

# Solar energy in renovation: zero emission multifamily house in Lithuania

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# Zero-emission multifamily house



## INTRODUCTION

- THERE ARE PLENTY OF OLD STYLE MULTIFAMILY BUILDINGS IN LITHUANIA
- ENERGY SUPPLY OF MANY OF THEM IS **FAR AWAY FROM POSSIBILITIES** OF XXI CENTURY
- LAST TECHNICAL AND ECONOMICAL ACHIEVEMENTS **OPENS NEW VERY ATTRACTIVE POSSIBILITIES** FOR MODERNIZATION OF ENERGY SUPPLY OF SUCH BUILDINGS
- RESEARCH AND MODELLING MADE SOLAR ASSOCIATION MEMBERS DURING EU HEROES PROJECT SHOWS REAL POSSIBILITIES TO **REACH ZERRO EMMISION OF SUCH BUILDINGS**

# Zero-emission multifamily house



## BASIS FOR THE DEVELOPMENT OF ZERO – EMISSION BUILDINGS

- **FLEXIBLE PV NET- METERING** AND PROSUMERS SYSTEM IN THE COUNTRY
- POSSIBILITY TO **COLLECT** SOLAR ENERGY **IN SUMMER** AND **USE** IT FOR HEATING **IN WINTER**
- **EFFECTIVE** GEOTHERMAL AND AEROTHERMAL **HEAT PUMPS**
- EXPERIENCE OF CREATING **COMMUNITIES OF RESIDENTS** IN MULTIFAMILY HOUSES. IT PRESERVES GOOD CONDITIONS TO **TRANSFORM THEM TO ENERGY COMMUNITIES**
- DISSEMINATION OF GREEN IDEAS IN THE SOCIETY

# Zero-emission multifamily house



## NET – METERING AND PROSUMERS ACCORDING TO LITHUANIAN LEGISLATION

- EVERY PRIVATE OR LEGAL CONSUMER CAN USE NET-METERING SYSTEM AND BECOME PRODUCING CONSUMER
- POWER LIMIT FOR PROSUMING – **500 kW !**
- PLACES OF PV PRODUCING AND CONSUMING **CAN BE DIFFERENT:**
  - producing in one part of the country – consuming in other
- CONSUMER HAS OPPORTUNITY TO ACQUIRE **SMALL PART OF BIG PV STATION** AND BECOME PROSUMER
  - E.g. household can own 5 kW in 10 MW PV station and use its electricity at home

# Zero-emission multifamily house

## PILOT PROJECT IN SMALL TOWN VARNIAI



# Zero-emission multifamily house

## GENERAL CHARACTERISTICS OF THE PROJECT

- TOTAL AREA OF THE HOUSE – **1040 sq. m.**
- NUMBER OF APARTMENTS IN THE HOUSE – **20**

Annual energy consumption, kWh/year	Before project	After project
ELECTRICITY CONSUMPTION	<b>24 000</b>	<b>79 000*</b>
HEAT (for heating and hot water) CONSUMPTION	<b>364 000</b>	<b>165 000 **</b>

\* Increased because of electricity supply of heat pump

\*\* decrease because of house insulation

# Zero-emission multifamily house

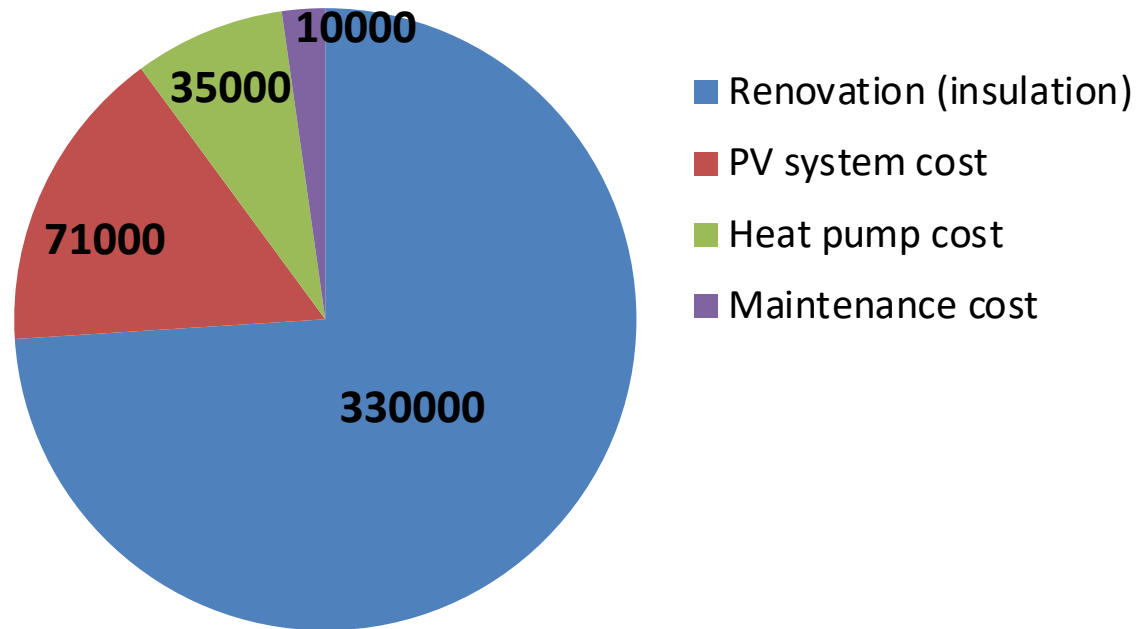
## ENERGY CHARACTERISTICS OF THE PROJECT

Parameter	Value
PV system size	<b>79 kW</b>
Specific system yield	<b>1000 kWh/kW</b>
Specific system cost	<b>900 Eur/kW</b>
Direct consumption rate	<b>30%</b>
Net-metering rate	<b>70%</b>
Electricity tariff (direct consumption )	<b>0,15 Eur/kWh</b>
Net-metering credits rate	<b>0,05 Eur/kWh</b>
Heat pump size	<b>40 kW</b>
Heat cost before project –	<b>0,06 Eur/kWh</b>

# Zero-emission multifamily house

## FUNDING SCHEME

Total – 446 000 Eur



## SUPPORT SCHEME

- Subsidy for renovation – **30 %**
- Subsidy for energy modernization – **60%**



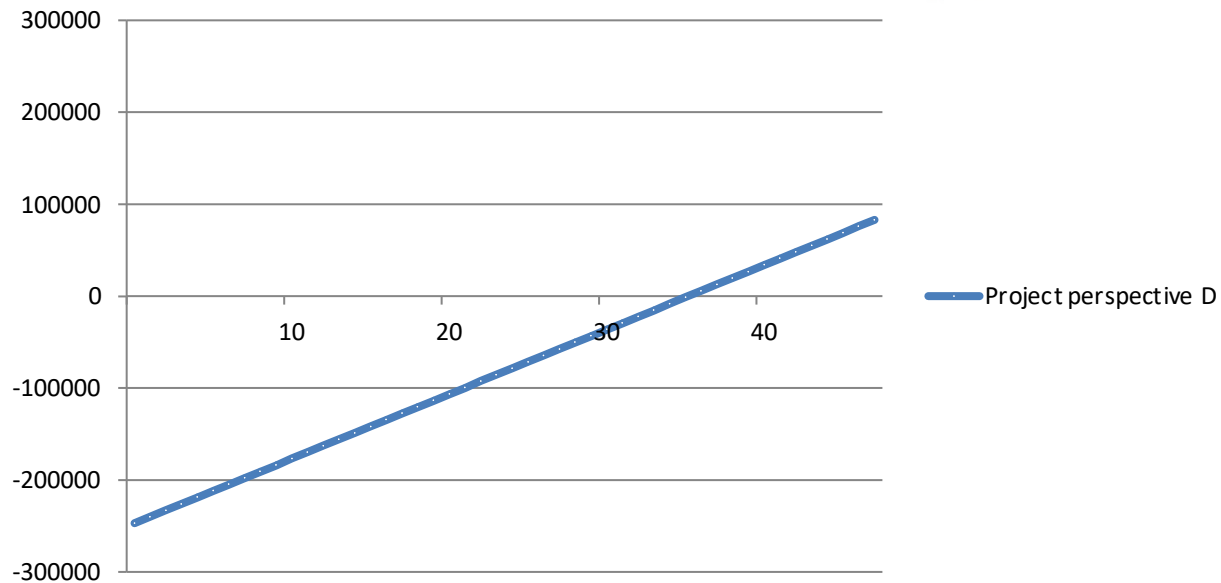
## MODELLING CASES

- **A** — SITUATION AFTER GENERAL RENOVATION (INSULATION OF THE BUILDING SHELL), WITHOUT ENERGY MODERNIZATION
- **B** — SITUATION AFTER GENERAL RENOVATION PLUS ENERGY MODERNIZATION WHICH INCLUDES HEAT PUMP POWERED BY CONVENTIONAL ELECTRICITY
- **C** — SITUATION AFTER RENOVATION PLUS ENERGY MODERNIZATION WHICH INCLUDES PV ELECTRICITY (for powering of heat pumps, general needs of common areas and electricity for household needs)

# Zero-emission MFH: payback period

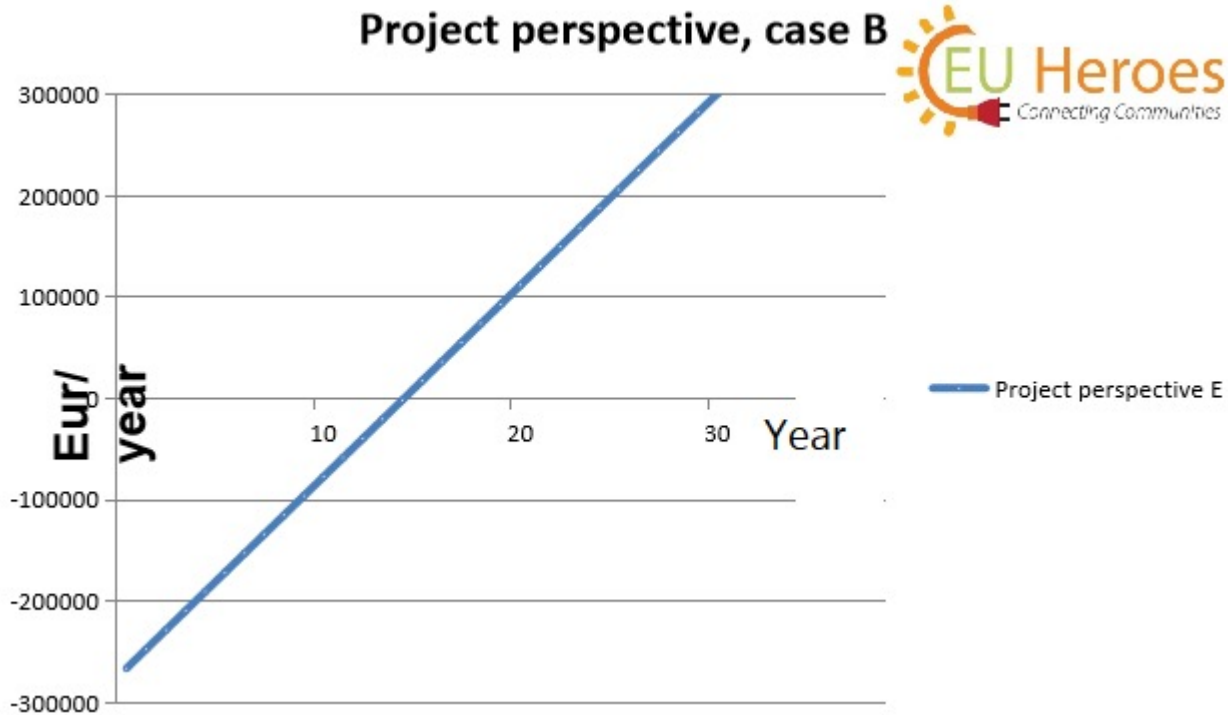


## Project perspective, case A



**A** — SITUATION AFTER GENERAL RENOVATION (INSULATION OF THE BUILDING SHELL), WITHOUT ENERGY MODERNIZATION;  
**Payback period – 33,5 years**

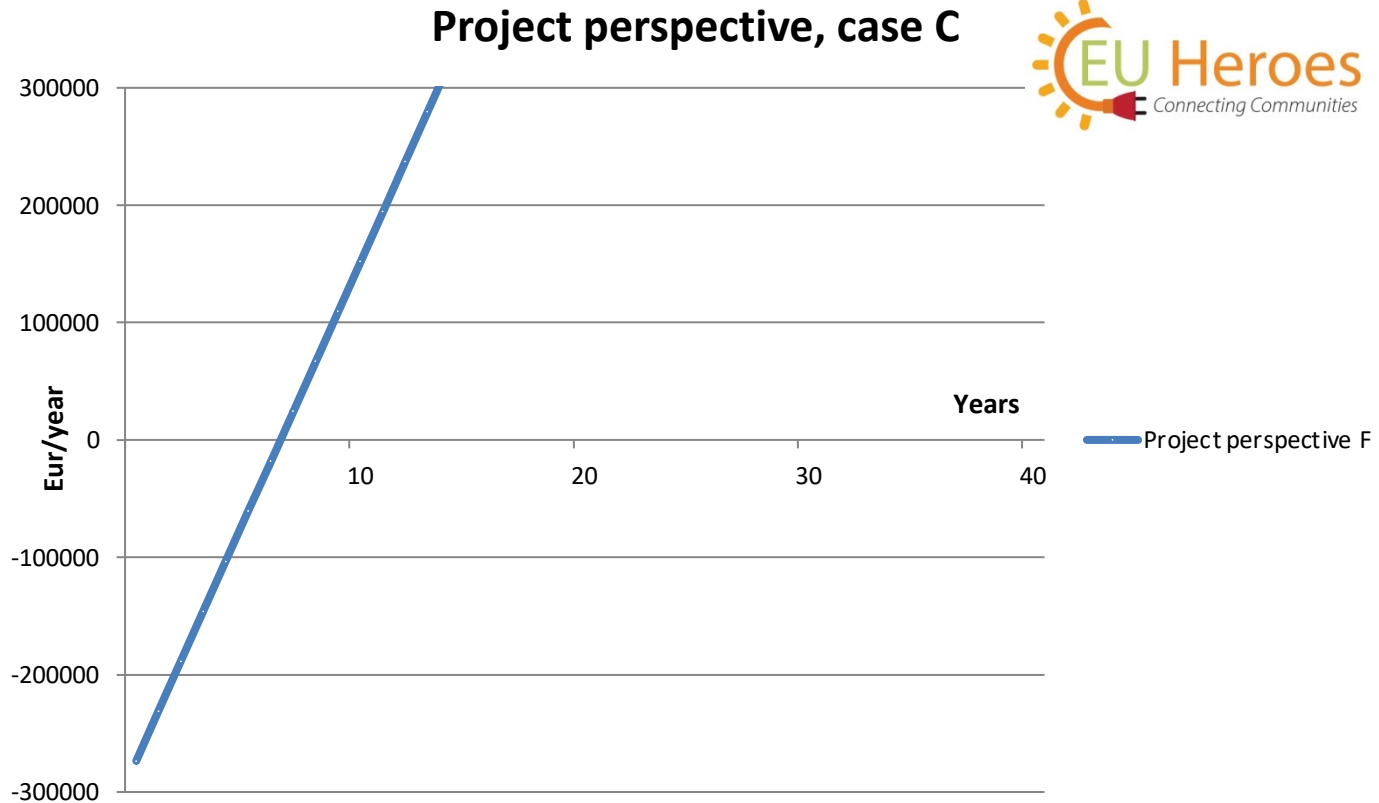
# Zero-emission MFH: payback period



**B** — SITUATION AFTER GENERAL RENOVATION, PLUS ENERGY MODERNIZATION WHICH INCLUDES HEAT PUMP POWERED BY CONVENTIONAL ELECTRICITY

**Payback period – 13,5 years**

# Zero-emission MFH: payback period

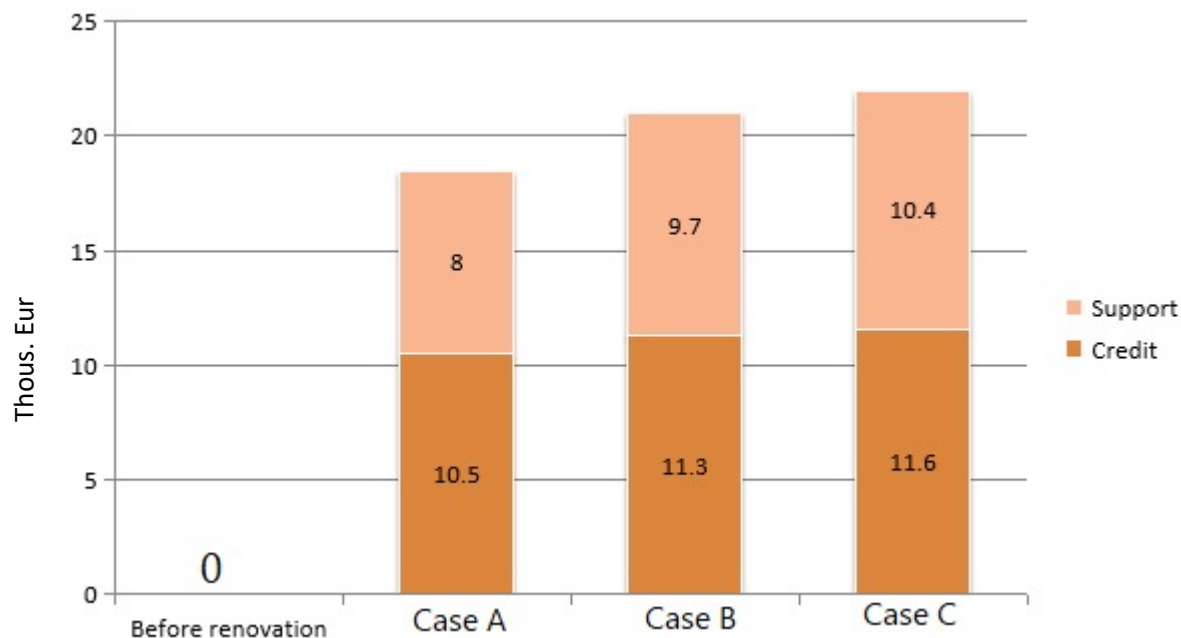


**C** — SITUATION AFTER RENOVATION, PLUS ENERGY MODERNIZATION WHICH INCLUDES PV ELECTRICITY  
(for powering of heat pumps, common needs of whole house and electricity for household needs)

**Payback period – 8 years**

# Zero-emission MFH: household investment

## INVESTMENTS FOR 1 HOUSEHOLD



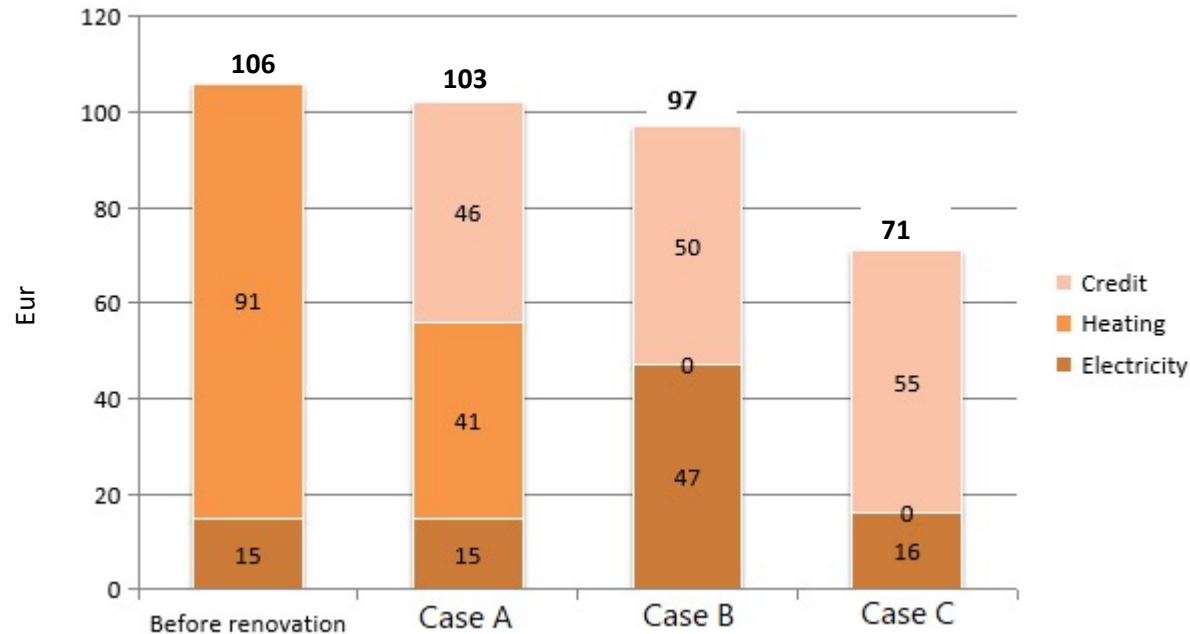
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# Zero-emission MFH: household expenditures

## MONTHLY EXPENDITURES OF 1 HOUSEHOLD



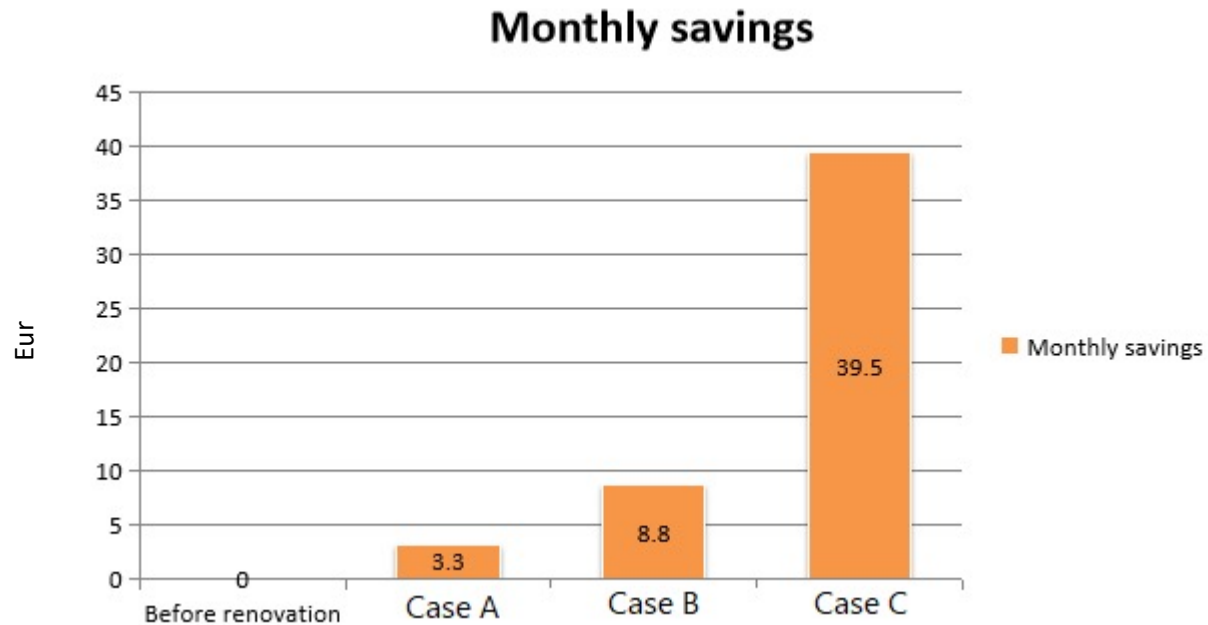
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# Zero-emission MFH: household savings

## MONTHLY SAVINGS FOR 1 HOUSEHOLD



CASE A — SITUATION AFTER GENERAL RENOVATION (INSULATION OF THE BUILDING SHELL), WITHOUT ENERGY MODERNIZATION

CASE B — SITUATION AFTER GENERAL RENOVATION, PLUS ENERGY MODERNIZATION WHICH INCLUDES HEAT PUMP POWERED BY CONVENTIONAL ELECTRICITY

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# Zero-emission multifamily house

## OBSTACLES

- **COMPLEX PROJECTS COMBINING SOLAR ENERGY WITH HEAT PUMPS ARE RATHER COMPLICATED FROM TECHNICAL AND ECONOMICAL POINTS OF VIEW. THEREFORE, IT IS NOT EASY TO EXPLAIN ITS ADVANTAGES FOR ORDINARY HOUSEHOLDS – PARTICIPANTS OF THE PROJECTS**
- **ELECTRICAL AND HEAT COMPANIES ARE NOT PREPARED FOR THE WORK TOGETHER AS INTEGRATORS. THEREFORE, IT IS NOT EASY TO FIND SOLUTIONS SUITABLE FOR ALL PARTIES OF THE PROJECTS**
- **LEGISLATION AND TECHNICAL REQUIREMENTS ARE NOT PREPARED ENOUGH FOR SUCH INTEGRATION. THEREFORE, IT REQUIRES MUCH MORE EFFORT AND GOOD WILL FROM PUBLIC AUTHORITIES AND MUNICIPALITIES TO REDUCE OBSTACLES FOR SUCH INNOVATIVE PROJECTS**



# Conclusions



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- VARNIAI EXPERIMENT AND COMBINING **SOLAR ENERGY TOGETHER WITH THERMAL ENERGY** SHOWED VERY HIGH ECONOMICAL AND TECHNICAL EFFECTIVENESS FOR ENERGY SUPPLY OF BUILDINGS
- PROJECT SHOWED THAT CREATING **ENERGY COMMUNITIES** TO SUPPLY GROUPS OF BUILDINGS CAN BE EVEN MORE EFFECTIVE
- EXPECTED PROJECT DEVELOPMENT – OPENING COUNTRY PROGRAM FOR CREATION OF **ZERO-EMISSION DISTRICT HEATING SYSTEMS** APPLIED FOR SMALL TOWNS

# Zero-emission village

## **ZERO-EMISSION VILLAGE IN THE CURONIAN SPIT**

### **JUODKRANTE**

- **INHABITANTS - 1300**
- **BOILER FOR DISTRICT HEATING: FUEL-LIQUID GAS — 95t/year**
- **EXPENDITURES FOR THE HEAT — 12ect/kWh**

## GREEN VILLAGE JUODKRANTĖ

- Annual usage of heat energy – 1000 MWh
- Requirements for heat pump – 350 kW
- Price of heat pump – 390 000 Eur
- Necessary solar power plant – 330 kW
- Price of solar power plant – 300 000 Eur
- Investment total: **690 000 Eur**
- Land plot for solar power plant – 0,6 ha

**RESULT: ALL ENERGY FOR JUODKRANTE –  
FROM THE SKY! 😊**



# LETS ENJOY THE SUN!

