**Utilization of RES and Energy Saving Technologies in Public Buildings of Sofia**

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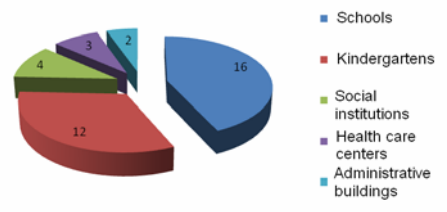
## Objectives and scope

- Energy assessment of the municipal building stock
- Identifying energy saving and RES measures, technical and economical feasibility
- Priorities and action plan for implementation



## Objectives and scope

- 38 public buildings in districts Vazrajdane and Vrabnitsa






## Methodology

- **Source of information:**
  design documentation, energy consumption data, energy audits, questionnaire, walk through audits and visits
- **Building types:**
- Use – schools, kindergartens, etc.
- Type of construction – monolithic, monolithic with reinforced concrete columns, prefabricated panels



## Current conditions – building envelope

Example values of the heat transmission coefficient U, W / m²K

| Elements | Current conditions | U, W / m²K | Reference value 2009 |
|---|---|---|---|
| External walls | Brick masonry 50 cm | 1,1 | 0,35 |
| Floor above no heated basement | Concrete slab without insulation | 1,70 | 0,50 |
| Roof | Concrete slab with insulation Keramzit 15 cm | 1,11 | 0,30 |
| Windows | 2 wooden frames | 3,45 | 1,70 |

## Problems in the surrounding elements

- Walls are without thermal insulation
- Leakages
- In some places windows are not replaced
- In most of the cases the floors are not insulated and the roof insulation is in bad conition
- Some of the buildings are monuments of culture

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## Problems in the surrounding elements


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## Installations

**Heating installations:**

- Boilers on oil and pellets
- District heating

**Lighting:**

- Incandescent bulb
- Fluorescent lighting




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## Problems in the insulations

**Heating:**

- Not insulated pipelines
- Old district heating stations and boilers
- Not optimal control
- Old installations and lack of thermostatic valves

**Lighting:**

- Incandescent bulbs
- Missing lamps, not effective installations

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## Problems in the installations



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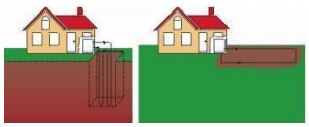
## Problems with swimming pools

- Lack of covers
- In some places there is no water filtration system
- Non efficient ventilation system

Losses:
-Evaporation
- Ventilation
- Water exchange

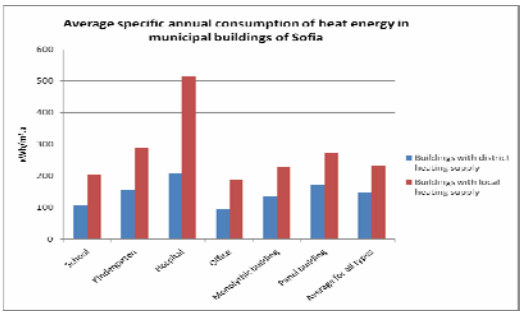
## Possibilities for RES utilization

- In one kindergarten pellet boiler is installed
- Solar thermal systems – for kindergartens with swimming pools
- Ground sourced heat pumps
- Heat recovery for boilers





## Analysis of the energy consumption





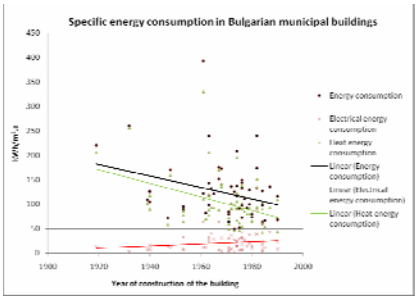

## Analysis of the energy consumption

| BUILDINGS WITH DISTRICT HEATING SUPPLY | | | | | |
|---|---|---|---|---|---|
| *Site:* | *kWh/a* | *BGN/a** | *kWh/m².a* | *kWh/m³.a* | *kgCO₂/a* |
| School | 594 193 | 42 960 | 109 (95) | 33 | 146 766 |
| Kindergarten | 290 039 | 20 970 | 156 (119,5) | 53 | 71 640 |
| Hospital | 1 000 075 | 72 305 | 210 (110,3) | 76 | 247 019 |
| Administrative building | 174 961 | 12 650 | 94 (89,2) | 34 | 49 864 |
| Monolythic building | 432 633 | 31 279 | 135 | 39 | 108 061 |
| Panel building | 494 798 | 35 774 | 170 | 37 | 122 215 |
| *Average for all categories*** | *425 987* | *30 799* | *149* | *40* | *106 224* |
| **BUILDINGS WITH LOCAL HEATING SUPPLY** | | | | | |
| School | 532 437 | - | 202 (95) | 61 | 162 234 |
| Kindergarten | 437 727 | - | 287 (119,5) | 126 | 145 102 |
| Hospital | 1 998 303 | - | 515 (110,3) | 155 | 621 472 |
| Administrative building | 184 278 | - | 186 (89,2) | 107 | 57 310 |
| Monolythic building | 477 740 | - | 229 | 73 | 153 545 |
| Panel building | 584 905 | - | 273 | 136 | 200 772 |
| *Average for all categories*** | *503 514* | - | *232* | *86* | *160 621* |

* At the price of 72,** BGN/MWh of „Toplofikacia – Sofia" district heating utility as to 12.2007
**Related to the classification according to the use of the buildings. Includes other categories, not shown in the table.



## Analysis of the energy consumption






## Priorities

• **Short term:**
- Adoption of the proposed action plan
- Energy monitoring system and actual database
- Energy management system

• **Medium term:**
- Municipal advisory board
- Energy audits of all public buildings
- Design documentation and project readiness
- EE and RES measures implementation
- Municipal normative acts for energy efficiency
- Programme for SMART Grids

• **Long term:**
- Energy management center to cover all municipal buildings



## Proposed measures

| Measure | Expected result | Payback period* |
|---|---|---|
| Measures on the heating systems – isolations, adjustment, boiler inspections, radiator flush, thermostatic valves | 3-10% | Up to 1 year |
| Energy management – instructions, training of the personnel, clear roles and responsibilities | 5-10% | Up to 1 year |
| Improvement of the thermal characteristics of the building envelope | 20-25% | Up to 7 years |
| Use of RES (solar installations, biomass, heat pumps) | 10-30% | 5-10 years |
| Implementation of EN 16001/ISO 50001 for energy management and monitoring | 5-10% | Up to 3 years |

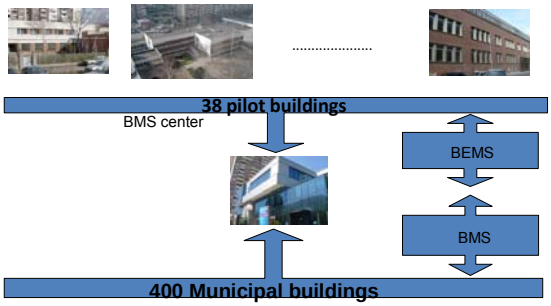
* Payback period without EU or national grant

# Energy management

- Concept for energy management and monitoring
- Developing and upgrade of database for municipal buildings
- Implementation of energy management standard EN 16001/ISO 50001
- Centralized energy management in compliance with the smart grids concept



# Energy management






# Action plan

| No | Measure | Cost, EUR | Source of Financing |
|---|---|---|---|
| 1. | **Secure of safe conditions of heating systems operation** | 9000 | Municipal budget, delegated budgets |
| 2. | **Ensuring project readiness for application for implementation of energy saving measures and use of RES in each building** | 316000 | Programmes for technical support, municipal budget |
| 3. | **Increase of the energy efficiency in district heating substations and boilers** | Subscription + expenses for repairmen | Municipal budget, delegated budgets |
| 4. | **Implementation of the standard for energy management EN 16 001** | 9000 | Municipal budget |



# Action plan

| No | Measure | Cost, EUR | Source of Financing |
|---|---|---|---|
| 5. | **Establishment of energy management center (excluding the system covering all municipal buildings at price of 1,8 mln.)** | 1 100 000 | Operative Programme Competitiveness, PPP |
| 6. | **Implementation of measures for building stock renovation (incl. 183 700 for replacement of district heating substations and measures for the swimming pools – 1 357 400)** | 3 250 000 | Operative Programme Regional Development, National Trust Eco-fund, others, ESCO |
| 7 | **Installations for Renewable Energy Sources Utilization** | 600 000 | Operative Programme Regional Development, National Trust Eco-fund, others, ESCO |
| | **Total** | **5 284 000** | |



# Conclusions

- Holistic planning approach – policy, legislative, financial, behavior, economic and social aspects
- Developed action plan for pilot implementation of EE&RES measures and energy management for 38 buildings, at the amount of 5 284 000 EUR;
- Anticipated results – 30% energy savings
- Recommendations for pilot implementation



# Thank you for your attention!