# Energy efficiency in sustainable development and in the work of regulators of electricity and gas systems

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# Introduction

- Mechanical engineer.
- Specialization:
  - energy efficiency
  - renewable energies
  - district heating
  - energy strategy development for municipalities.
- 35 years with an organization called EGI
  - government background institution until 1992
  - after privatization: member of the international GEA Group.

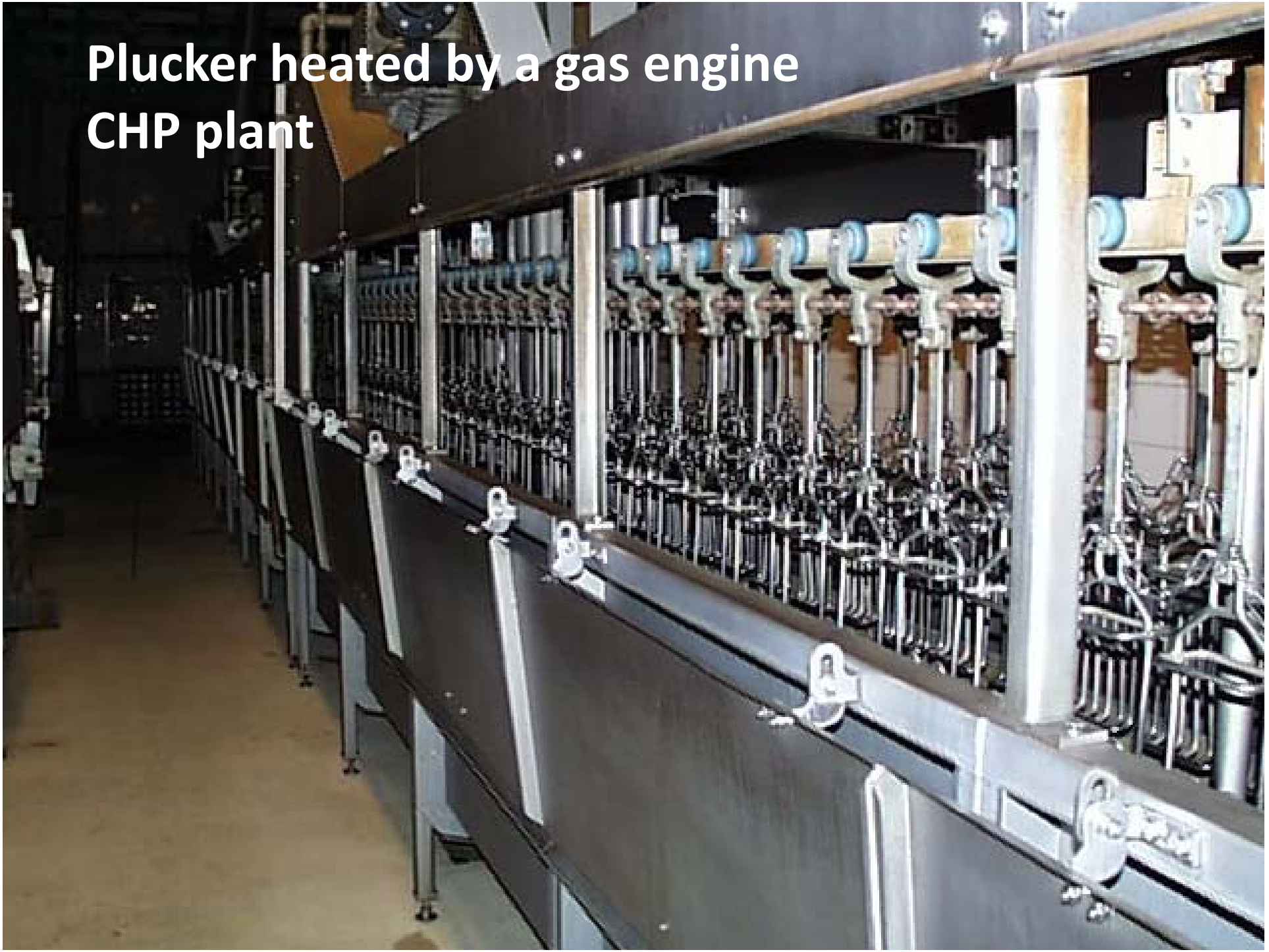
# EE related activities of EGI

- Energy studies and audits.
- Waste heat recovery.
- Gas engine and gas turbine based CHP.
- Upgrading of DH systems.
- Solid biomass based power and heat generation.
- Biogas production and use in gas engines.
- Processing agricultural wastes for power plant fuel.
- Use of cogenerated heat in DH and agriculture.
- Use of combustion residues for soil enhancement.

# 5x4 MW gas engine CHP plant

# 20 MW DH CHP Plant

# Gas turbine plant in the Budapest DH system


Plucker heated by a gas engine
CHP plant

# Sawmill waste processed to chips

# Loading of 40/23 ton special vehicle

Ready-made wood chips unloaded in a biomass plant


Open-air chips pile of a power plant

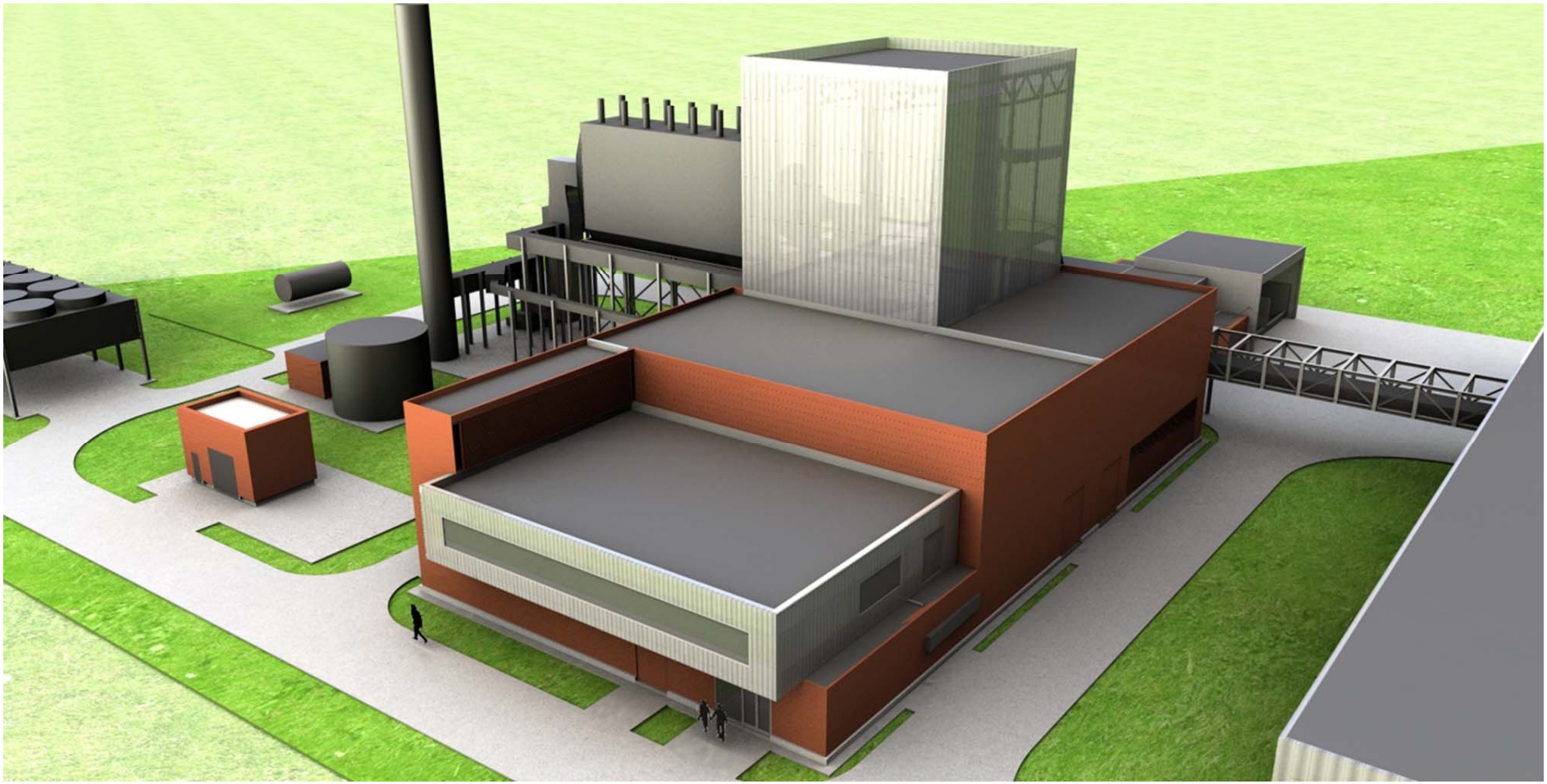
# Processing of cutting area wastes for power plant fuel

# Energy plantation

# 20 MW Biomass Power Plant

# The central building block and the ESP

# 3D view of a 15 $MW_e$ straw fired biomass plant for district heating service



# View of a 8 MWe biomass power plant complying with the new Hungarian regulatory expectations

# Biogas CHP plant serving agricultural heat consumers

**Special heating technology for greenhouses that can utilize low tempera-ture waste heat**

# Sustainable development

- Man's impact on ecosystems has grown tremendously to meet exponentially growing human demand for materialistic services and goods.
- The present "development" of Man cannot be maintained.
- Major change is required in the relationship between Man and Nature, as well as among Man and Man.

# SD and Energy

- Energy usage is to cause global crisis, ending the present way of human development,
  - either on the **supply side** through the depletion of fossil energy resources
  - or on the **emission side** through the climate change.

**EE can help on both sides.**

# Global effects of EE

- Reduces GHG emissions.
- Slows down the depletion of traditional energy sources, gives more time to transfer the human society to another energy system.
- Slows down the depletion of other natural resources, such as iron and rare metals, reduces air pollution, freshwater use and other burdens on the environment.

# Regional/local effects of EE

- Reduces air pollution, fresh water use, etc.
- Creates new jobs and revenues for local players.
- Reduces the capital requirement of energy infrastructure.

# Energy efficiency in electric, gas and district heating systems

- **End-use EE** reduces the required capacity of the supply side (generation, transformation, distribution);
  - can postpone or make unnecessary infrastructure developments;
  - can contribute to affordable and reliable energy supply;
  - is not the business of the utilities (?).

# Energy efficiency does not happen at the desirable level

- The market cannot take into account longer term considerations.
- Energies are often underpriced.
- External costs are not included in the price.
- Market barriers exist.

**Policy tools are applied to fight the market barriers.**

# The policy tools have to be designed according to the structure of the energy sectors and level of liberalization

The concept of the **rational market player** helps, who acts according to economic rationality.

- Make energy consumption (wasting) expensive or prohibited.
- Make investment into EE feasible, cheap, attractive, and trendy.

# Market barriers and possible policy tools to overcome them (1)

- Lack of feedback about energy consumption and costs → **Regulation of billing, energy management systems, smart metering.**
- Lack of investment money → **Investment grants and subsidies, soft loans.**
- EE investments not attractive enough → **Soft loans, tax reliefs, eco-taxing.**
- The EE technology is not well demonstrated, application seems to be risky → **Public sector demonstration programs, R&D**

# Market barriers and the policy tools to overcome them (2)

- Lack of proper information about EE possibilities → **Labeling, energy audits, information campaigns, utility DSM programs.**
- Lack of motivation of the market player, short-term thinking → **Appliance and building standards, motivation campaigns, utility DSM programs.**
- Lack of management capacity → **ESCOs, utility DSM programs.**
- Split interests (tenant and landlord) → **Better rental contracts.**

# Demand Side Management (DSM)

- Modification of consumer demand through financial incentives and education.
- First generation DSM: the main purpose is to **reduce peak demand**, smooth the demand curve.
- Second generation DSM: the main purpose is **end-use energy conservation**. The regulated utilities are recognized as players who can effectively improve the end-users' EE. New name: Energy Company Obligation (ECO) or Energy Efficiency Resource Standard.
- Demand Response Management Programs: harmonize end-user demands with cost-effective generation possibilities. The end-users have an active role in balancing the system.

# The role of regulators in promoting EE (1)

- Unambiguous role on the supply side: give priority to EE measures over capacity developments as long as it is more cost effective.
- Apply cost-based energy pricing, avoid subsidies and cross-financing.
- New recognition after the oil shocks of the 70's: DSM is an effective tool to avoid costly developments on the supply side.
- With vertically integrated utilities the regulation of ratepayer funded DSM programs was relatively easy.

# The role of regulators in promoting EE (2)

- Liberalization of the energy markets temporarily narrowed the role of regulators, as the scope of monopolistic activities decreased.
- Now the regulated utilities are recognized as players who can effectively improve the end-users' EE.
- The regulators' role in ‚command and control' strategies is getting important again (ECO = Energy Company Obligation). ECOs can be accompanied by Tradable White Certificate systems.
- The new EE Directive of the EU allocates outstanding responsibilities for the regulators in enforcing obligatory EE measures.

# ECOs (in both the electric and gas sectors)

- Obligated player: the DSO or the retailer, which is in direct contact with the end-user.
- The scope of eligible measures, eligible customers, and rules of verification specified by the legislation.
- Utilities get their projects qualified by the regulator prior to implementation.
- Strict monitoring and verification. → Issue of White Certificate. (WCs can be traded.)
- Independent third parties may come in.
- The scheme backed by penalties.
- ECO schemes: cost effective in terms of saving energy.

# ECOs in the EU (2008)

| Country | Obligated Company | Eligible Customers | Target set by | Administrator |
|---|---|---|---|---|
| Belgium - Flanders | electricity distributors | residential and non energy intensive industry and service | Flemish Government | Flemish Government |
| France | retailers of non-transport energy | All (including transport) except EU ETS | Government | Government |
| Italy | electricity & gas distributors | All including transport | Government | Regulator (AEEG) |
| GB | electricity & gas retailers | Residential only | Government | Regulator (Ofgem) |
| Denmark | electricity, gas & heat distributors | All except transport or covered by EU ETS | Government | Danish Energy Authority |



From Eoin Lees, RAP/ERRA

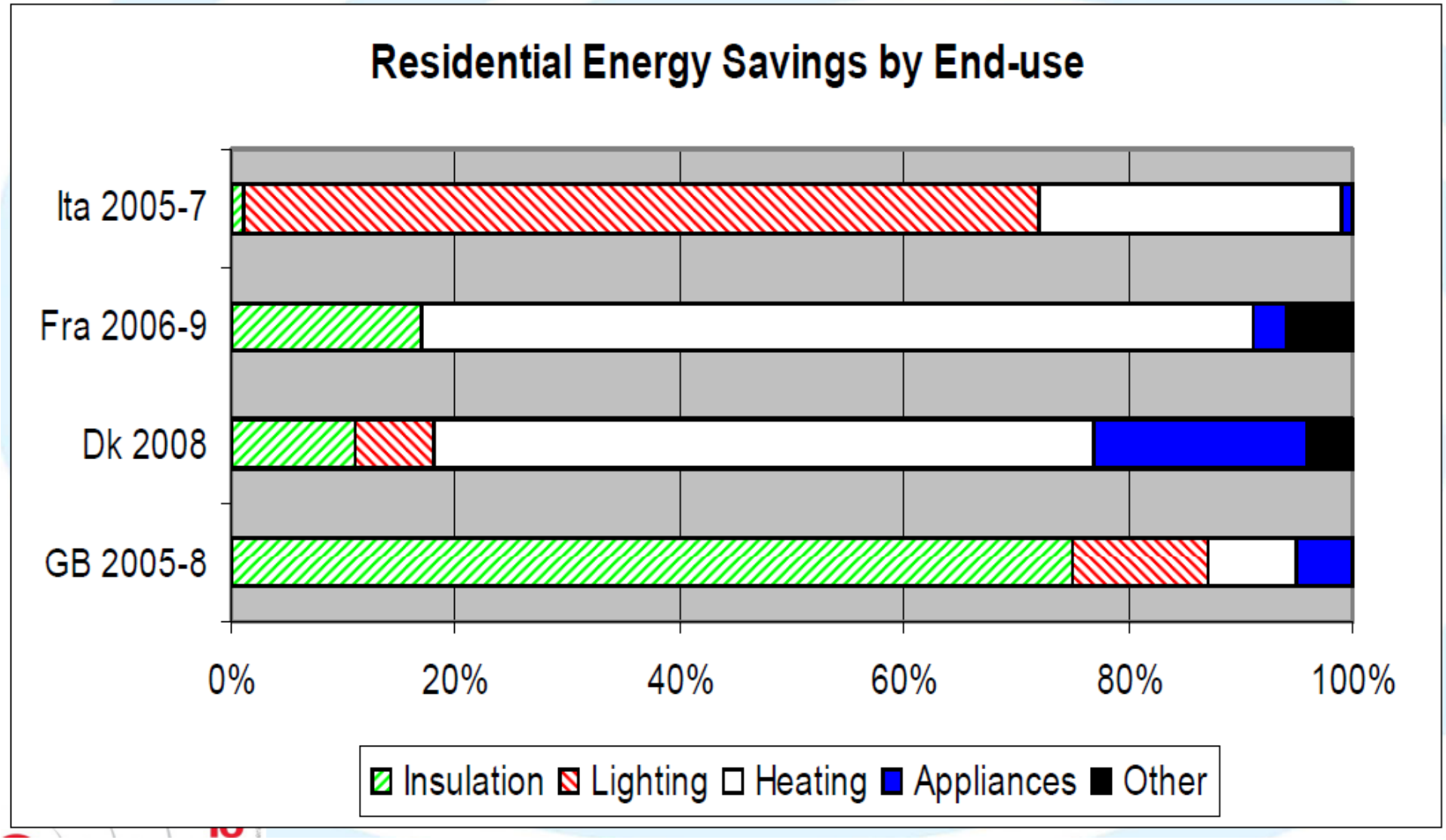
# ECOs in the EU (2008)

| Country | Nature of saving target | Size of target in 2008 | Estimated annual spend by companies €M {€/person} |
|---|---|---|---|
| Belgium – Flanders | 1st year primary energy | 0.6 TWh annual | 26 {4} |
| France | lifetime delivered energy | 54 TWh over 3 years | 180 {3} |
| Italy | cumulative 5 year primary energy | 2.2 Mtoe in 2008 | 190 {3} |
| GB | lifetime CO2 | 154 MtCO2 in 3 years to 2011 | 900 {15} |
| Denmark | 1st year delivered energy | 0.82 TWh annual | 25 {5} |

# Most ECO Activity is in Residential Sector

| Country | Period | % energy savings from residential sector |
|---|---|---|
| Belgium - Flanders | 2008 | 58% (mandated) |
| Denmark | 2008 | 42% |
| France | 2006-9 | 87% |
| Italy | 2005-8 | 83% |
| GB | 2005-8 | 100% (mandated) |

# Where do the savings come from in residential programs?



# The role of regulators in promoting EE (3)

Further roles:

- Giving priority to generators of renewable and cogenerated power in the electricity networks.
- Roll-out of smart meters.
- Regulation of billing.
- Assistance in designing and evaluating government-run (taxpayer funded) EE programs.