REKK Regional Centre for Energy Policy Research

# V4 experiences in the field of energy efficiency
# - Hungary -

Zsuzsanna Pató

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Kiev

# Structure of the day

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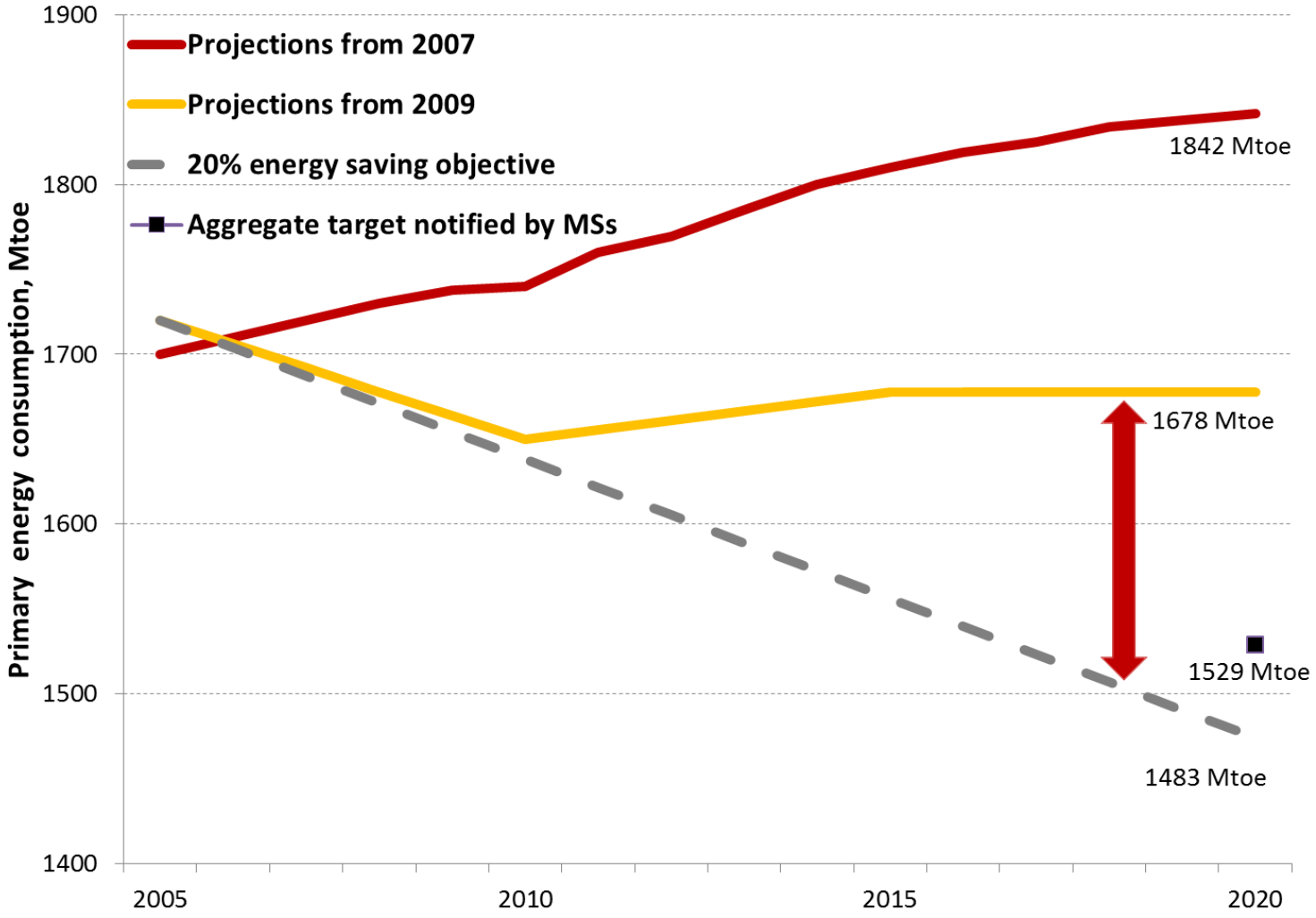
- EU and Hungarian energy efficiency policy and horizontal legislation
- Financial and non-financial support for energy efficiency
- Hungarian experience in building energy efficiency society and business: policy instruments
- Energy efficiency investment: case study
- Information campaigns in favour of energy efficiency – role of the state and local authorities
- Conclusions

# EU AND HUNGARIAN ENERGY EFFICIENCY POLICY AND HORIZONTAL LEGISLATION

# Major EU legislation

- Energy Service Directive - ESD (Directive 2006/32)
  - 9% energy efficiency target until 2016 for all EU countries
  - all EU countries have to prepare a National Energy Efficiency Action Plan (NEEAP)
- Energy Efficiency Directive – EED (2012/27/EU) repealing ESD
  - Horizontal legislation
  - Bundling together many areas of energy savings
  - Key vehicle to achieve the 2020 EU energy efficiency goal
- 2030 EE goal: 27% (potentially 30%) compared to BAU

# Why do we have the EED?



# Main provisions of EED

- **Setting of an indicative national energy efficiency target** translated into absolute level of primary/final energy consumption in 2020
- **Achievement of a certain amount of final energy savings** between 2014 and 2020 by using **energy efficiency obligations schemes** or other targeted policy measures (‚alternative measures')
- **Information provision for consumers**: easy and free-of-charge access to data on real-time and historical energy consumption through more accurate individual metering
- **Energy audits**:
  - *Obligation for large enterprises* to carry out an energy audit at least every four years (the first executed by 5 December 2015)
  - *Incentives for SMEs* to undergo energy audits to identify energy saving options

# Main provisions of EED

- **Public sector**:
  - renovating 3% of buildings owned and occupied by the central governments (from 2014)
  - energy efficiency considerations in public procurement
- **Heating and cooling**:
  - comprehensive assessment of the H/C potential for the application of high-efficiency cogeneration and efficient district heating and cooling (by 2015)
  - mandatory cost benefit analyses whenever existing thermal electricity generation installations, industrial installations or DHC networks (above 20 $MW_{th}$)are planned or substantially refurbished with a view of promoting co-generation
- **Energy transport**: Identifying measures and investments for energy efficiency improvements in the network infrastructure (with timetable for their introduction)

# Article 7 of EED

- Achievement of a certain amount of final energy savings between 2014 and 2020 by using **energy efficiency obligations schemes (EEOS)**
- Energy efficiency obligation schemes can be fully of partially substituted by other policy measures if the resulting energy savings at least equals the target
  - Energy tax, labelling schemes, financial incentives, standards and norms, voluntary agreements etc.
- Amount: new annual energy saving equaling 1.5% of the baseline, i.e. average final energy consumption of 2010-2012 but
  - Flexibility in defining the baseline
  - Exemptions to reduce the savings target
- Energy savings should be achieved at the end consumer

# Implementation issues

- Typical problems:
  - Proposing actions that are not aimed at energy savings (mainly renewable projects): RES versus EE
  - Proposing actions that are not additional to EU mandatory requirements (e.g. refurbishment of building to reach the cost optimal level required the EPBD)
  - Proposing projects that are not aimed at end-users (e.g. CHP promotion and network loss reduction)

# Target

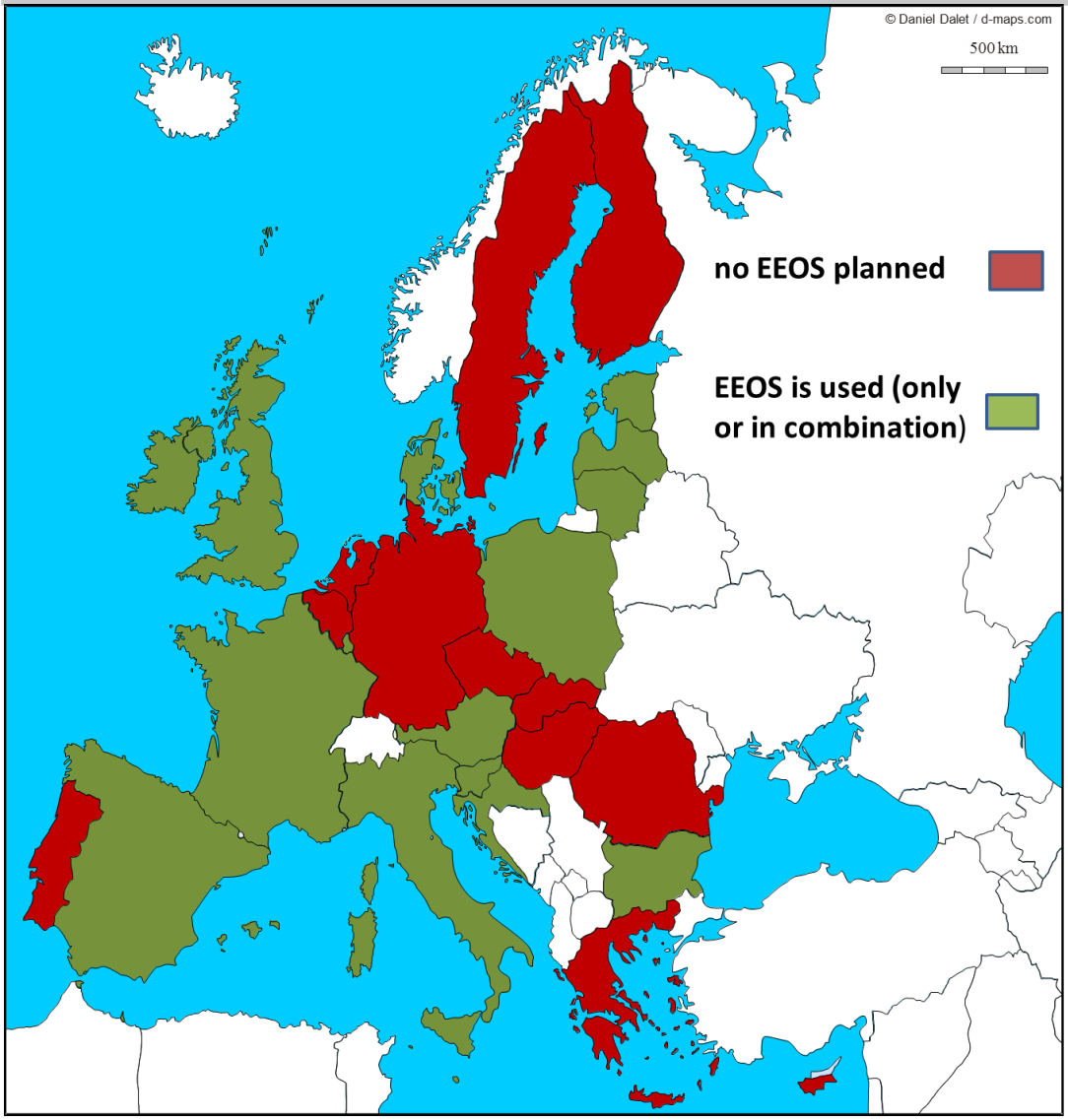
- Target: new annual energy saving equalling to 1.5% of the baseline
- Example: if the baseline is 100 Mtoe then the savings target is 42 Mtoe

| Year | Energy savings [Mtoe] | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| **2014** | 1.5 | | | | | | | 1.5 |
| **2015** | 1.5 | 1.5 | | | | | | 3.0 |
| **2016** | 1.5 | 1.5 | 1.5 | | | | | 4.5 |
| **2017** | 1.5 | 1.5 | 1.5 | 1.5 | | | | 6.0 |
| **2018** | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | | | 7.5 |
| **2019** | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | | 9.0 |
| **2020** | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 10.5 |
| **Total** | | | | | | | **42.0 Mtoe** | |

# Flexibility options in Art 7: baseline and exemptions

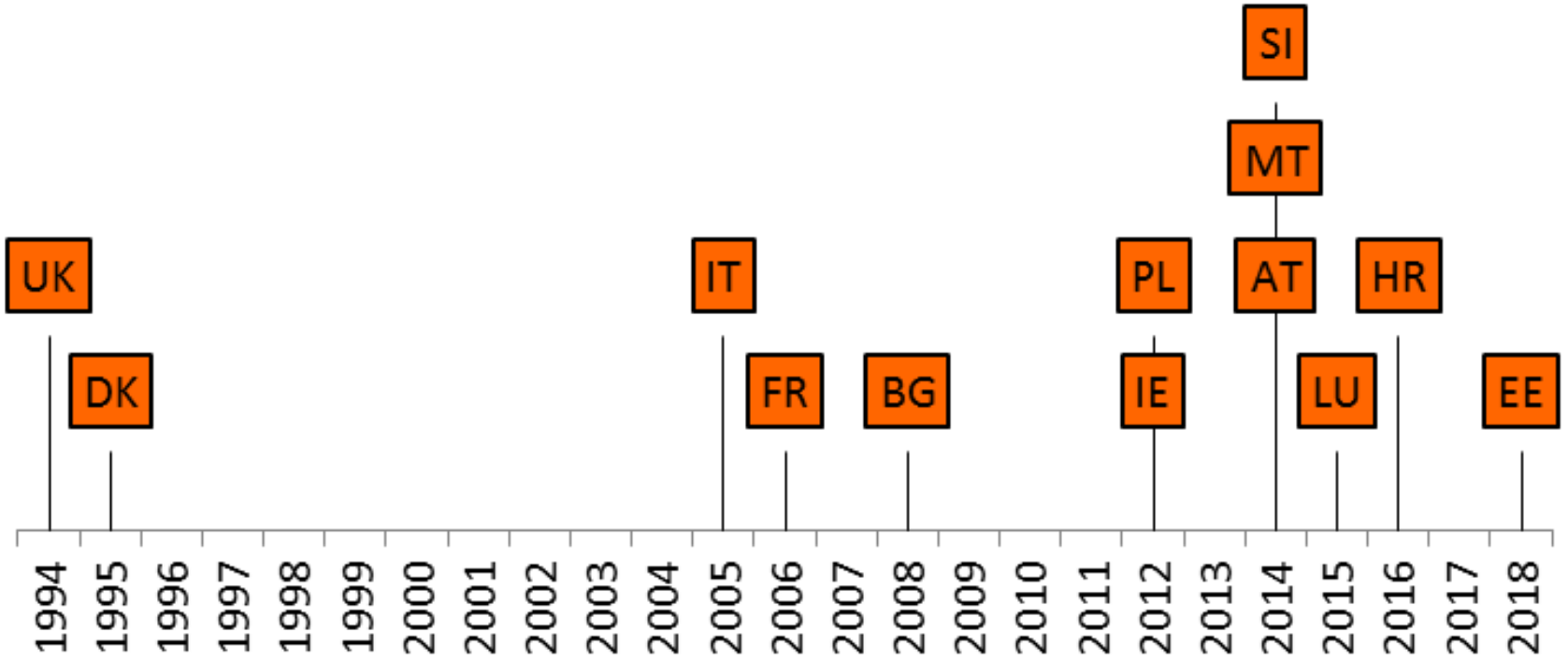
- Baseline for target calculation:
  - Energy used by transport and energy produced for own use (not sold) can be excluded
- MS can reduce their calculated target up to 25% by the followings:
  - Gradual phase-in of savings rate: 1% in 2014 and 2015; 1.25% in 2016 and 2017; 1.5% in 2018-2020
  - Exclusion of energy use of industrial installation covered by the EU ETS
  - Exclusion of energy savings from transformation, transmission and distribution
  - Exclusion of savings from early action (implemented after 2008 and having effect at least until 2020)

# The use of EEOS in Art 7

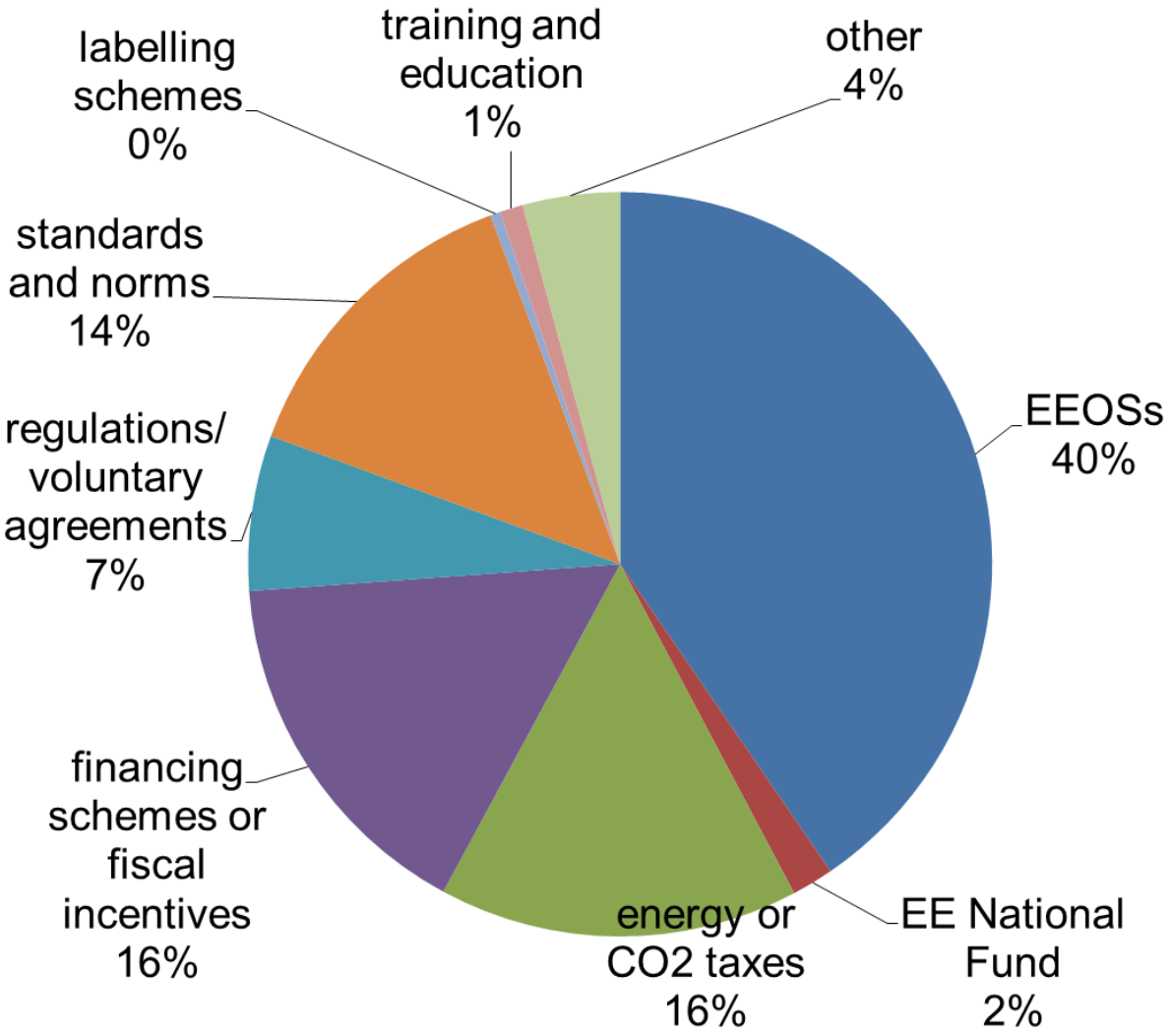



- The majority of MSs will use EEOS (16)
- BG,DK, LU and PL will use EEOS exclusively
- 12 MSs will use only alternative measures

# Introduction of EEOS



# Planned delivery of savings




- EEOSs: only 40% of savings
- MSs are to use more ‚traditional' measures

# Targets

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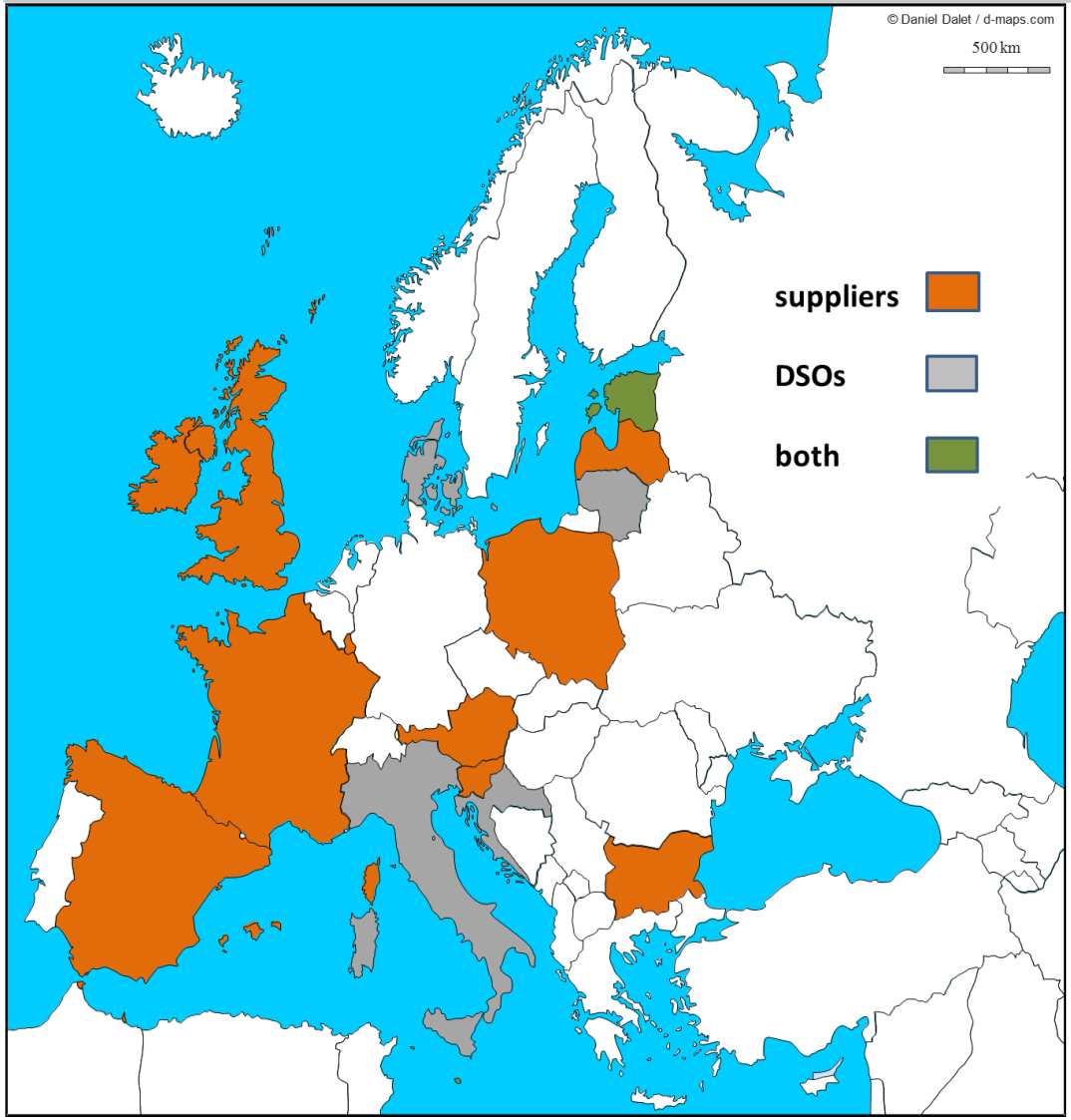
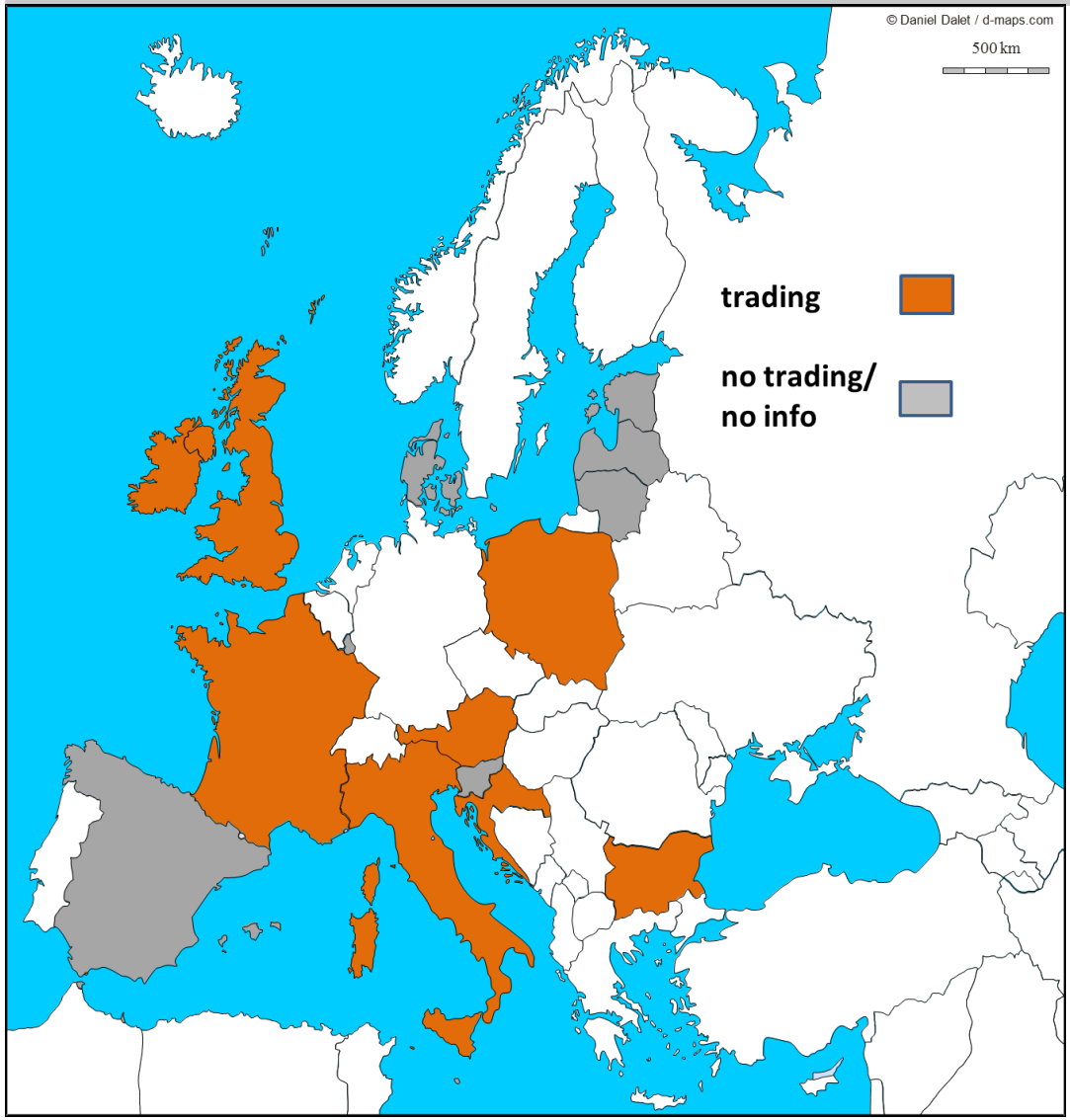
| MS | % of savings target by delivered by EEOS | MS | % of savings target by delivered by EEOS |
|---|---|---|---|
| DK | 100% | IT | 62% |
| BG | 100% | IE | 48% |
| PL | 100% | CR | 41% |
| LU | 100% | SI | 33% |
| FR | 87% | MT | 17% |
| ES | 44% | UK | 21% |
| AT | 42% | LT | 65% |
| EE | 5% | LV | 77% |

# Obligated parties (OPs)




- Most MS oblige suppliers
- DSOs as OPs only in 4 (IT, DK, CR and LT)
- EE: both DSOs and suppliers
- MT: single company

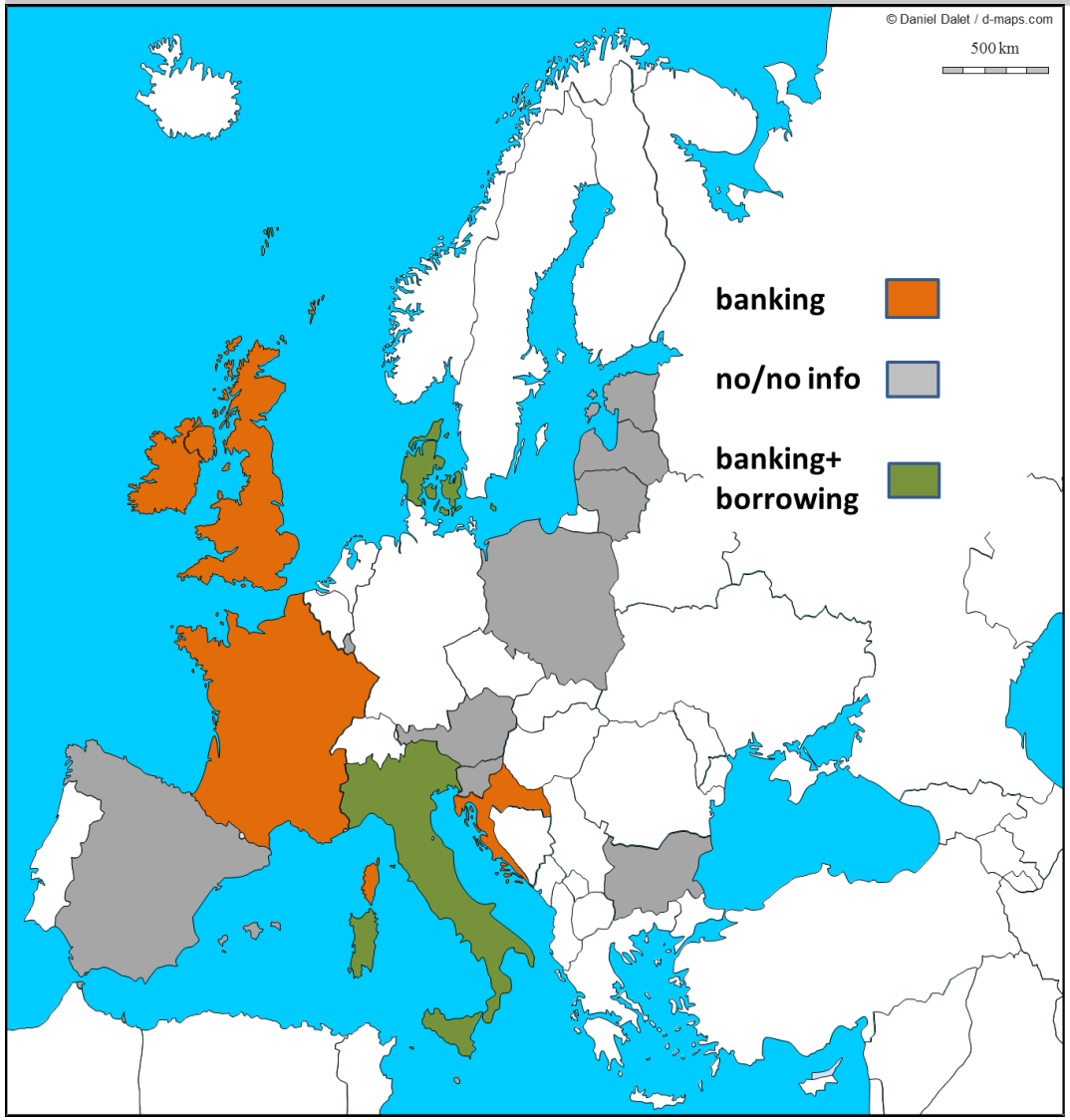
# Trading of energy savings




| | |
|---|---|
| Bilateral trading | AT |
| Third party savings | BG, CR, PL |
| Both | FR, IE, IT, UK |

Via trading platform

# Banking and borrowing




- Banking is allowed in 4 MSs: IE, UK, FR, CR
- Banking and (limited) borrowing only in IT and DK

# Design: social aims

- MS may define energy savings subtargets with social aims but this option is used only in 4 MSs:
  - Austria: uplift by factor of 1.5 for savings achieved in fuel poor households
  - France: option for obligated parties to contribute to 4 programs on fuel poverty
  - Ireland: 5% of savings need to be achieved in energy poor households (receiving certain welfare transfers or located in designated areas)
  - UK: part of the target needs to be achieved in 25% lowest areas on the Index of Multiple Deprivation and in households receiving certain welfare transfers

# Penalty regimes

| MS | Penalty | MS | Penalty |
|---|---|---|---|
| AT | 0.2 €/kWh | IE | 1.25 of the buyout price |
| BG | €510-255,000 | IT | not defined “ex ante” |
| CR | contribution to EE Fund is not recoverable | MT | up to €100,000 or €600/day |
| UK | up to 10% of global turnover | PL | up to m€2 but less than 10% of income |
| FR | buy-out of 0.02 €/kWh | SI | €15,000-€250,000 |

# Conclusions and the way ahead

- EEOS operating pre-EED all contribute to the implementation of Article 7 (except BE): viability of the policy instrument
- EEOSs have a significant contribution to the savings target but failed to become the single dominant policy instrument
- Suppliers and DSO are both affected depending on the MS – new business opportunities
- Trading - especially via trading platforms - can results in cost effective solutions
- The Commission shall assess the implementation of Article 7 by June 2016 and report on it to the European Parliament and Council

# Buildings

- Energy Performance of Buildings Directive - EPBD (Directive 2002/91/EC) required all EU countries:
  - to develop a method to for calculating the energy performance of buildings
  - to define minimum energy efficiency requirements
  - to introduce energy certification schemes for buildings
  - to have inspections of boilers and air-conditioners
- recast EPBD in 2010 (Directive 2010/31/EU)
  - application of a cost-optimal methodology for setting minimum requirements for both the envelope and the technical systems
  - new and retrofitted nearly-zero energy buildings by 2020 (2018 in the case of public buildings)

# EPBD: Cost optimal methodology

- „the energy performance level which leads to the lower cost during the estimated economic lifetime” (Art 2.14.)
- Step of methodology development:
  - Define reference buildings (residential/non-residential, new/existing)
  - Define energy efficiency measures
  - Assess primary and final energy demand of the reference building before and after intervention
  - Calculate NPV of measures for the lifecycle (inc. Investment, O&M, earning from energy savings)

# Cost optimality: renovation packages

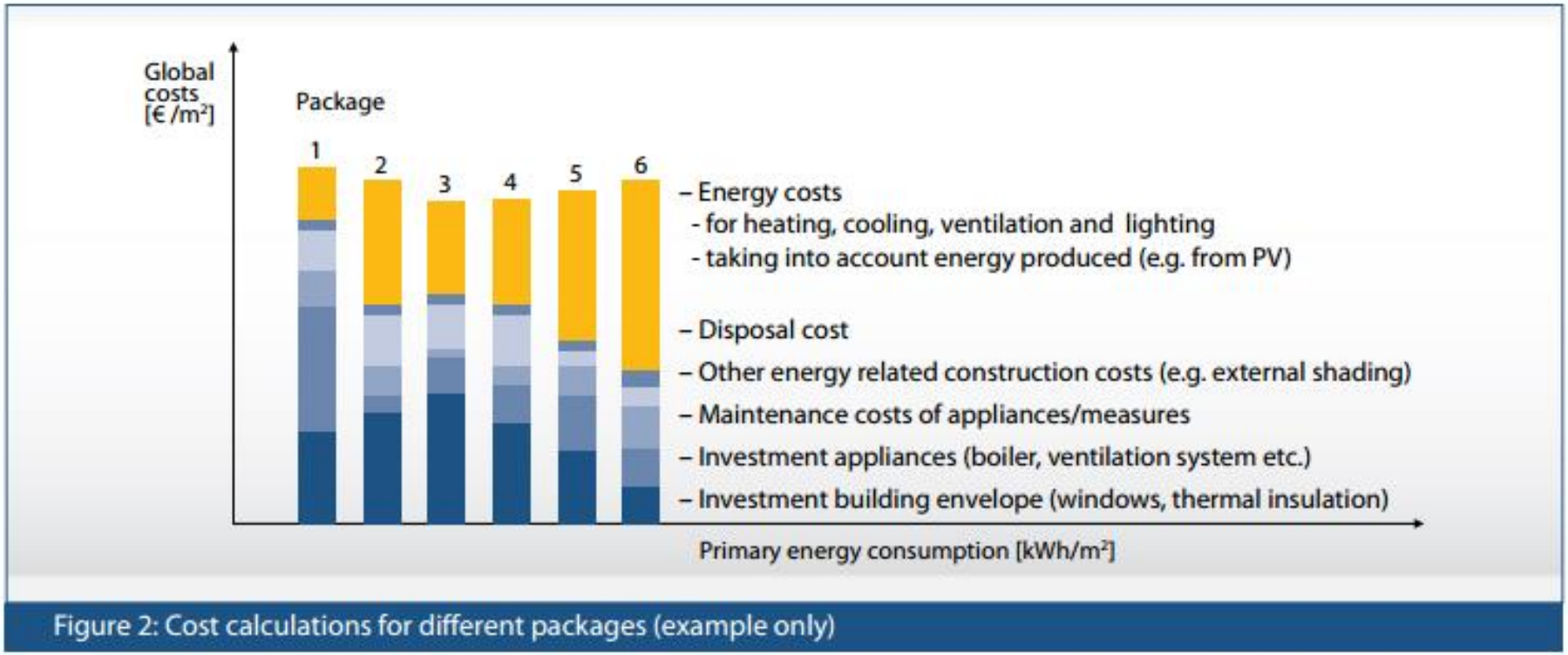
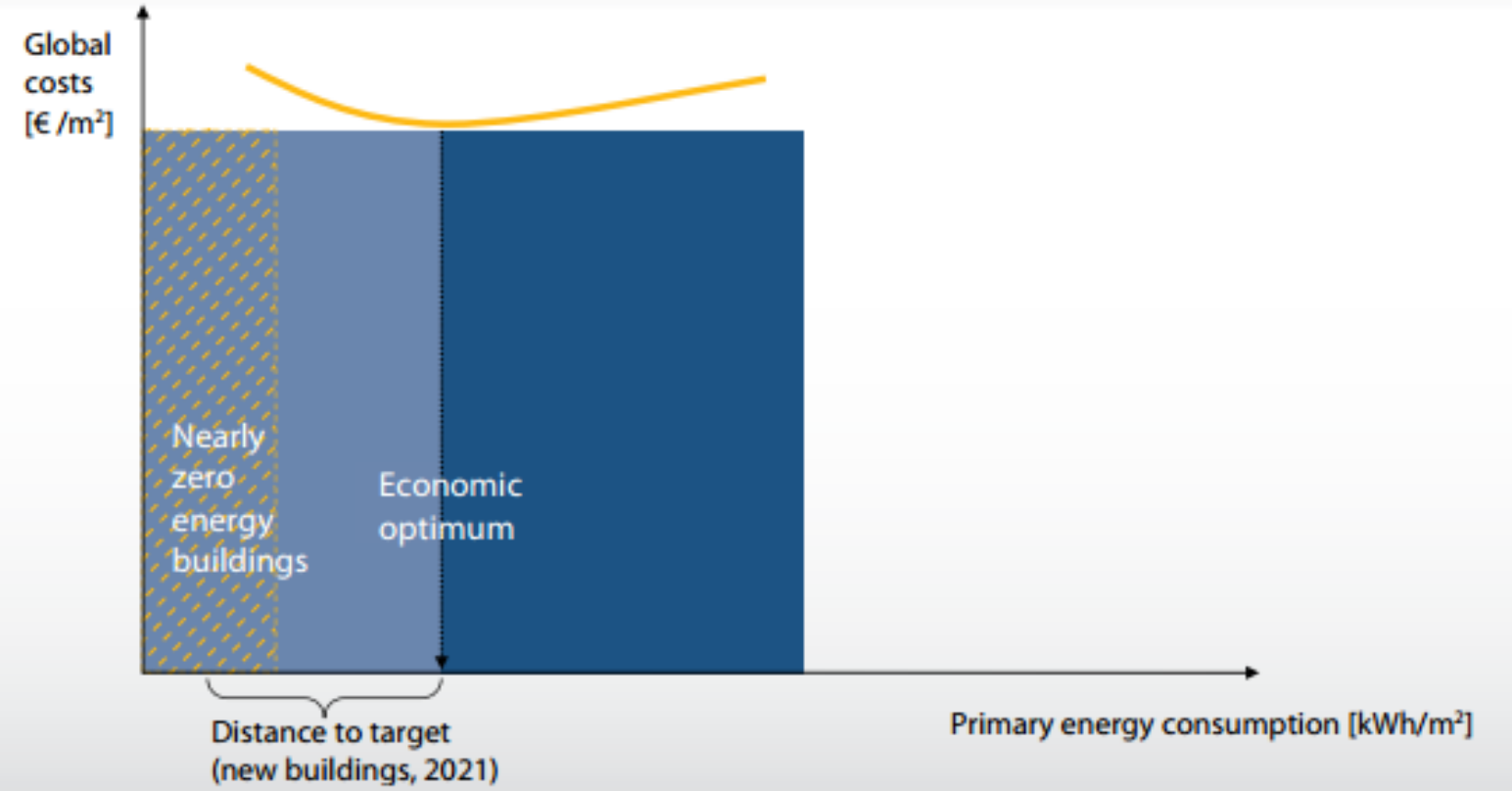



Figure 2: Cost calculations for different packages (example only)

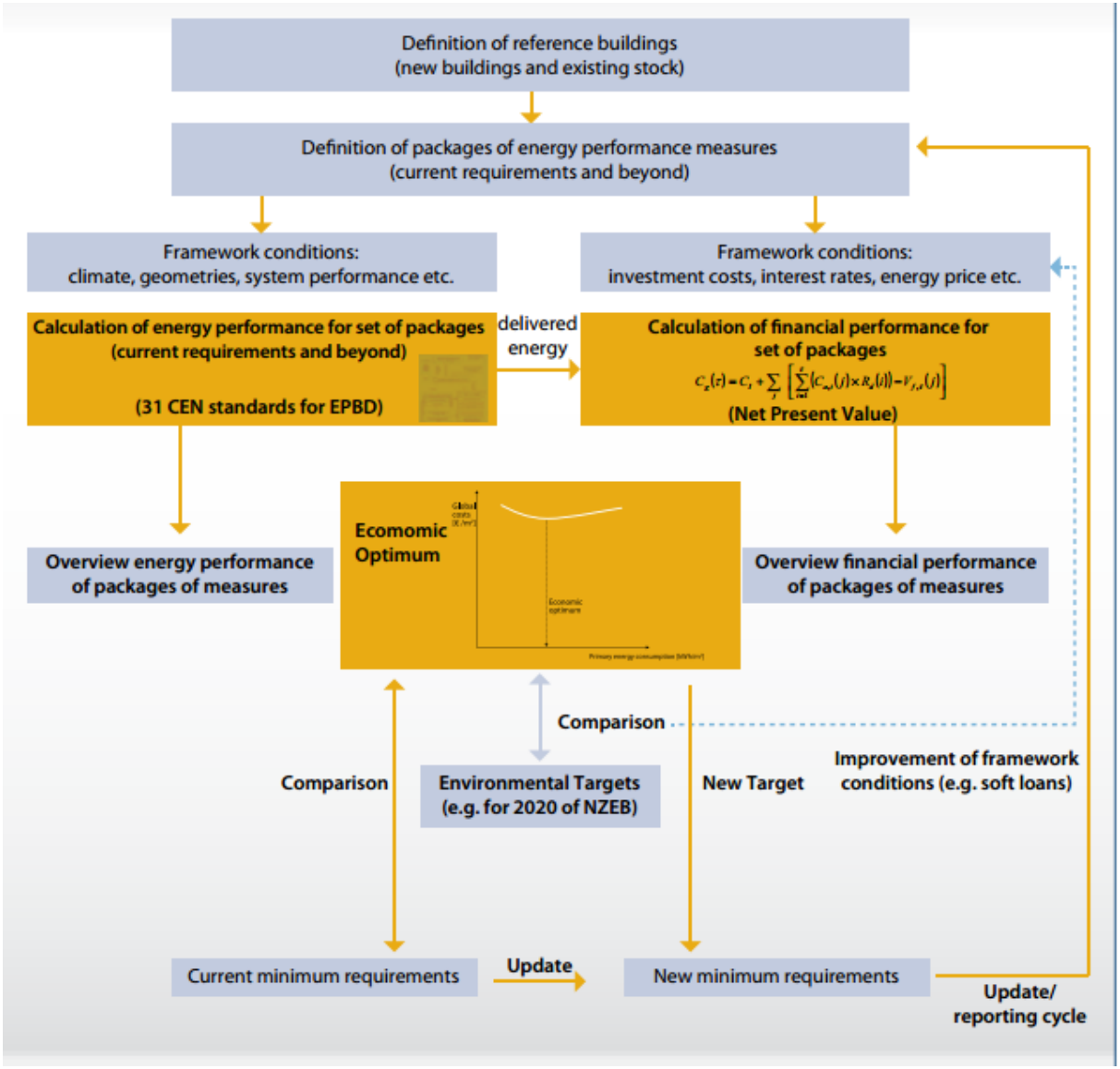
Source: BPIE, Cost optimality, 2010

# Cost optimality: optimal versus NZ




Source: BPIE, 2010

# Comparing existing with optimal




Source: BPIE, 2010

# EPBD: NZEB

- NZEB: almost zero or very low energy requirement that is mainly covered by renewable sources (national definitions)
- All new buildings by 2020 (public by 2018)
- Mandatory national plan and policies to increase the number of NZEB via refurbishment



# EPBD: Certification of buildings

- Compulsory for buildings/flats built, rented out or sold
- Informs buyers and tenant about the energy performance of the unit
- Issues:
  - Content of certificate
  - Process of certification
  - Use of certificate in publicity
  - Role of labelling in applying financial tools
  - Monitoring and data collection
  - Quality assurance

# Main Hungarian documents

- Energy Efficiency Law of 2015
- NEEAP of 2015
- Building strategy of 2014

# Energy use projection and savings target

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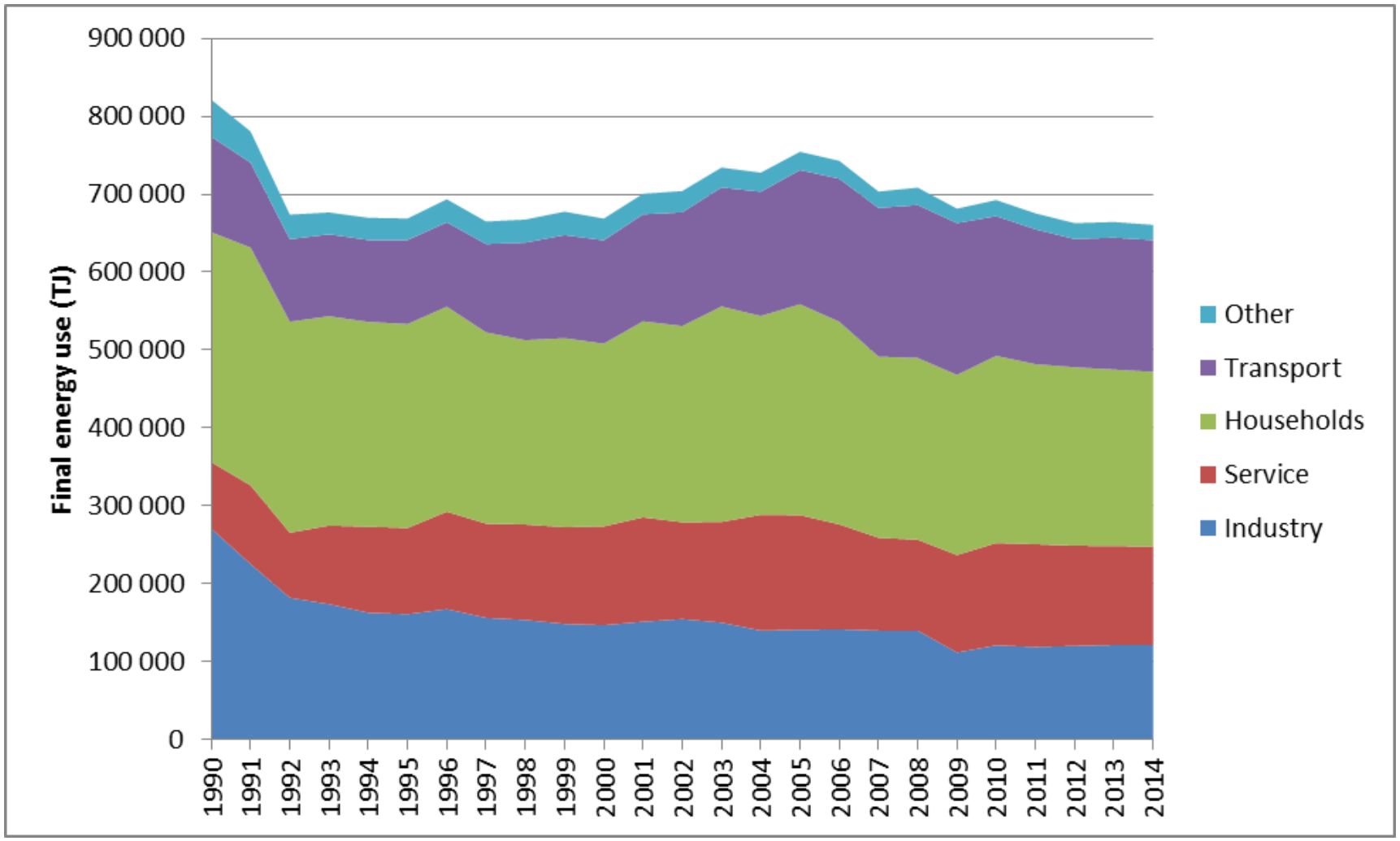
| PJ | 2008 | 2012 | 2020 | | 2030 | |
|---|---|---|---|---|---|---|
| | | | BAU | Policy | BAU | Policy |
| **Primary energy use** | 1120 | 992 | 1101 | 1009 | 1217 | 1028 |
| **Final energy use** | 788 | 677 | 766 | 693 | 840 | 692 |
| Industry | 139 | 96 | 124 | 114 | 139 | 126 |
| Transport | 196 | 157 | 161 | 147 | 173 | 151 |
| Residential | 233 | 215 | 247 | 207 | 284 | 187 |
| Service | 117 | 116 | 126 | 118 | 135 | 121 |
| Agriculture | 22 | 17 | 18 | 17 | 19 | 17 |
| Non-energy use | 81 | 77 | 90 | 90 | 90 | 90 |

| PJ | Savings target (final energy use, 2020) |
|---|---|
| Industry | 10 |
| Transport | 14 |
| Residential | 40 |
| Service, agriculture and public buildings | 9 |
| **Total** | **73** |

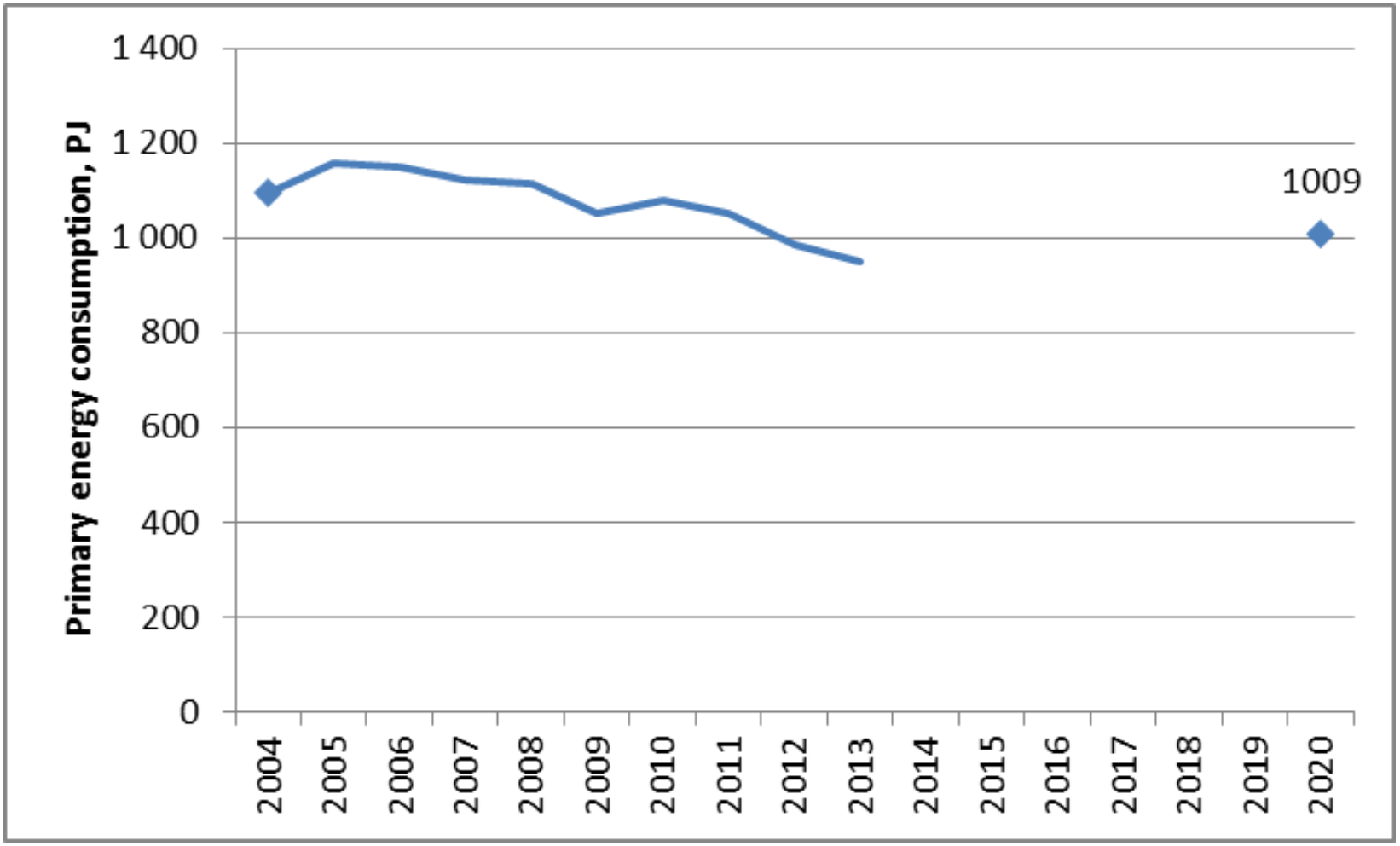
2010 projection based on 2008 data: 1113 PJ

# Final energy use by sectors




Source: Eurostat

# Is it a strong EE target?



# NEEAP Compulsory elements

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1. Introduction
2. Overview of national energy efficiency targets and savings
2.1. National 2020 energy efficiency targets
2.2. Additional energy efficiency targets
2.3. Primary energy savings
2.4. Final energy savings
3. Policy measures implementing EED
3.1. Horizontal measures
3.1.1. Energy efficiency obligation schemes and alternative policy measures (EED Article 7, Annex XIV, Part 2 3.2)
3.1.2. Energy audits and management systems (EED Article 8)
3.1.3. Metering and billing (EED Articles 9-11)
3.1.4. Consumer information programmes and training (EED Articles 12 and 17)

# NEEAP Compulsory elements cont.

3.1.5. Availability of qualification, accreditation and certification schemes (EED Article 16)

3.1.6. Energy Services (EED Article 18)

3.1.7. Other energy efficiency measures of a horizontal nature (EED Articles 19 and 20)

3.2. Energy efficiency in buildings

3.2.1. Building renovation strategy (EED Article 4)

3.2.2. Other energy efficiency in buildings sector

3.3. Energy efficiency in public bodies

3.3.1. Central government buildings (EED Article 5)

3.3.2. Buildings of other public bodies (EED Article 5)

3.3.3. Purchasing by public bodies (EED Article 6)

# NEEAP Compulsory elements cont.

3.4. Other end use energy efficiency measures including in industry and transport

3.5. Promotion of efficient heating and cooling

3.5.1. Comprehensive assessment (EED Article 14)

3.5.2. Other measures efficient heating and cooling (EED Article 14)

3.6. Energy transformation, transmission, distribution, and demand response

3.6.1. Energy efficiency criteria in network tariffs and regulation (EED Article 15)

3.6.2. Facilitate and promote demand response (EED Article 15)

3.6.3. Energy efficiency in network design and regulation (EED Article 15)

# Hungarian energy efficiency policy: Law on EE (57/2015) and NEEAP (2015)

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- Transposition/implementation of EED, including the listing of further implementing legislation and the responsible public institutions (ministry, energy office: HEPURA)
- HEPURA is responsible for the collection and aggregation of energy savings data
- Art 7: full use of flexibilities and no EEOS but a financial package that would provide support for the energy savings actions of households and companies:
  - energy audit mentor service: consultancy to prepare the energy audit of companies and to develop cost efficient energy savings interventions,
  - “green loan” program and/or other financial tools to finance residential energy efficiency actions, and
  - preferential loans for the energy companies serving households to support their ESCO activities.

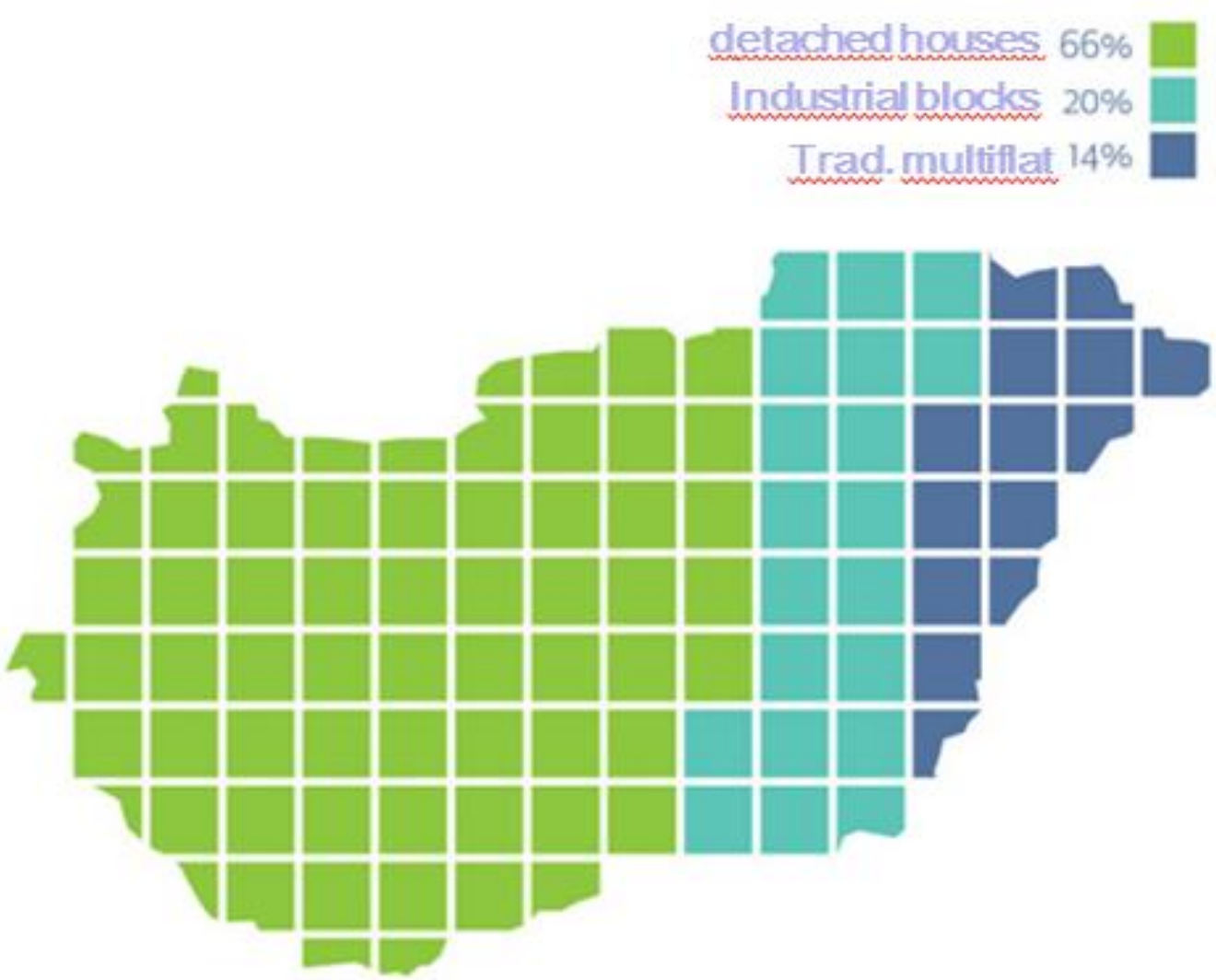
# CHP

- Potential estimation and policy development for CHP and district heating to be developed by HEPURA (by the end of 2015)
- The cost benefit methodology is to be developed by the HEPURA (under development)
- HEPURA can provide exemption both from the CBA analysis and the compulsory combined heat production (based on general justification but mandatory reporting to the European Commission)

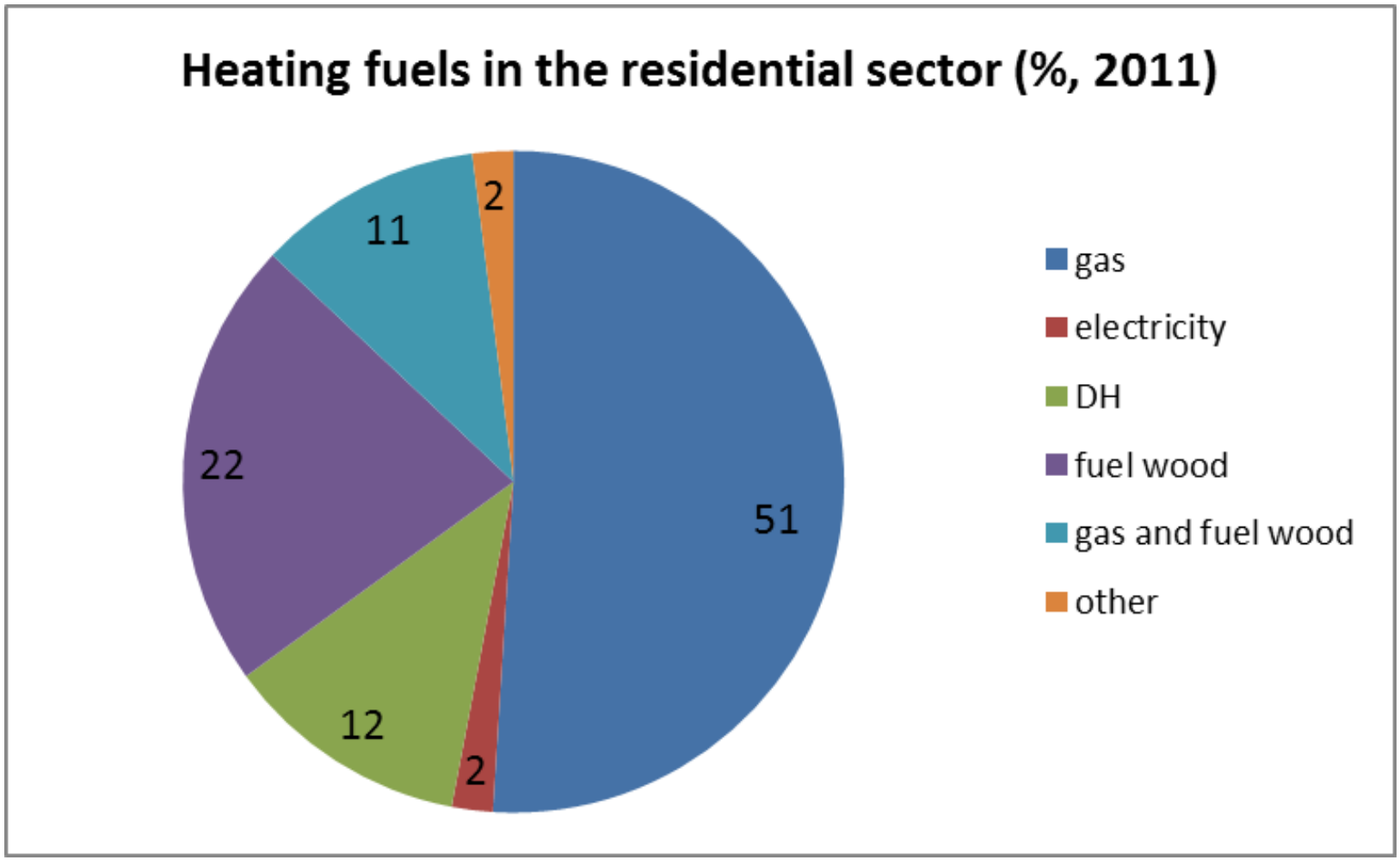
# Audit

- SMEs
  - Dominant company form in Hungary: 690 000
  - No support included in the Operational Programs (for EU funds)!
- Large companies
  - More than 250 employee and 50 mEUR turnover: 865 (below 2000 considering partner and connected enterprises)
  - Companies using EN ISO 50001 are exempt  from a compulsory audit
- Registry of auditors (HEPURA):
  - Engineering education and practice
  - Successful exam at an authorised professional organisations
  - Regulated mandatory data provision

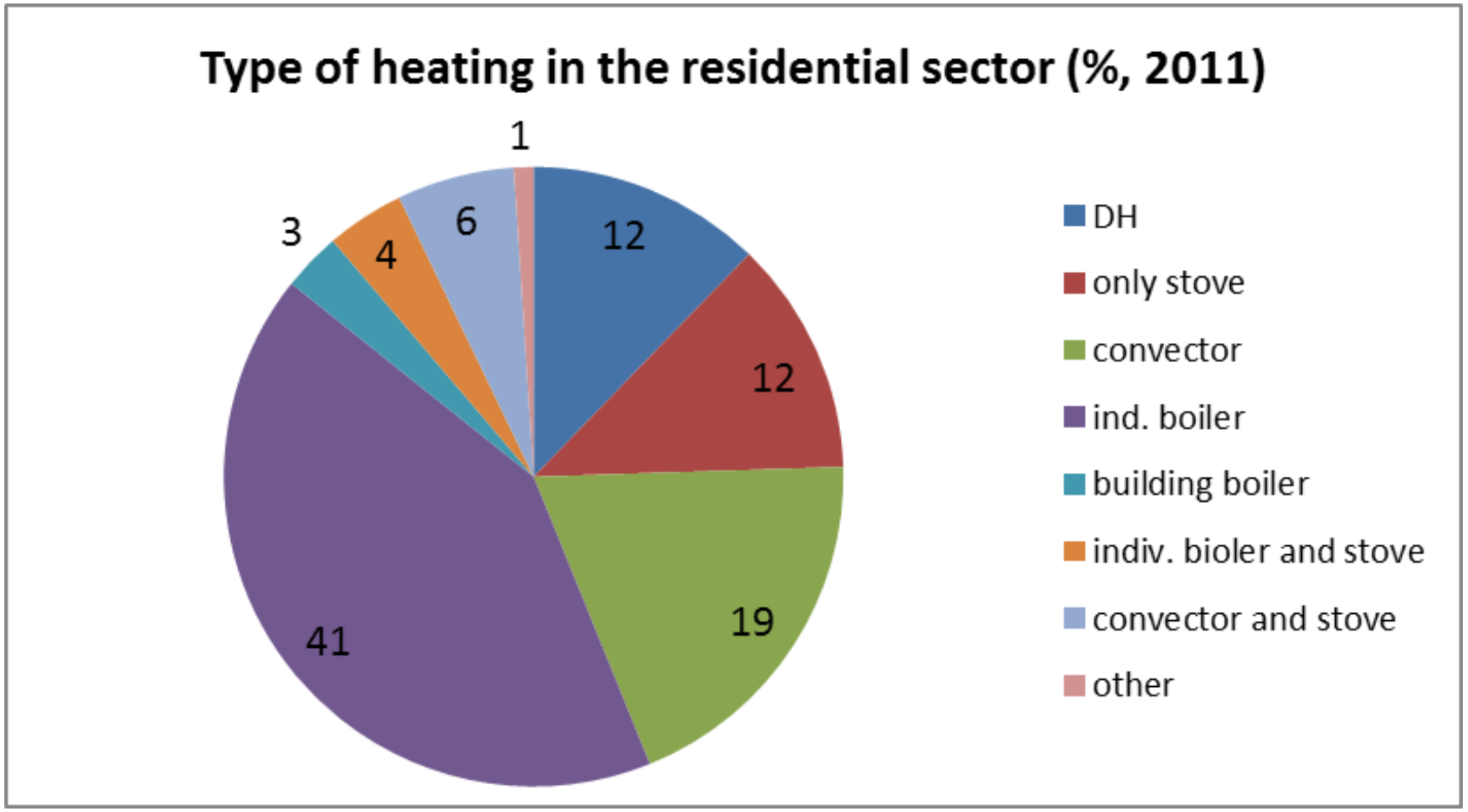
# Buildings in Hungary



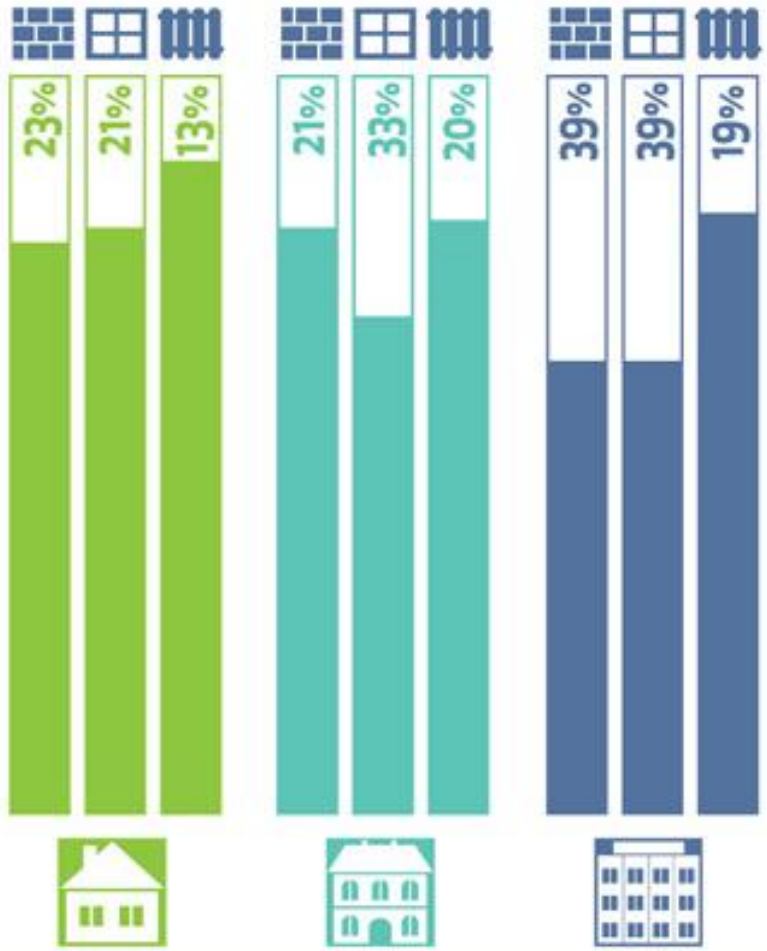
# Buildings in Hungary



# Buildings in Hungary



# Estimation of already executed refurbishment




insulation

windows

heating system

# Exemplary role of public sector

- Renovation of 3% of central government buildings annually (Art 5 of EED):
  - Minimum cost optimal level but Hungary targets NZEB level (with renewable) with EU funding (close to100% support intensity!)
  - 66 buildings altogether (many monumental so only some elements can be renovated)
- Green public procurement: energy efficiency needs to be considered only if it is „cost efficient, economically viable, sustainable, technically feasible and compatible with competition” – weak language

# Building Stategy: based on modelling

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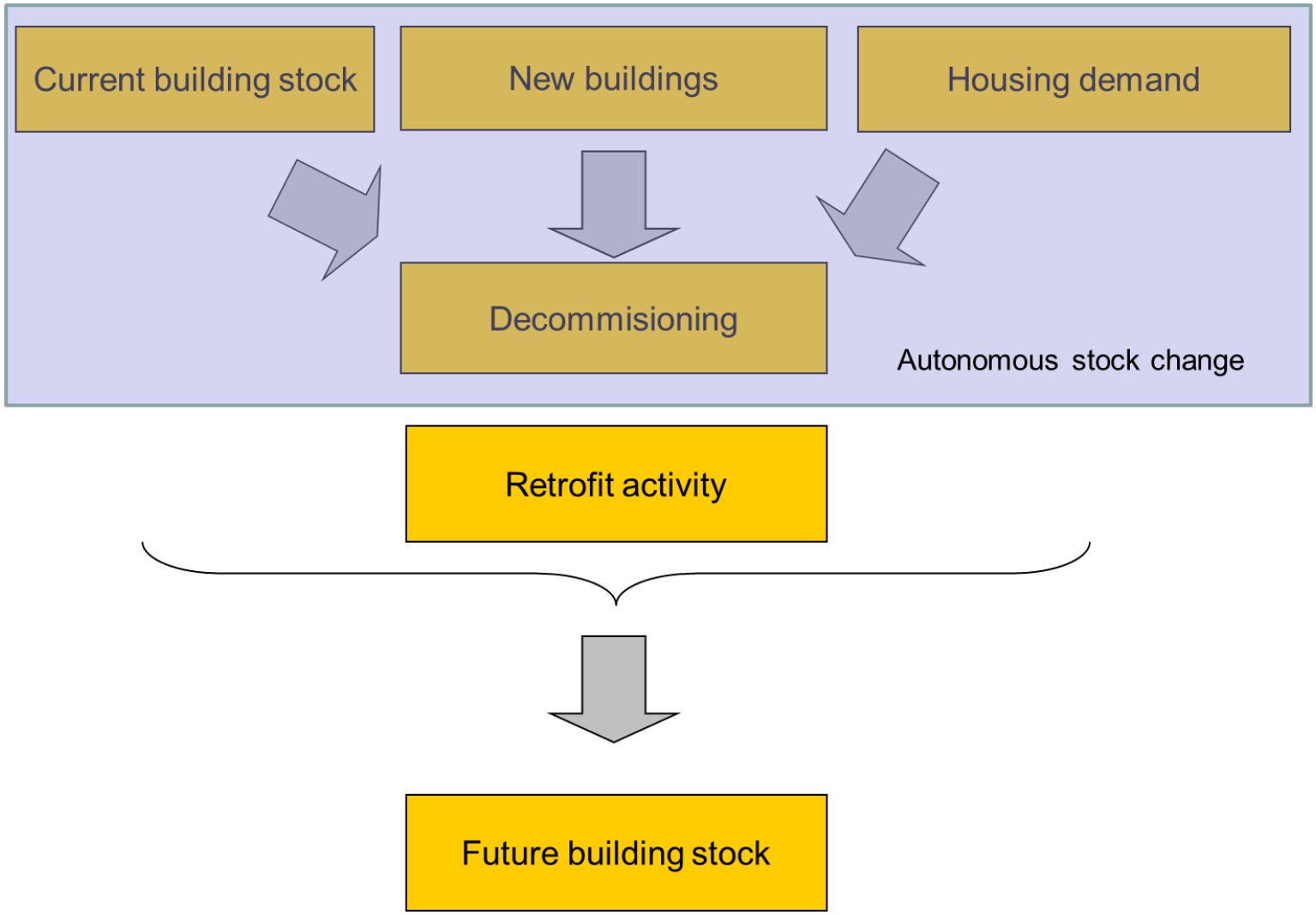
- Bottom-up approach built on the identification of building types that can represent adequately the national stock (residential flats and public buildings only!)
- Building types are defined along several characteristics such as their vintage, construction material, the type of building (single flat, block etc.)
- Building typology is projected to the whole building stock (need for calibration!)
- Retrofit levels, the corresponding technology packages and costs are defined
- Scenario analysis based on various assumptions related to the retrofit levels, timing of retrofits of each type and the autonomous stock change (new and decommissioned buildings)

# Basic characteristics

- building stock model that ranks the refurbishment options (type of building, retrofit deepness) on the basis of the unit cost of energy saving
- Calculation based on m2 (not number of flats) and kWh/$m^2$/annum
- the resulting aggregate cost of a modernisation program means the minimum amount that is required for reaching the predefined aggregate energy saving goal
- certain input parameters can be changed to provide some insight to the policy options available to the decision makers (e.g. future rate of new buildings or $m^2$ per inhabitant)

# Building stock model (residential buildings)



# Data requirement

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- Aggregate m2 of residential floor area
- Sub-aggregates of total m2 along with the dimensions of the typology (e.g. detached versus block building, vintage, typical wall material etc.)
- Share of uninhabited and not heated floor area
- Share and deepness of already implemented energy refurbishment (for each type)
- Energy statistics related to the energy use of residential buildings (by fuel type) for model calibration
- New building activity rate

# Flat typology

| | Type | Vintage |
|---|---|---|
| 1 | detached house_small | -1944 |
| 2 | detached house_big | -1944 |
| 3 | detached house_small | 1945-1979 |
| 4 | detached house_big | 1945-1979 |
| 5 | detached house | 1980-1989 |
| 6 | detached house | 1990-2001 |
| 7 | semi-detached | 2001- |
| 8 | block house (4-9 flats) | -2001 |
| 9 | block house (4-9 flats) | 2001- |
| 10 | block house (10+ flats) | -1944 |
| 11 | block house (10+ flats) | 1945-2001 |
| 12 | block house (10+ flats; concrete) | 1944-2011 |
| 13 | industrial block house (10+ flats) | -1979 |
| 14 | industrial block house (10+ flats) | 1980-2001 |
| 15 | block house (10+ flats) | 2011- |
| 16 | new detached house (1-3 flats) | 2013-2015 |
| 17 | new detached house (1-3 flats) | 2015-2021 |
| 18 | new detached house (1-3 flats) | 2021- |
| 19 | new detached house (4+ flats) | 2013-2015 |
| 20 | new detached house (4+ flats) | 2015-2021 |
| 21 | new detached house (4+ flats) | 2021- |

- 2 types of new flats
- Different level of minimum energy performance requirement according to vintage

# Retrofit packages

| | Primary energy use, kWh/m2/annum | | | |
|---|---|---|---|---|
| Type | before retrofit | current requirement | 2015 requirement | NZEB |
| 1 | 551 | 230 | 140 | 100 |
| 2 | 408 | 217 | 128 | 100 |
| 3 | 517 | 221 | 139 | 100 |
| 4 | 405 | 178 | 135 | 100 |
| 5 | 336 | 167 | 109 | 86 |
| 6 | 227 | 174 | 114 | 92 |
| 7 | 173 | 173 | 123 | 91 |
| 8 | 312 | 125 | 111 | 92 |
| 9 | 125 | 125 | 99 | 82 |
| 10 | 344 | 134 | 99 | 95 |
| 11 | 299 | 103 | 95 | 67 |
| 12 | 244 | 106 | 85 | 78 |
| 13 | 218 | 94 | 84 | 74 |
| 14 | 200 | 89 | 80 | 77 |
| 15 | 100 | 100 | 80 | 72 |

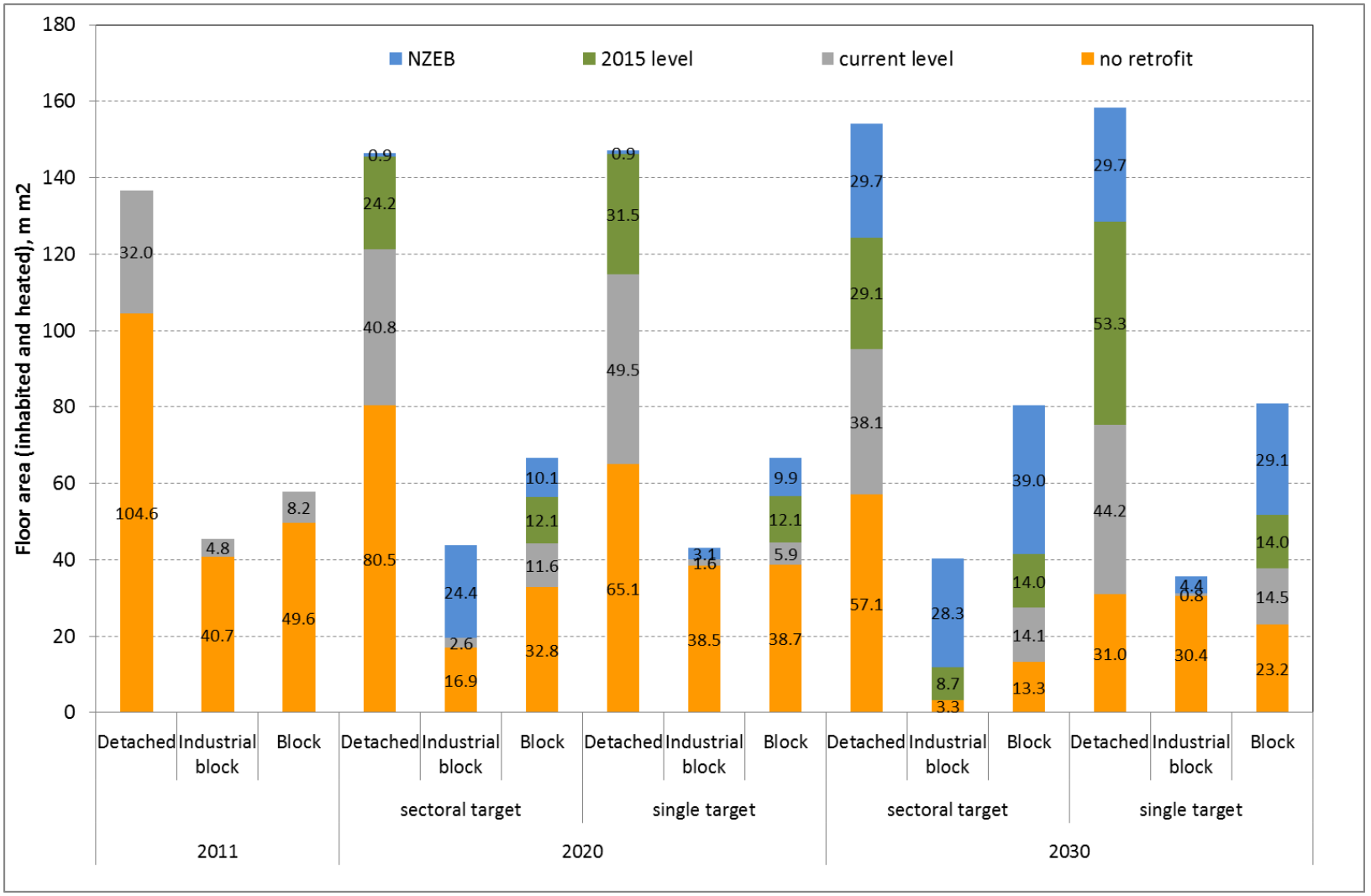
- Unit cost (HUF/m2) is assigned to each building type and retrofit level based on market information

# Scenarios

| Scenario | Energy savings target , PJ | | single versus sectoral target |
|---|---|---|---|
| | 2020 | 2030 | |
| 1 | 38.8 | 80 | sectoral |
| 2 | 38.8 | 80 | single |
| 3 | 38.8 | 104 | sectoral |
| 4 | 38.8 | 104 | single |
| 5 | 38.8 | 80 | sectoral |
| 6 | 38.8 | 80 | single |
| 7 | 0 | 80 | sectoral |
| 8 | 0 | 80 | single |

- Single target: retrofit sequence is based on unit cost
- Sectoral target: predefined for detached houses, block house and industrial block
- Different 2030 ambition: 80 vs 104 PJ
- 7-8: delayed retrofit action (no action until 2020)

# Results (Scenario 1-2)



# Results

| bn HUF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 2013-2020 | 1160 | 1104 | 1160 | 1104 | 1083 | 1010 | 15 | 1 |
| Difference | 56 | | 56 | | 73 | | 14 | |
| 2013-2030 | 2122 | 2109 | 3506 | 3170 | 2012 | 1991 | 2091 | 1986 |
| Difference | 13 | | 336 | | 21 | | 106 | |

- Sectoral targets deviate from cost efficiency in all scenario pairs and time horizon
- Higher ambition (Scenario 3-4) means higher efficiency loss
- The predefined sectoral targets prefer industrial houses and the larger and cheaper potential in detached houses in not used

# HUNGARIAN EXPERIENCE IN BUILDING ENERGY EFFICIENCY SOCIETY AND BUSINESS: POLICY INSTRUMENTS

# Role of policy instruments

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- Basic problem: often even economically viable energy savings investment are not implemented (market failure)
  - Financial/liquidity barriers
  - Lack of information: e.g. what elements of the building needs renovation?
  - Split incentives: landlord versus tenant
  - Implementation and technological risk: e.g. will the investment bring the expected savings?
  - Social trends: e.g. 4 cm insulation + air conditioning

# Policy measures types

| | |
|---|---|
| Administrative | norms, limit values |
| Economic | Fiscal measures (refundable and non-refundable) |
| | Taxes (concessions or energy/CO2 tax) |
| | Obligation Schemes/white certificate |
| | Tenders |
| | ESCOs |
| Informational | Labelling, training and educational activities |
| Voluntary agreements | |

# Energy performance requirements of buildings

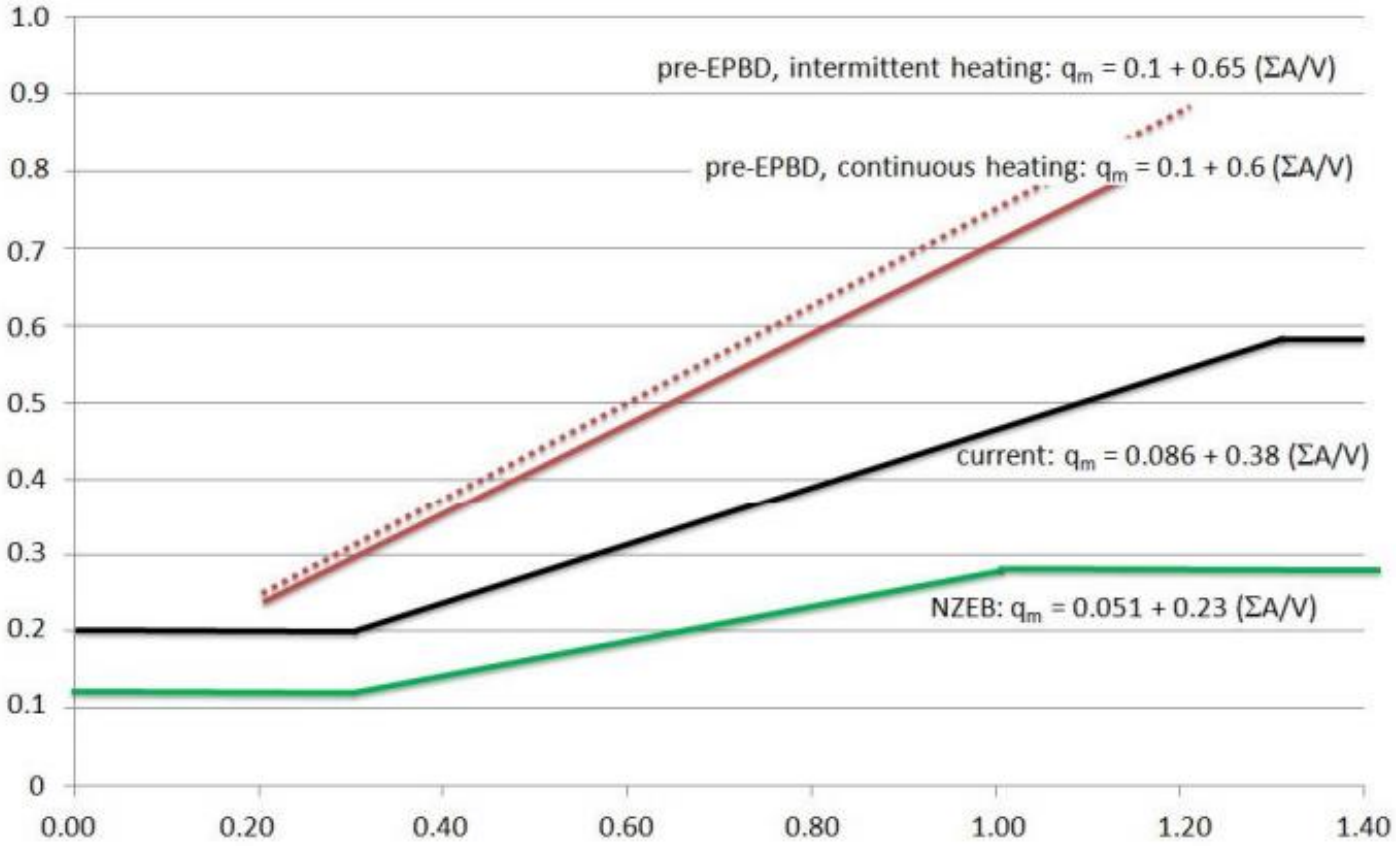
- Defined in 176/2008. gov. order amended by 40/2012 min. decree
- Applies to:
  - New buildings and major renovation (25% of the surface of the building is retrofitted) above 1000 $m^2$ buildings and from 2013 any public building renovation (over 1000 $m^2$)
- Three types of requirements:
  - U value of building elements
  - Specific heating energy need ($W/m^3.K$)
  - Annual primary energy need ($kWh/m^2/year$) including:
    - Heating
    - Domestic hot water
    - Cooling
    - Lighting (in case of non-residential buildings)

# U value evolution

| U values (W/m2K) | -2006 | 2006-2018 | 2018- |
|---|---|---|---|
| | pre-EPBD | | cost optimal |
| exposed wall | 0.7 | 0.45 | 0.24 |
| flat roof | 0.5 | 0.25 | 0.17 |
| attic floor slab | | 0.3 | 0.17 |
| floor slab over basement | | 0.5 | 0.3 |
| window | 2.8 | 1.6 | 1.15 |

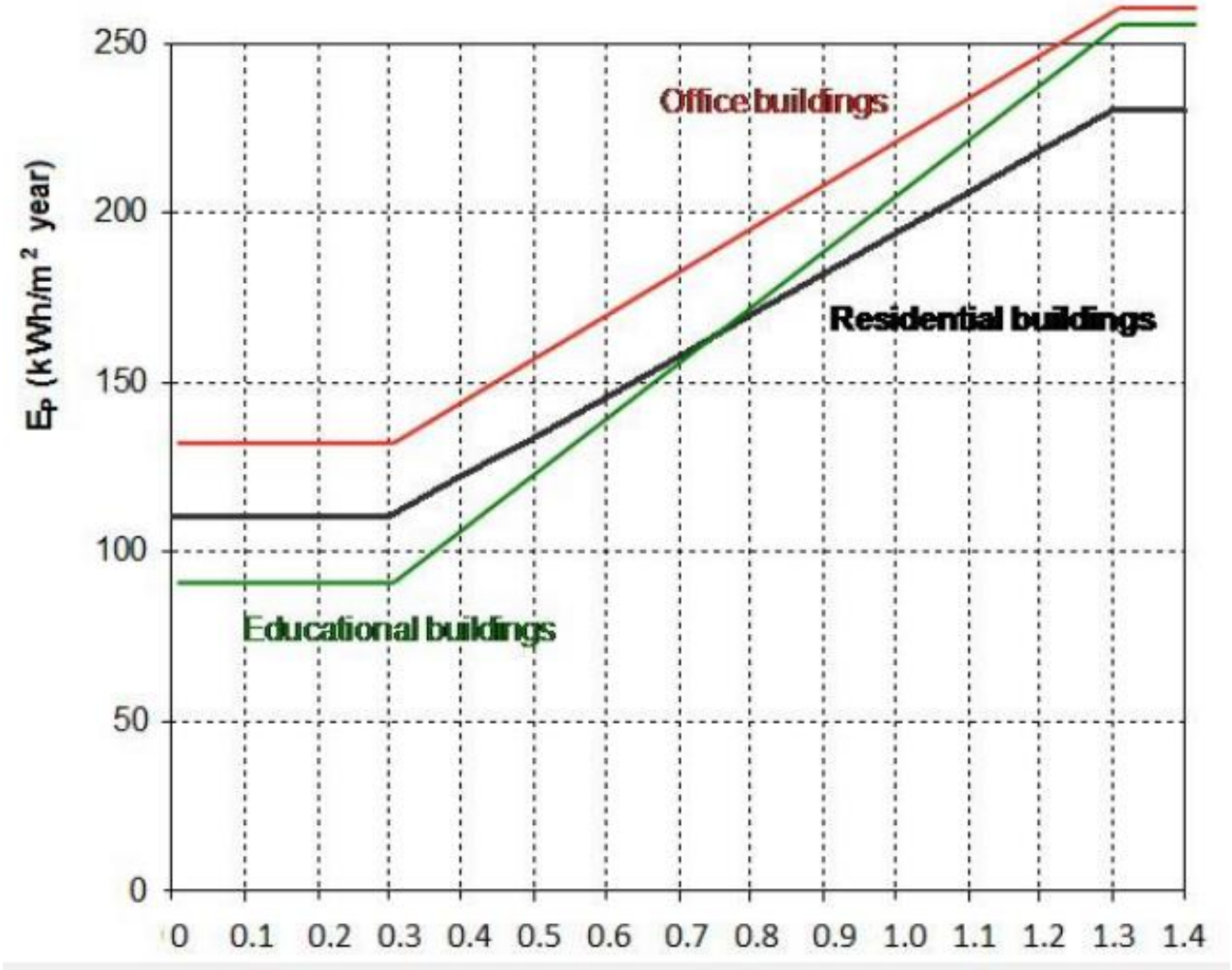
- In case public support is involved in the renovation, the cost optimal values needs to be adhered from 2015 already.
- The application of renewables are generally not cost optimal (except solar collectors and PV at schools).

# Specific heat loss coefficient (W/m³.K)




Compliance with U value for elements does not automatically translates into compliance with specific heating energy need requirement (ratio of walls/windows, thermal bridges).

# Yearly primary energy need – current requirement



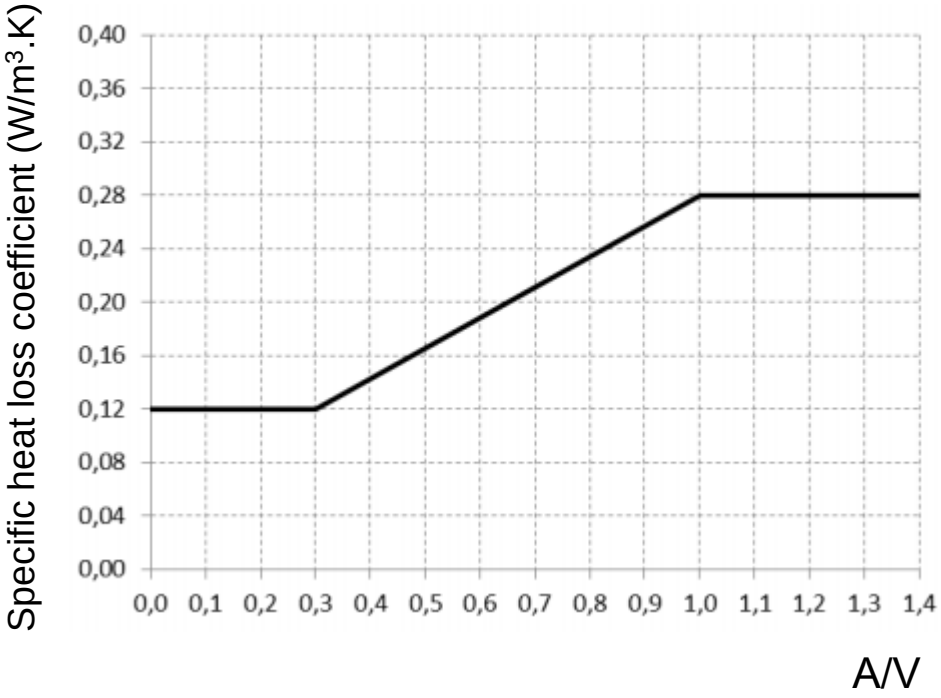
# Building strategy

- Cost optimal level needs to achieved from 2015 when public support is used (new and renovated), otherwise from 2018
- Public buildings:
  - Registry of public buildings: energy and building data
- Financial support from EU funds
- Energy savings targets:

| | 2020 energy savings target (PJ) | Number of refurbished flats by 2020 (thousand) | Estimated total investment cost by 2020 (bn HUF) |
|---|---|---|---|
| Detached houses | 17.6 | 130 | 743 |
| *Block houses built with industrial technology* | 12.8 | 380 | 536 |
| Traditional multi-flat houses | 8 | 190 | 329 |
| *Residential subtotal* | *38.4* | *700* | *1608* |
| Public buildings | 1.6 | 2.4 | 152 |
| Service sector buildings | 4 | | |
| Other building related savings | 5 | | |
| **Total** | **49** | | |

# NZEB in Hungary

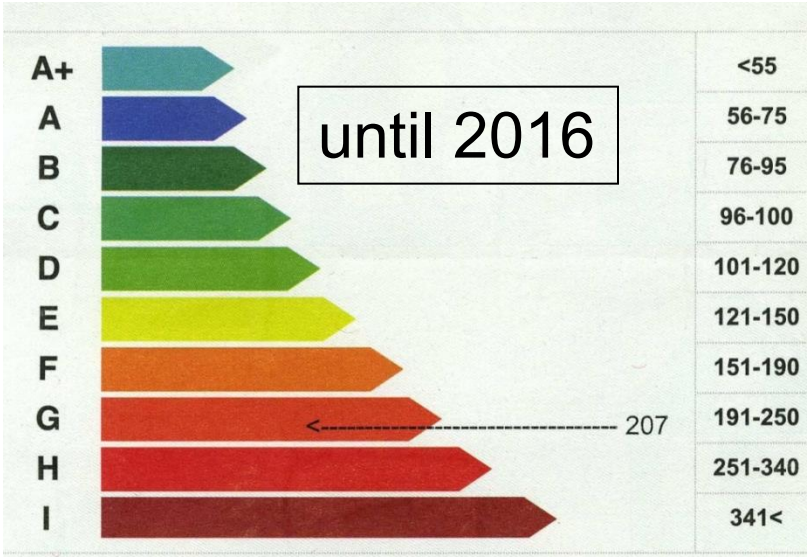
- Annual primary energy need cap:
  - Flats: 100 kWh/m2/annum
  - Office and commercial building under 1000m2: 90 kWh/m2/annum
  - Educational buildings: 85 kWh/m2/annum




At least 25 % of the energy demand shall be supplied by renewable energy generated within the building or on or near the property!!

# Building certification in Hungary

- Compulsory for all buildings/flat in case of rental or sale and valid for 10 years
- Minimum size:
  - 50 $m^2$ for private buildings/flats
  - 250 $m^2$ for public buildings



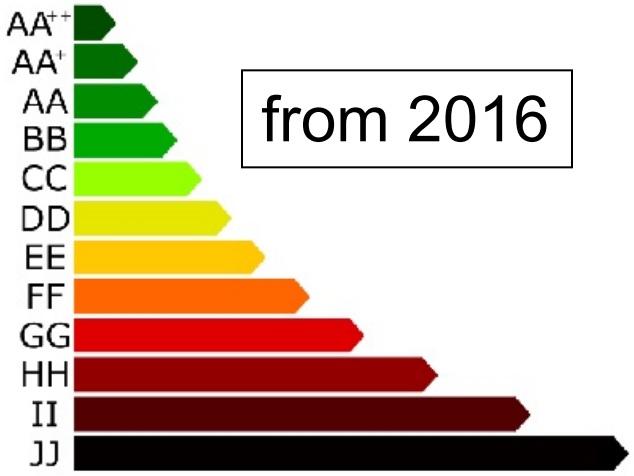

Scheme until 2016:

- certification could be based on bills as well (not only calculation or measurement): quality problem!
- Labelling according to the % compared to the reference building (category C: value depending on A/V: 110-230kWh/m2/year)

# New labelling scheme

- New A categories to accommodate NZEB
- A flat in a multiflat building can only get BB is the building already has BB rate
- Labelling compared to a fix value of 100 kWh/m2/year (category BB)
- AA category requirements:
  - Heating is outer temperature driven
  - Heating/cooling is adjustable at room level
  - Part of the building owned/rented by different actors are equipped with individual meters or cost allocators

- Same building (210 kWh/m2/year) until now received C, from 2016 FF label.
- New building is generally 110-130 kWh/m2/year: CC




from 2016

# District heating labelling

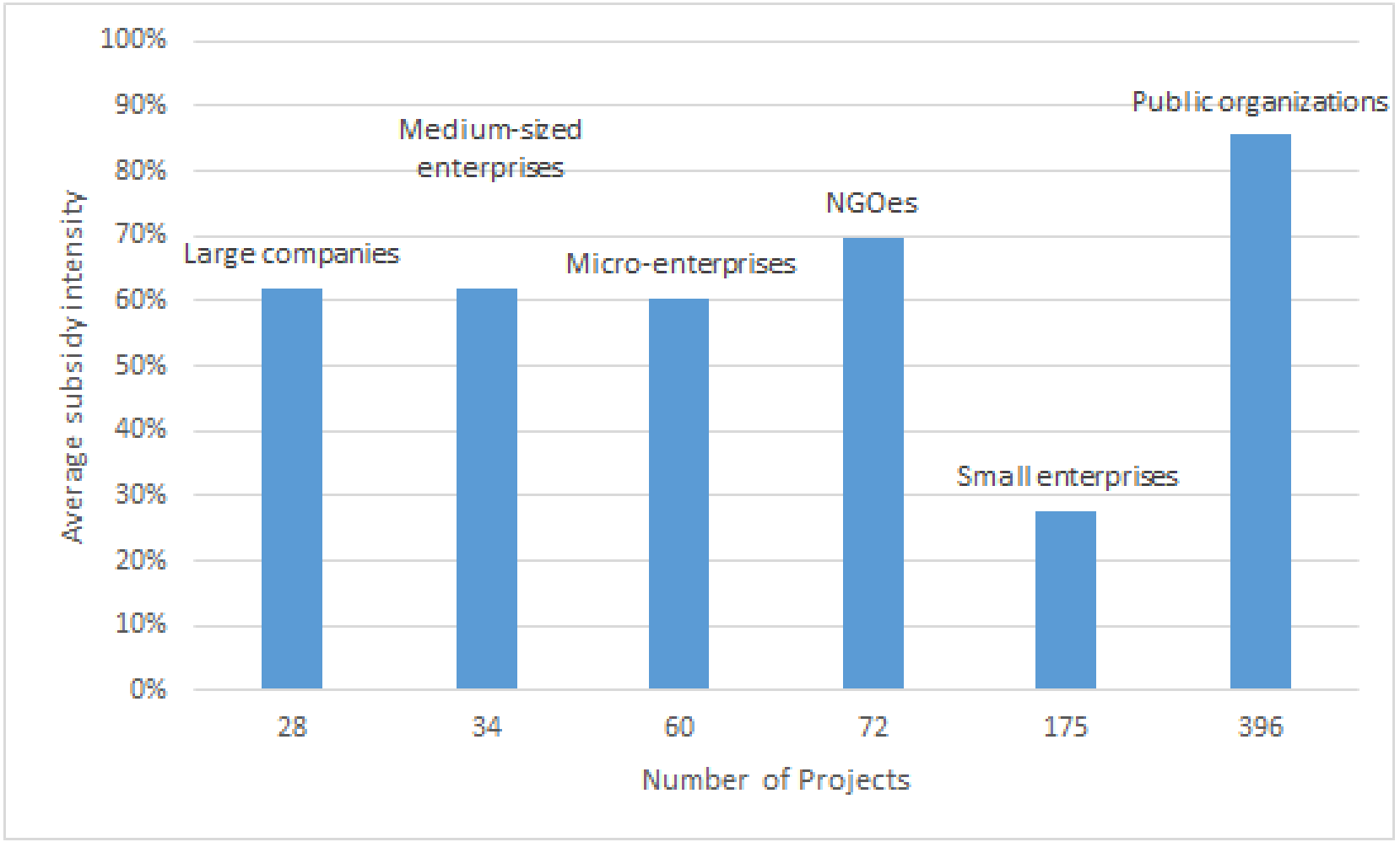
- New initiative of the Association of DH companies
- Includes info on:
  - Energy efficiency of the system
  - Share of renewables
  - CO2 emissions

# FINANCIAL SUPPORT FOR ENERGY EFFICIENCY

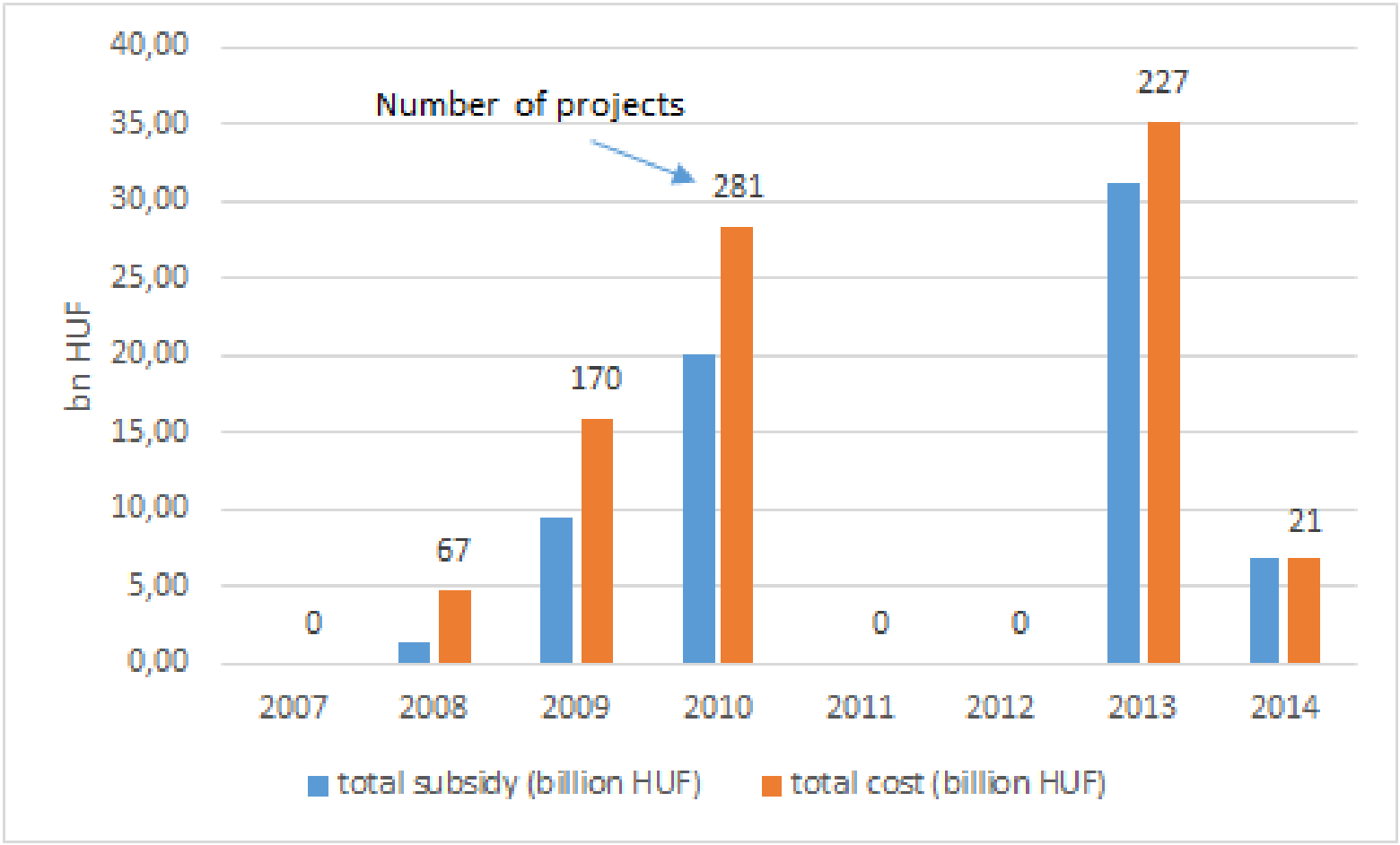
# Major sources of funding

- EU funds:
  - Dispersed according to Operation Programs
  - 2007-2013 and 2013-2020 funding periods
  - Targeting legal persons only (companies, public organisation, churces, NGOs BUT NOT households)
  - In 2007-2013 administered by a separate institution (National Development Agency) – now by ministries according to their portfolio
  - Energy efficiency and renewable energy investments often appear jointly in the calls
- AAU sales
- EUA sales

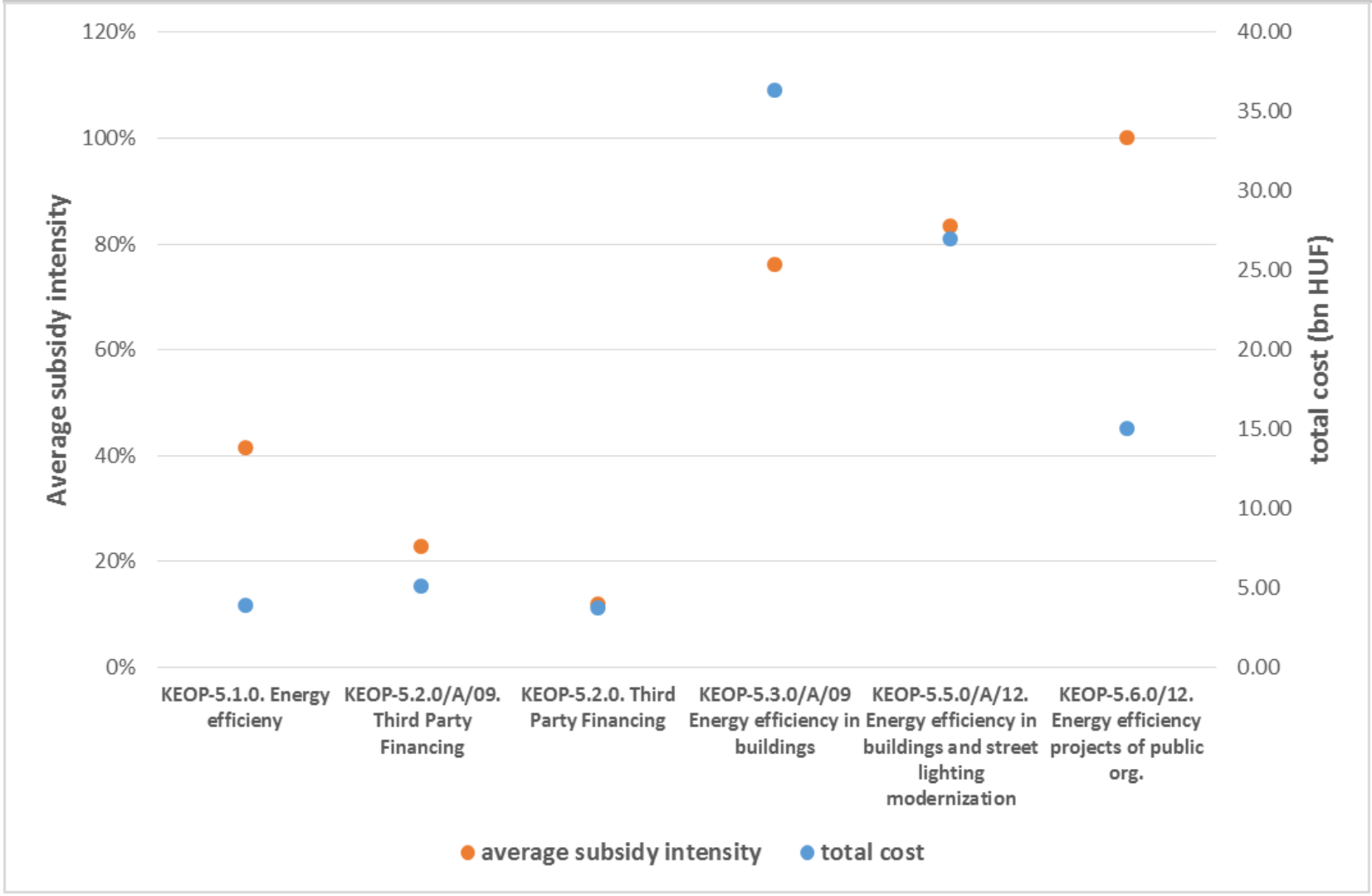
# Use of EU funds: 2007-2013 period



# Use of EU funds: 2007-2013 period



# Use of EU funds: 2007-2013 period



# Planned use of EU funds: 2013-2020 period

| | Priority | Action | Target group | Budget (mEUR) | type |
|---|---|---|---|---|---|
| KEHOP | 5: EE and RES | 5.1: RES-E for grid | companies | 78.64 | Non-ref |
| | | 5.2: EE and RES in buildings | public sector, churches, LGs | 761.99 | Non-ref |
| | | 5.3: district heating | DH companies (producers and providers) | 147.53 | Non-ref |
| | | 5.4: Educational campaigns | schools, NGOs, LGs, churches | 6.61 | Non-ref |
| TOP | 3: low carbon development in cities | EE and RES in local governments | LGs | 431.21 | Non-ref |
| | 5:Development of county level cities | EE and RES in local governments | large LGs | 201.39 | Non-ref |
| VEKOP | 5: RES and EE | RES and EE for companies | companies in the Central Region | 37.91 | Non-ref |
| | | accompanying financial tools | financial institutions | 37.91 | Ref |
| GINOP | 4: energy | RES and EE for companies | SMEs | 225.55 | Non-ref |
| | 8: Financial tools | accompanying financial tools | financial institutions | 141.65 | Ref |
| | | accompanying financial tools (KEHOP) | financial institutions | 425.53 | Ref |
| **Total** | | | | **2495.92** | |

# Support for natural persons/households

- Funding source: AAU and EAU sales
  - AAU: Kyoto GHG quota – excess can be sold by the state to other countries
  - EUA: EU ETS CO2 quota – EU level auctioning revenue is distributed among the Member States
- Green Investment Scheme (GIS) of Hungary:
  - Revenue  from AAUs must be used for GHG mitigation or adaptation
  - Use of fund needs to be reported to the buyer of AAUs
  - Closed in 2014
- Green Economy Financing Scheme from 2014
  - Financed from EUA revenues

# Major GIS support programs

REKK Regional Centre for Energy Policy Research

| Name | Opening | Notes | Number of flats/items involved | Notes |
|---|---|---|---|---|
| Climate friendly home - panel buildings II | 2009 | window replacement, wall insulation | 46000 | |
| Climate friendly home - traditional buildings | 2009 | complex refurbishment and new buildings | 15000 | |
| Household machine replacements | 2010 | support households in special needs | 195 | |
| Lightbulb replecement | 2010 | support households in special needs | 238 | |
| Our home | 2011 | complex refurbishment and new buildings | 439 | |
| Solar collector program | 2011 | | 1400 | |
| Window/door replacement | 2014 | | 2000 application | minimum cost optimal U value |
| Household machine replacements | 2014 | support households in special needs | 25000 planned | minimum 10% energy savings |
| Boiler replacement | 2014 | | 900 planned | condensing boilers |

# Climate Friendly Home Energy Efficiency Sub-Program

- Eligibility:
  - Residential buildings built with conventional technology, improved by at least one energy category compared to its original state as a result of the investment
  - new buildings with an energy category of minimum A+, with a maximum 130 $m^2$ of net useful floor area
- Ex post funding: support payments effectuated after the investment is completed.
- 2 363 applications received, 1 224 were accepted and 858 executed
- The total GIS support awarded: 4.81 million EUR

# Climate Friendly Home Energy Efficiency Sub-Program

- For refurbishment investments grant consists of a cost-proportionate basic grant and an efficiency-related Climate Bonus funding:
- basic grant: 30% with a max. 2 055 to 5 444 EUR, depending on the type of investment
- Climate Bonus: 10% - 30%, depending on the energy category reached (B, A, or A+) with a max 740 to 12 000 EUR)
- Planned energy saving (of approved applications): 52 417 GJ/year (14 560 000 kWh/year)
- Average cost: 88,59 HUF/kWh saved (0.328 EUR/kWh saved)

# Programs supported from EUA revenue

| Name | Opening | Notes | Number of flats/items involved | Notes |
|---|---|---|---|---|
| Climate friendly home - panel buildings I | 2008 | window replacement, wall insulation | 36000 | |
| Individual heat metering | 2009 | heat meters and cost allocators | 110000 | average savings is 15% |
| The Warmth of Home - multiapartman buildings | 2015 | complex refurbishment | n/a (ongoing) | 4-60 flats |

# The Warmth of Home - multiapartman buildings

REKK Regional Centre for Energy Policy Research

- Individual metering is a prerequisite
- Support is given per saved kgCO2/year:
  - 750 HUF for window replacement+insulation (DH)
  - 950 HUF for RES utilisation (DH)
  - 850 HUF for refurbishment of individually heated flats
- Minimum advancement in labelling category: 2 (min C)
- 150000 HUF (max 50%) for boiler replacement
- The refurbisment should results in completely modernised building envelope
- Minimum cost-optimal U values

# ENERGY EFFICIENCY INVESTMENTS: CASE STUDY

# District heating reconstruction in Kaposvár

- Plan: fully renewable based energy use by 2050
- Realised projects:
  - Reconstruction of district heating
  - Biogas based heating in the swimming pool (from local sugar factory)
  - Solar based public lighting (city park)
- Planned projects:
  - CNG buses
  - Biomass CHP
  - PV park

Source: Zanatyné, 2015 October

# District heating system in Kaposvár

REKK Regional Centre for Energy Policy Research

- Own installed capacity: 65 $MW_h$ and 1.4 $MW_e$
- Purchased from CHP: 5 $MW_h$
- Heat demand: 48 MW
- Number of connected flats: 6813
- Other buildings: 284
- Heat production: 1 gas based unit
- Number of heat centers: 352
- Lenght of network: 26.4 km
- Population of Kaposvár: 68 000
- Population served by DH: 23 000 (34%)

# District heating system in Kaposvár

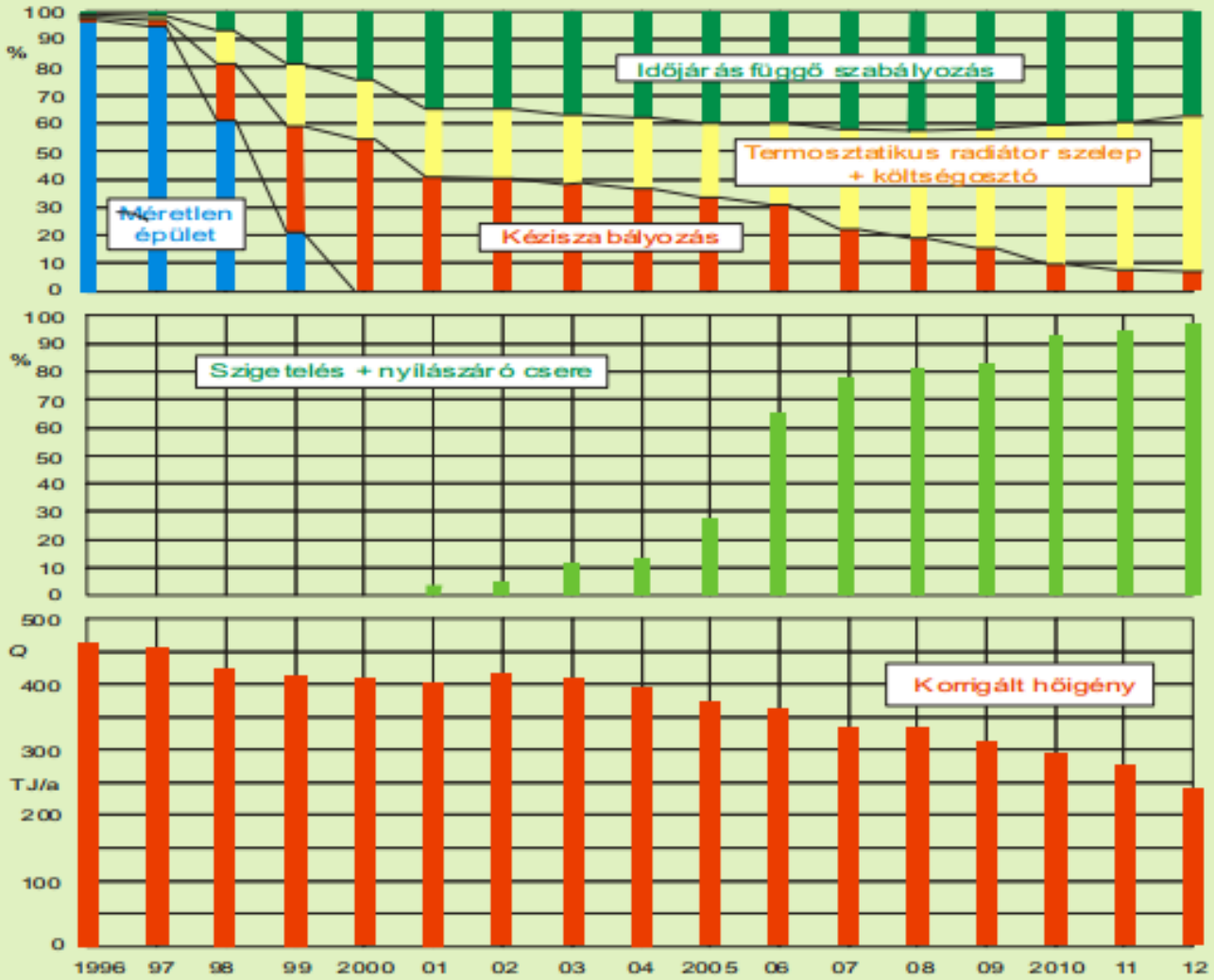
REKK Regional Centre for Energy Policy Research

- 1992: 5 boiler houses, outdated network, bills based on average system cost
- Due to the increasing energy prices the price of DH rises that requires the modernisation of the service provision
- Goal: affordable and controllable DH service
- Means:
  - Energy efficiency at end use
  - Supply side modernisation (generation and distribution)
  - Inclusion of cheaper heat production sources

# Implementation

- Introduction of individual heat metering: consumer interest in savings
- Insulation and/or change of windows and doors
- Inculation of the external walls
- Modernization of the network
- Multiple financial sources:
  - Municipality
  - Consumers
  - DH company

# EE: Impact on heat demand




Weather-sensing control

Thermostatic radiator control + cost allocator

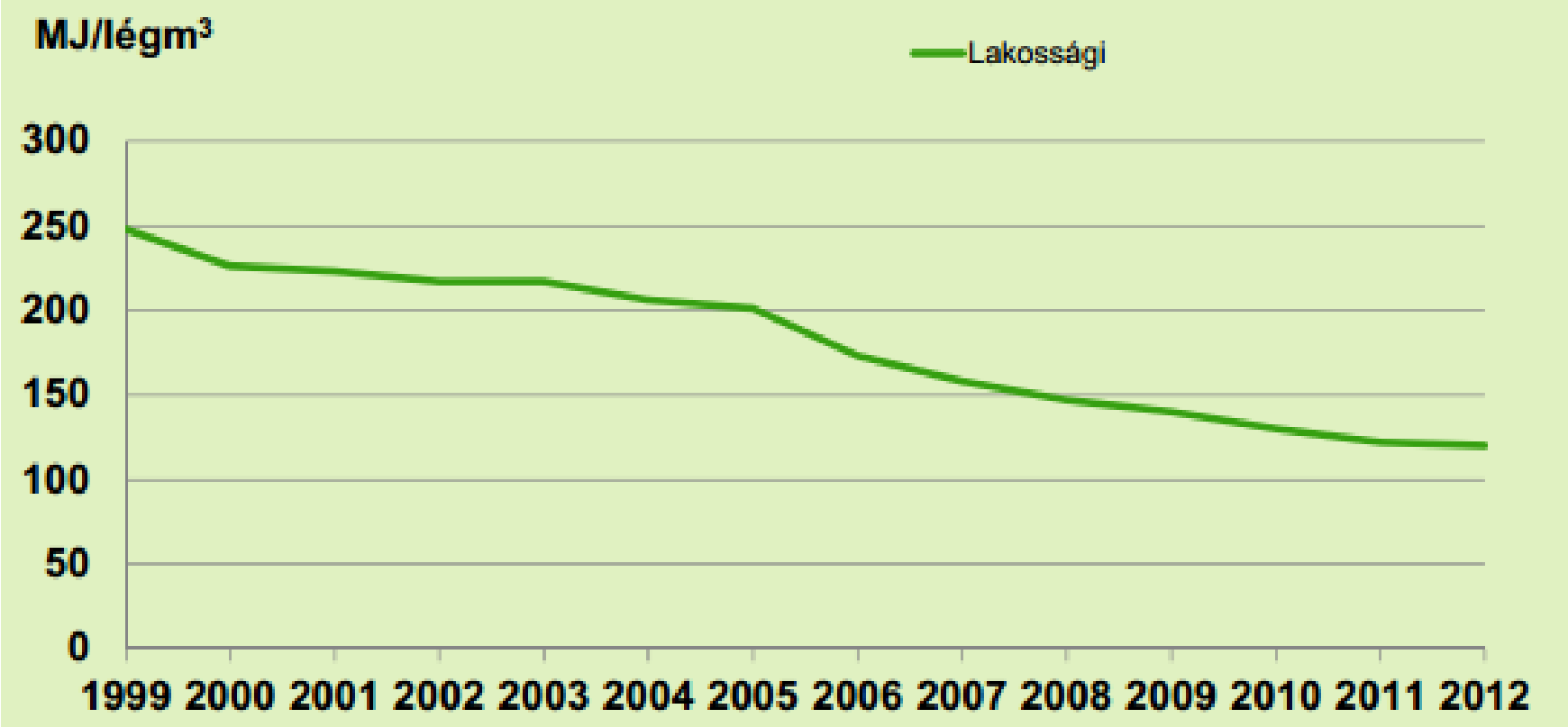
Manual heat control

Non-metered buildings

Insulation + windows

Adjusted heat demand

# EE: Reduction of unit heat demand at residentail consumers (MJ/M³)



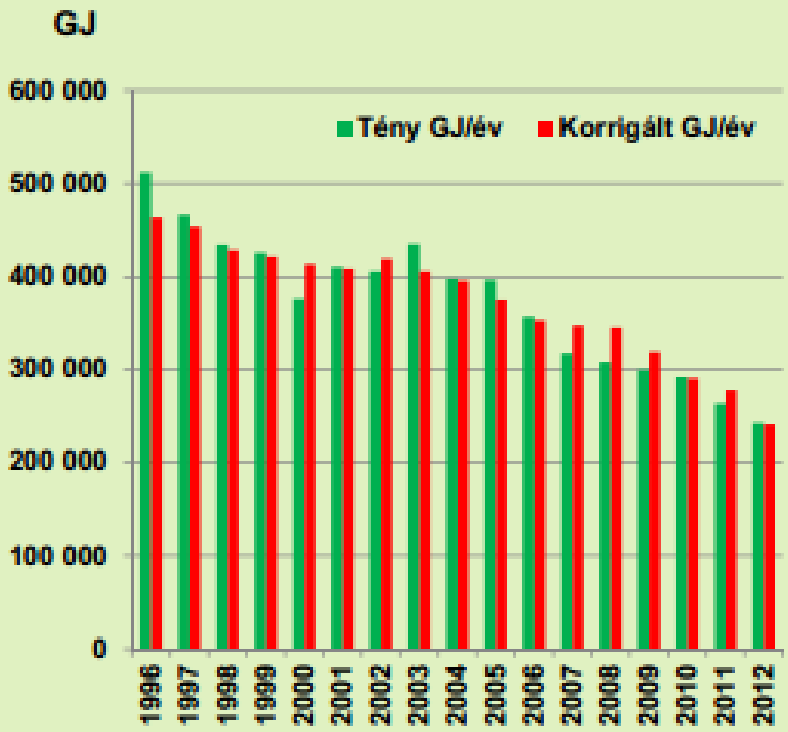

Average flat: from 33 GJ/year to 16 GJ/year!

# Suply side investments

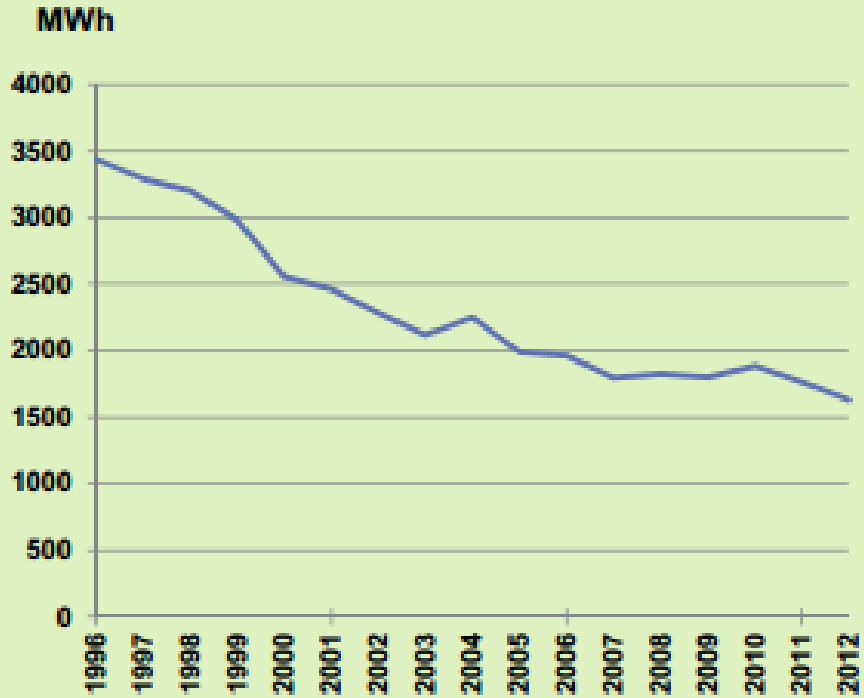
- Modernization of heat centers: new pumps and frequency modulators
- Flexible PLC based bioler and heat center control
- The 5 areas served by the 5 boilers has been connected with new network elements and 4 island biolers closed
- CHP production
- IT development: optic fiber intranet, real time data generation, collection and analysis, remote control

# Supply side energy savings

Produced heat (GJ/year)
(Metered and adjusted)




Electricity use (MWh/year)



# Overall results

- 50% residential energy savings
- 16 GJ/year – 6816 flats: 110 TJ/year
- 327 bn HUF savings (assuming a 48 000 Ft/flat/year heat cost)
- Gas consumption reduction: 136 TJ/year
- $CO_2$ reduction: 7600 tCO2/year
- 1600 MWh/year electricity use reduction
- 4.9 bn HUF savings at consumers and 114 140 t $CO_2$ emissions reduction during 15 years

# Network extension project

- Energy efficiency investment reduced heat demand considerably
  - Need for new consumers
  - Identification of their consumption and load features
  - Preparation of commercial offers
  - Assessment of finance options
- Regulatory changes:
  - VAT reduction of DH (27% to 5%)
  - EU funding available for DH reconstruction
  - Energy contract of the local hospital expiring (potential new consumer)
- 1060 mHUF investment:
  - 500 mHUF grant from EU sources
  - 400 mHUF bank loan
  - 160 mHUF equity

# Results

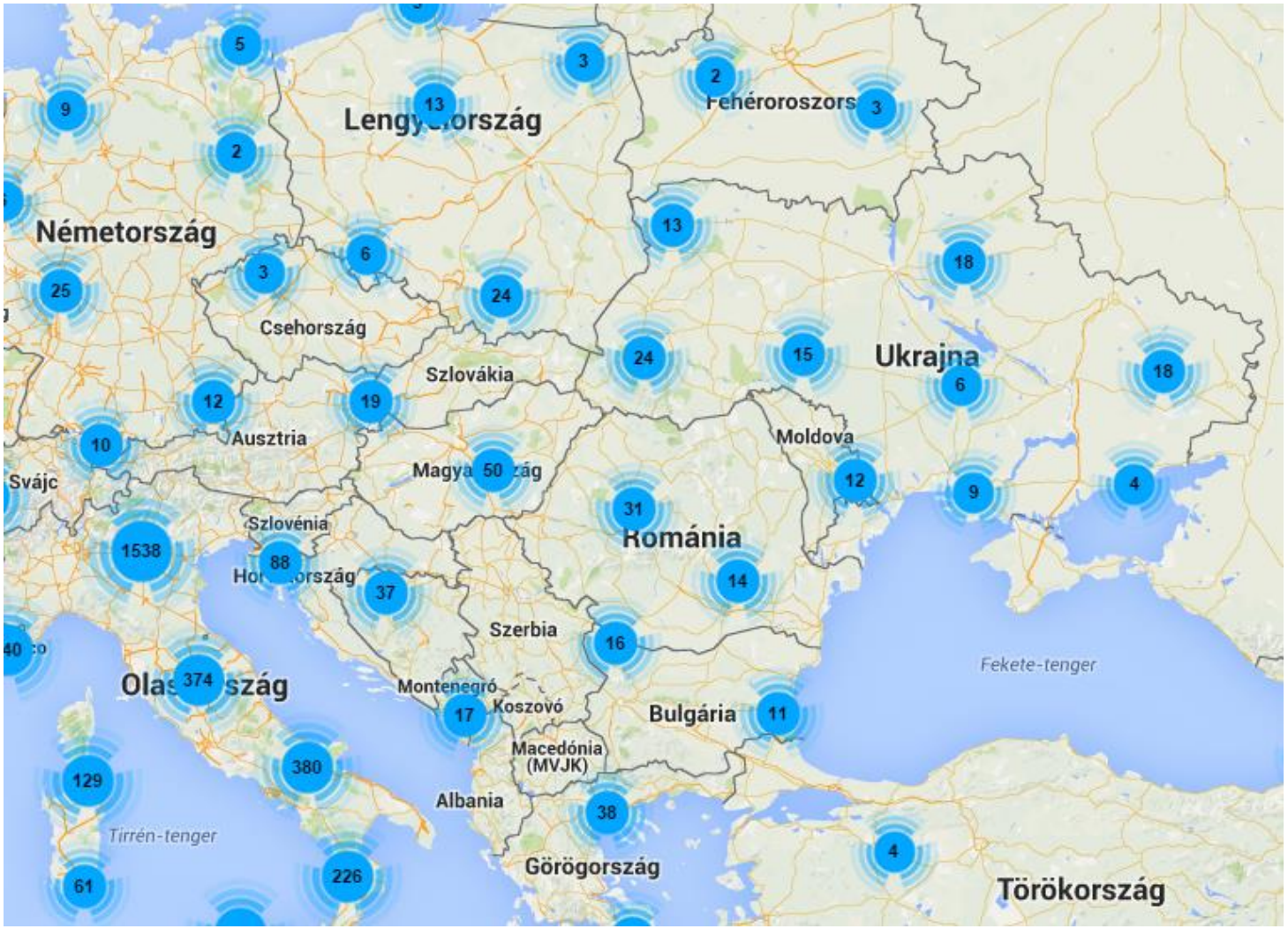
- 1980 m network element replaced
- New 6465 m core and distributor network elements
- 5 new compact heat centers
- Gas consumption reduction of 11.5 TJ/year
- 27% additional heat energy sold
- 2 MW new load can be connected to the network
- Option to connect renewable (planned 17 MW biomass plant) and waste heat sources (sugar factory) to the system

# Current DH regulation

- Utility price cut of 20% that undermines the economic position of DH suppliers
- New price regulation of 2011
  - Individual (approx. 100 companies) DH end user price setting by ministry and HEPURA (frequent changes)
  - Individual (approx. 100 companies) heat producers setting by ministry and HEPURA annually
  - Annual compensation for suppliers to reach max. 2% profit (ex post monitoring)
- cost reduction due to e.g. modernization of network is taken from the company the next year: no incentive

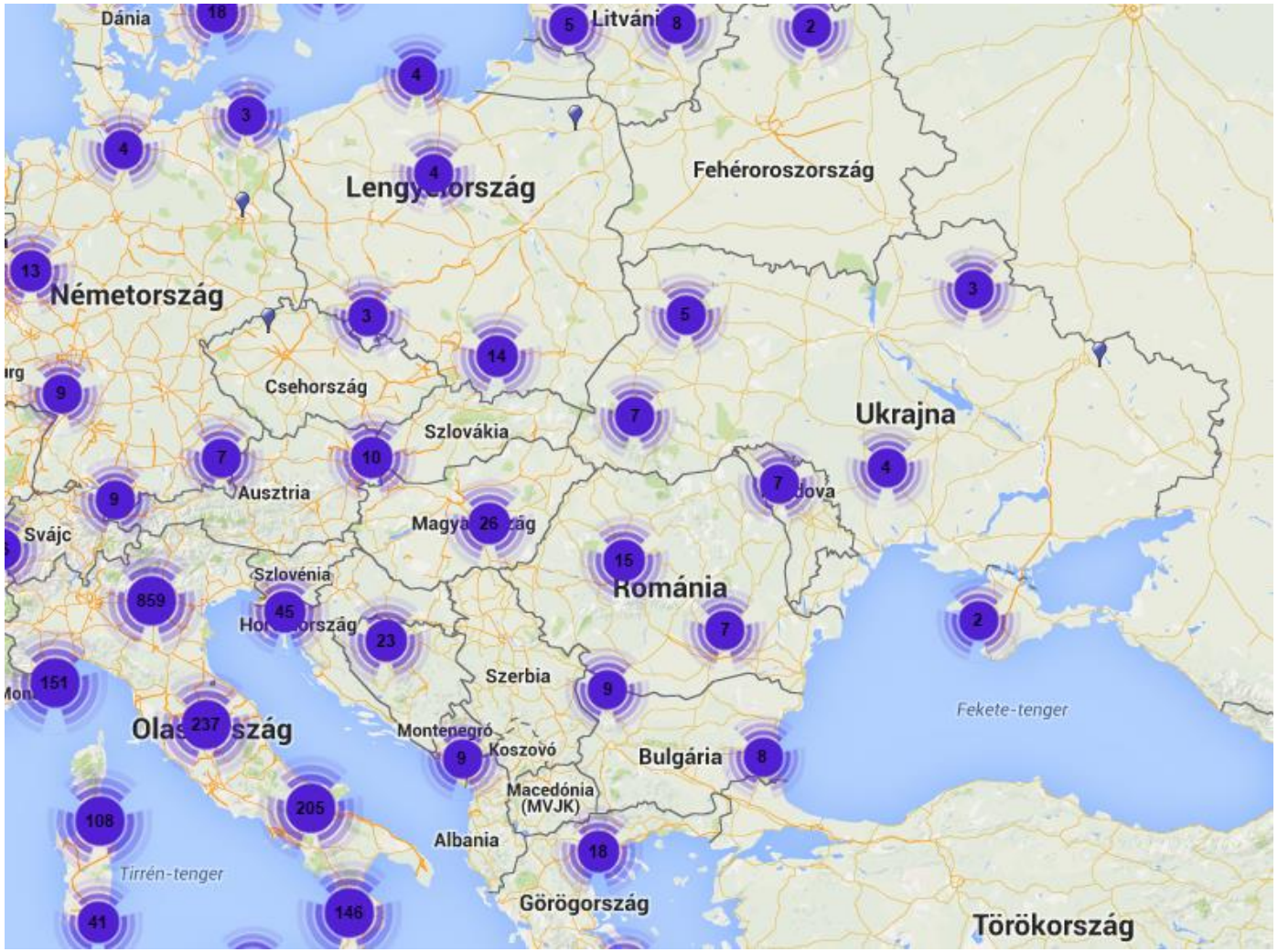
# INFORMATION CAMPAIGNS IN FAVOUR OF ENERGY EFFICIENCY – ROLE OF THE STATE AND LOCAL AUTHORITIES

# Covenant of Mayors: signatories




HU: 50
UA: 119

# Covenant of Mayors: SEAP submitted




HU: 26
UA: 21

SEAP: precondition for ELENA Funds (EIB)

# National Energy Consultant Network

REKK Regional Centre for Energy Policy Research

- Aim: to enhance the professional energy knowledge of the local governments and SMEs
- Today:
  - renewable and energy efficiency investments are often driven by the available funding calls and the persuasion of companies involved in certain technologies
  - Need for more rational decisions (fundamentally based on unit savings of investments)
- Professional advise will be free

# Conclusions

- Cost reflective energy prices are fundamental to energy efficiency improvements
- EED provides a strong impetus in many policy fields, especially the policy development on the energy performance of buildings
- Hungary decided not to establish an EEOS
- The building sector is key EE potential in Hungary, policy should focus on detached houses
- EU Funds are the dominant source of public finance for building renovation, their efficient use is key for the modernization of the building stock (no EU funds beyond 2020!)
- Modernization of DH system is often coupled with the integration of renewable resources (biomass and geothermal): need to substitute demand and for proper DH regulation
- The role and financial possibilities of local governments are limited

Thank you for your attention!

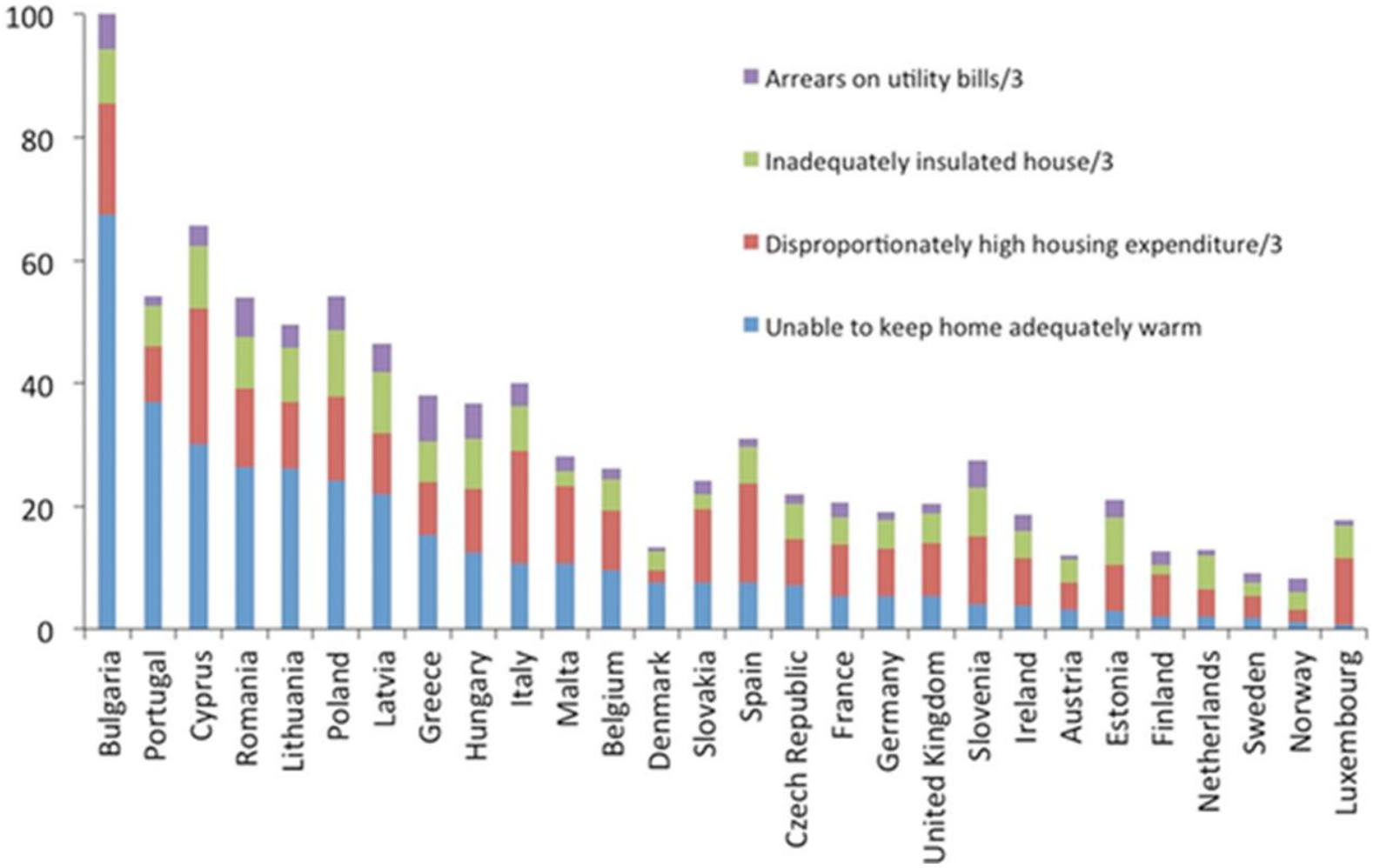
You can contact me at: zsuzsanna.pato@rekk.hu

# Discussion: what is required to ensure effectiveness of energy efficiency projects?

REKK Regional Centre for Energy Policy Research

- energy price as a fundamental determinant of economic viability of EE projects
- the impact of utility price cut in Hungary
- good and bad practice in support provision
  - cyclical versus medium term budget and schedule for calls
  - level of support intensity and the risk of moral hazard
  - how to avoid free riders?
  - grants versus preferential loans

# Energy poverty in the European Union: landscapes of vulnerability

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