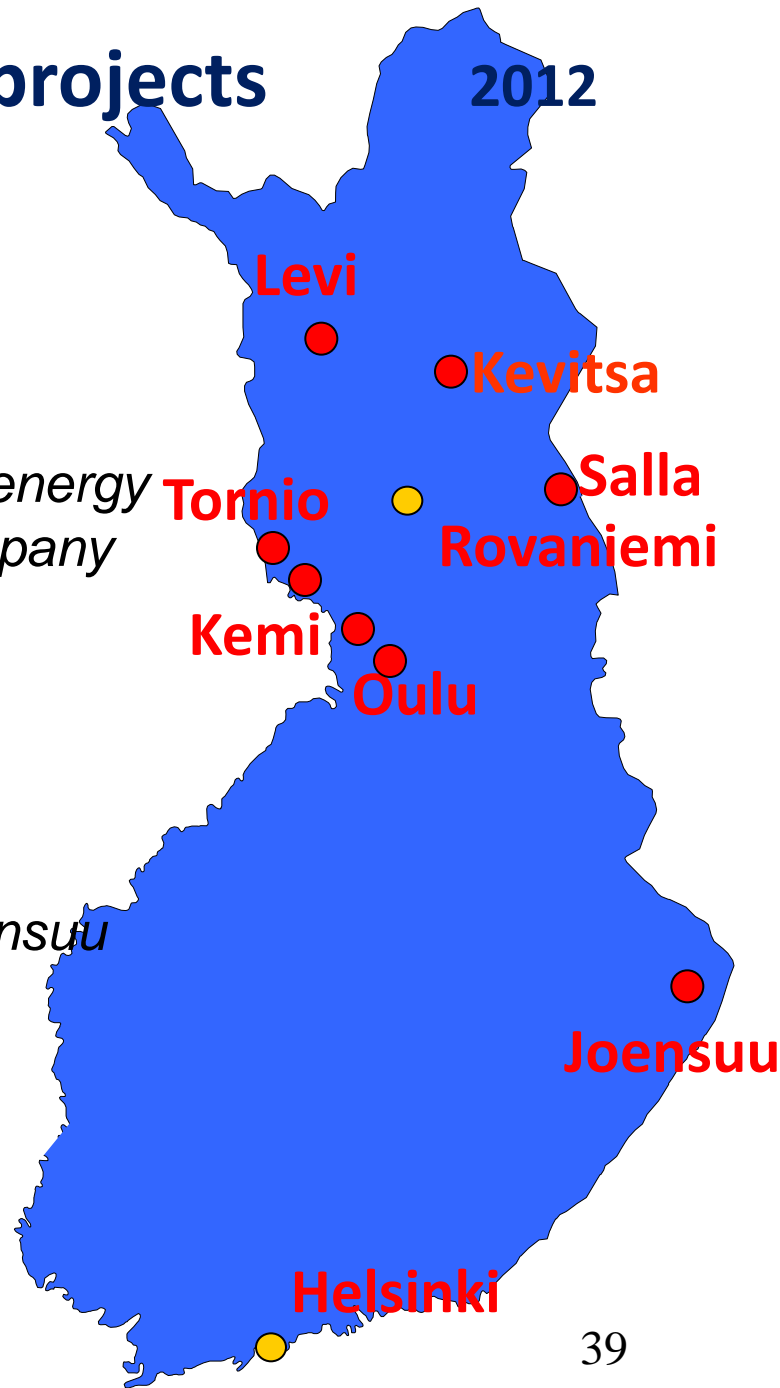
# Transmission lines in Lapland



# Bioenergy projects

2012

1. *Mustikkamaa CHP in Rovaniemi*
2. Energy Advice Practical Initiation of Rovaniemi
3. *Salla 2- Ski Resort & Bioenergy*
4. *Bioenergy in Mining Company*
5. *Interreg IV A*
  - *Noe (Swe, Nor, Fin)*
  - *Eceh (Swe, Fin)*
  - *HighBio (Swe, Fin)*
6. *Heat Pumps*
7. *Bioenergy (Oulu and Joensuu University)*
8. *Enpi - Russia*
9. *R&D - Levi*



## Efficient Control of heat & ventilation in low Energy Houses for single families (ECEH)

Interreg IVA

6/2012 – 2014

Kemi-Tornio University of Applied Sciences

Rovaniemi University of Applied Sciences

Kalix Electropolis AB

IUC Norrbotten AB

Luleå University of technology



# HighBio 2

## Biomass to Energy and Chemicals

The utilization of biomass in the production of energy as well as transportation fuels and chemicals becomes more important in order to achieve the national and international objectives aiming at increasing the utilization of renewable energy resources and restrain the global warming.

The aim of the project is to study especially the utilization possibilities of forest biomass in the production of energy as well as biofuels and different chemicals.

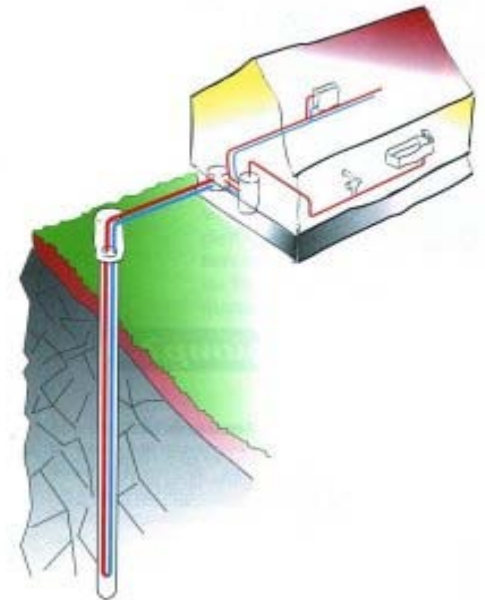
The project is strongly focusing on the development and optimization of the gasification process, as well as on the purification of syngas and subsequent processing of the obtained syngas.



# Energy Advice Practical Initiation of Lapland

- Project implemented in cooperation with the Ramk building department and the town and village of Lapland
- Energy awareness to all the Lapland's people
- Energy Efficiency
- New building directives 7-2012
- Etc.
- 2012-2016

• **1.5.2012 - 31.12.2012**



# *Bioenergy in Mining Company*

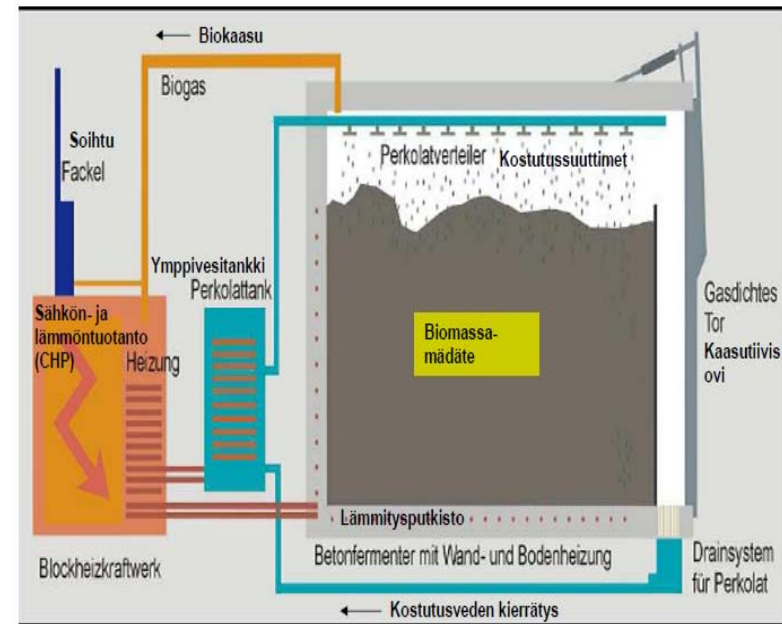
- The main objective of this project was to design a general model for energy planning in mining industry
- The idea was to develop a set of tools for comprehensive planning of purchase, production and consumption of energy in this line of business
- Simultaneously, it was aimed to increase knowhow of the project team and other involved local actors for future needs and use in education, training and business services in the field of renewable energy and energy efficiency



# ROIBIO - Biogas

The biogas produced in wastewater treatment plants is largely used to generate energy to run the plants' own processes

Like natural gas, biogas can be used to generate heat and power, as a vehicle fuel, or in homes for heating and cooking. The methane in biogas is well suited to use as vehicle fuel, since the exhaust gases from combustion contain only water vapour and carbon dioxide.



# Lapland's Energy school

- renewable energy
- cooperations
- laboratories
- innovation



ROVANIEMEN KOULUTUSKUNTAYHTYMÄ

Kemi-Tornionlaakson  
koulutuskuntayhtymä

# ENERU – Efficient Energy Management in Barents region

**Partners:** Ramk, Iin Micropolis Oy, Iin Micropolis Oy, Piteå Kommun, Bothnian Arc, Kemi-Tornionlaakso Municipal Education and Training Consortium Lappia, The Union of the Cities of the South of Kola Peninsula

## **Main outputs:**

- Network of energy management related organizations in the region
- Audit methodology on energy efficiency for Russian market
- Network handbook
- Action plan on energy efficiency and the use of renewable energy in the pilot region
- Miniature sample solution on efficient energy management



## HePuPro - Use of Heat Pump Promotion in Barents Region

### Project partners:

RAMK: lead partner

Narvik University College (Norway)

The Murmansk Regional Agency of Energy Efficiency (Russia)

**Project idea** lies in field of heat pump system development, testing and certification and bringing to market. Target operating area for this project will be Barents region (ENPI eligible area).

Heat pumps are widely known and used in Finland, Sweden, as well as in Norway, available in NW Russia (ground heat pumps).

# The test laboratory

There is a heat pumps test laboratory in Rovaniemi University of Applied Science

The measurement systems use EN 14511 standard by testing heat pumps in laboratory

Before and after test in Levi we will test pumps in our test laboratory in Rovaniemi





## R&D POSSIBILITIES IN TN AES

- PARTNERS OF TN ARCTIC ENGINEERING AND SCIENCE (AES):
  - UNIVERSITY OF ALASKA ANCHORAGE (UAA)
  - LULEÅ UNIVERSITY OF TECHNOLOGY (LTU)
  - ARCTIC TECHNOLOGY CENTRE (ARTEK) FROM TECHNICAL UNIVERSITY OF DENMARK (DTU)
  - ROVANIEMI UNIVERSITY OF APPLIED SCIENCES – RUAS

## R&D POSSIBILITIES IN TN AES

- TOPICS MAY BE:
  - ENERGY
  - MINING
  - COLD CLIMATE TECHNOLOGIES
  - ETC.
- EU-FUNDED PROJECTS?
- CO-OPERATION WITH ONE OF TN AES PARTNER OR WITH ALL
- "ENGINEER FOCUS" ON R&D PROJECTS

# ARCTIC POWER LABORATORY





# ARCTIC POWER LABORATORY



ARCTIC  
POWER  
LABORATORY



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