

White Certificates in MARKAL Models of Italy and Europe: Case Studies to Analyze Energy Efficiency Improvement Policies

*International Energy Workshop
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Objective

To present a EU project in progress, regarding market-based mechanisms to increase energy efficiency

To receive suggestions about how to simulate some selected innovative policies and measures with bottom-up technological models like MARKAL

The EU SAVE Programme



The SAVE Programme is the principal focus of the Community's non-technological action on energy efficiency.

It is the only Union-wide programme dedicated exclusively to **promoting energy efficiency and encouraging energy-saving behaviour** in industry, commerce and the domestic sector as well as in transport through policy measures, information, studies and pilot actions.

EU energy policy main concerns

SECURITY

- security of energy supply
- external hydrocarbons dependence

ENVIRONMENT

- environmental protection
- climate mitigation policies

ECONOMY

- competitive internal energy market
- energy cost reduction

“The European Union should rebalance its supply policy by clear action in favour of a demand policy.” – *Green Paper Towards a European strategy for the security of energy supply*

A transition to new energy systems in the long term may require a major change in energy supply mix.

In the medium/short term, energy and climate mitigation policies may be driven by **market-based mechanism** such as *White and Green Certificates* that respectively force to use energy efficient devices and to harness renewable energy sources, that are already competitive or not far from economic competitiveness.

So,
White Certificates
(or “Energy Efficiency Titles”, EET) are
market-based mechanisms
to increase the efficiency
of final energy utilization

The system of White Certificates
is already implemented in Italy and UK
(“Energy Efficiency Commitment”)

The White Certificates mechanism

The system of White Certificates, as now implemented in Italy, defines compulsory targets for increased efficiency of energy use as compared with business-as-usual trends.

It requires gas and electricity distribution companies to comply with this obligation by delivering "Energy Efficiency Titles" in proportion with the gas or electricity they distribute.

Such certificates are issued to certify interventions which reduce specific energy consumption, carried out either by the distribution companies themselves or by third parties (such as ESCO), not necessarily concerning clients of the companies.

Such titles are traded on the market.

The system closely resembles that of Green Certificates in a Renewable Portfolio Standard context, except for the certification of the energy savings obtained, which is somewhat more difficult than for electricity produced by RES.

The White Certificates mechanism

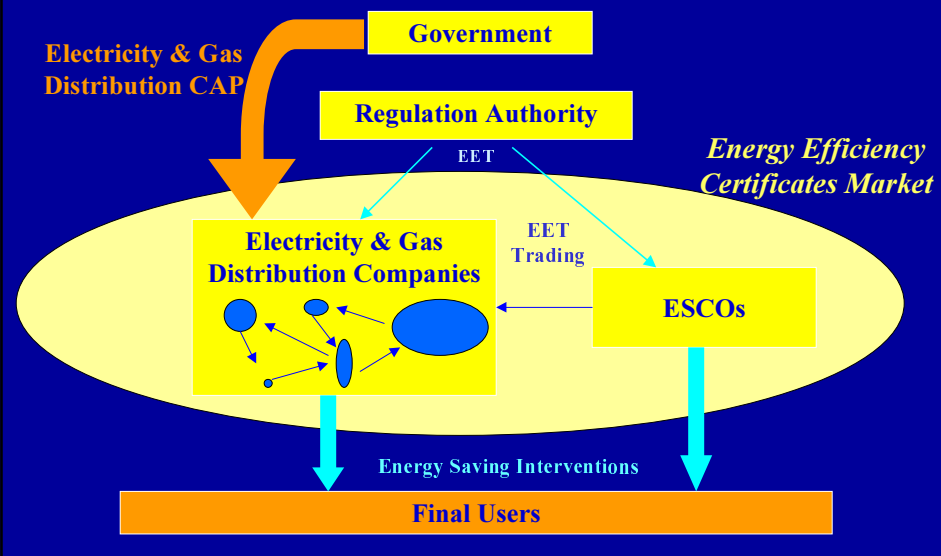
Two decrees established nation-wide quantitative objectives for the improvement of energy efficiency, expressed in primary energy units (Mtoe) for each year from 2002 to 2006.

Each electricity or gas distributor serving more than 100,000 clients is assigned a mandatory specific objective (or "obligation") evaluated as a percentage of the national objective represented by the energy distributed by each distributor.

Energy-saving projects are identified in tables annexed to the two decrees (e.g. re-phasing of electrical lines in industrial plants supplied at high voltage, low flux showers, etc.).

They also include projects that save primary energy even if they increase the amount of energy distributed (substituting gas for electricity, or vice-versa, when more efficient). Anyway, at least 50% of the obligation concerns electricity saving for the distributors of electricity and gas for gas distributors.

The White Certificates mechanism



Other 2 marked-based mechanisms which will be quantitatively analyzed in Wh&G project

⚡ CO2 Emission Trading

⚡ “Smart Regulation”

which is a near to market regulation approach

(e.g. energy design standards for any building as a whole, instead of single technology standards - like cavity wall insulation, lighting, etc. –

“more windows means more heat lost but also less artificial light required”: the market decides...)

Project Goals

- to identify the best characteristics of a market-based mechanism to increase the efficiency of final energy utilization
- to analyze in particular the practicability of using White Certificates in a single European market
- to analyze the effect of the various policies and measures (P&M) already implemented or innovative

Project Expected Results

The project will generate an in-depht analysis of market-based mechanisms for energy efficiency

The results should allow Member States and the European Commission to develop a consistent approach for dealing with this issue and possibly to establish a single market for Energy Efficiency Certificates in Europe

Project Phases

PHASE 1: Inventory of Innovative Policies and Measures (P&M)

PHASE 2: Selection of 3 Innovative P&M for in-depth Analysis

PHASE 3: Quantitative Assessment of the 3 Selected Innovative P&M

PHASE 4: Conclusions and Recommendations

PHASE 5: Communication and Dissemination

Project Partners

Sydkraft
(SW)



Lund University (SW)
IIIEE International Institute for
Industrial Environmental Economics



Utrecht University
Utrecht University (NL) - Copernicus
Institute for Sustainable Development
and Innovation Management



AIEE - Italian Association
of Energy Economists (IT)



The role of MARKAL models

PHASE 3: Quantitative Assessment of the 3 Selected Innovative P&M

The quantitative analysis of the effects of the three selected innovative P&M will be carried out essentially by modeling and simulation.

One approach is the use of a technical-economic model such as MARKAL:

- to compare the response of different energy technology to respond to policy changes,
- and to yield a consistent response in economic as well as environmental terms on the effects of different P&M

Why MARKAL ?

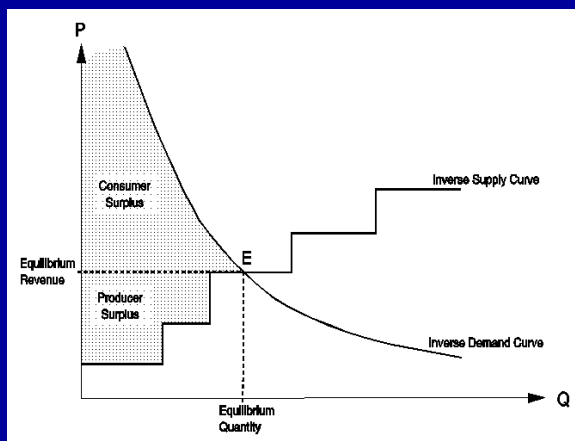
Because MARKAL models can answer to our questions:

- What would be for the various P&M the marginal cost of saving electricity or gas?
- What technologies would be taken up by the market to obtain these savings?
- What would be the effect (negative or positive) of keeping separate or pooling together Green and White Certificates?
- Should some technologies be kept out in order to use different instruments? Or use separate accounting within the same set of P&M?
- Should gas and electricity savings be interchangeable?
- What would be the advantages of a single market of white certificates?
- Should White Certificates include non-electric applications, such as solar thermal panels or biogas production?

... and so on ...

Furthermore...

MARKAL (ED) allows to combine the bottom-up approach required by this kind of analysis with a partial economical equilibrium model.



“A supply/demand equilibrium is reached when the sum of the producers’ and the consumers’ surpluses (the net social surplus) is maximized” (Equivalence Theorem)

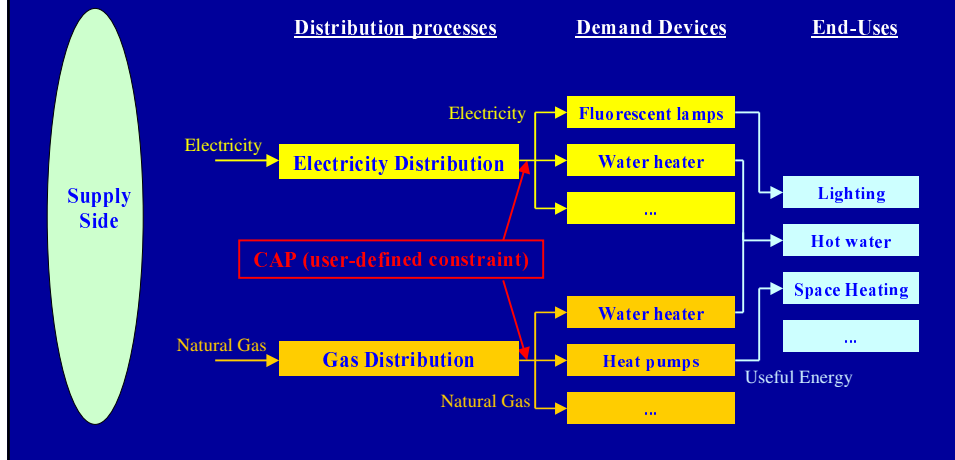
Which MARKAL model?

In order to perform the analysis described above, compare different approach to the MARKAL modelization of the selected measures, have details about the implementation of such measures in some EU Member States, the MARKAL models involved in this project will (probably) be:

-  - Western European Union (MARKAL-ED)
-  - Italy (MARKAL-MACRO)
-  - Germany
-  - Estonia

How we simulate White Certificates mechanism with MARKAL

$$\eta = \text{useful energy} / \text{final consumption}$$



First analysis with the WEU MARKAL model White Certificates Scenarios

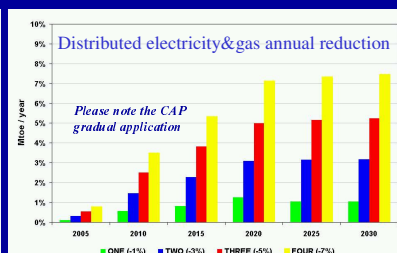
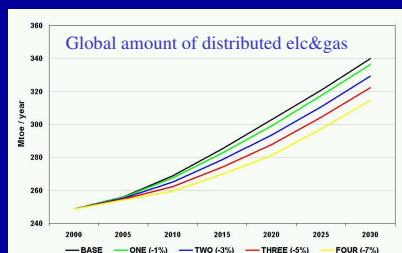


Electricity and natural gas distributed in commercial and residential sector:
4 reduction scenarios vs 1 base-case (b.a.u.)

User-defined constraint:

$$ELC_{\text{residential}} + ELC_{\text{commercial}} + GAS_{\text{residential}} + GAS_{\text{commercial}} \leq \dots$$

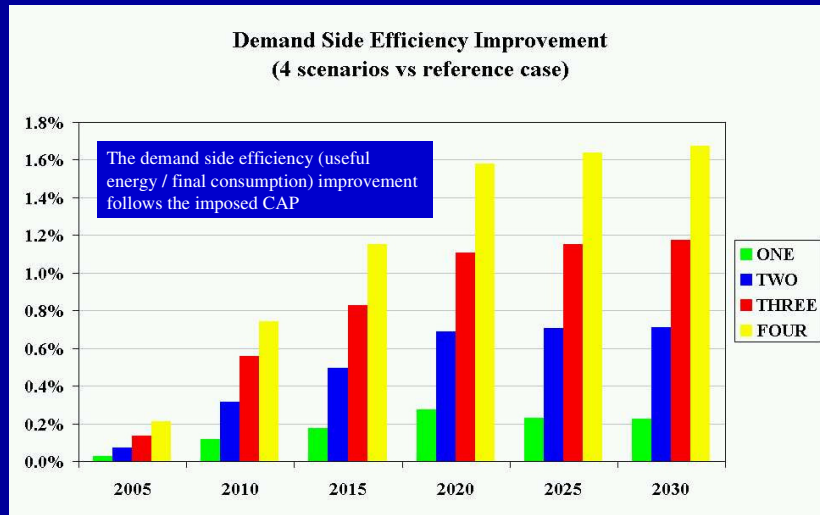
- 1%
- 3%
- 5%
- 7%



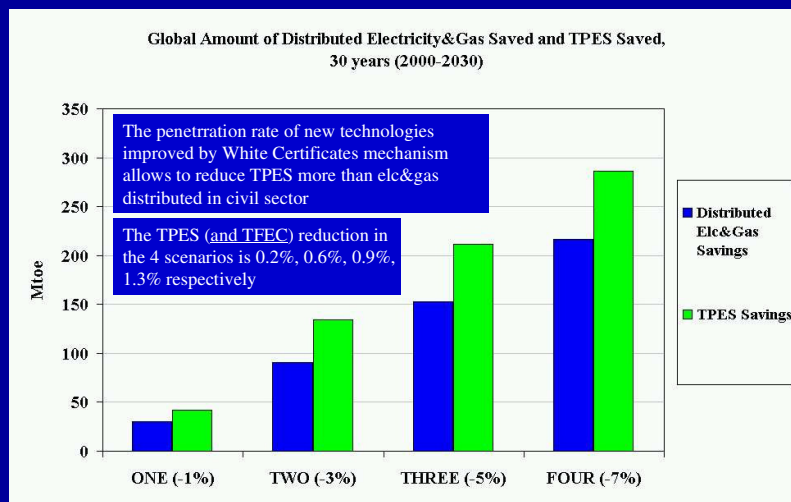
Italian target about 3%



First analysis with the WEU model



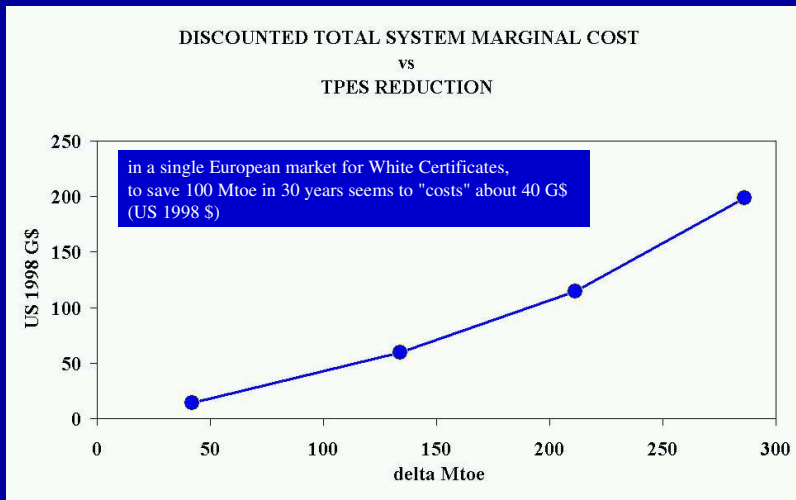
First analysis with the WEU model



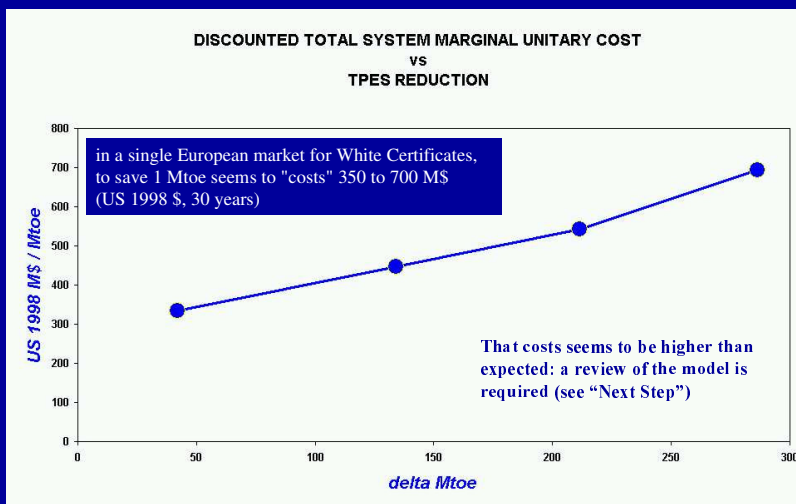
The Italian Annual TPES is about 180 Mtoe



First analysis with the WEU model



First analysis with the WEU model



Next Steps

In order to perform the quantitative analysis of the 3 selected measures using MARKAL WEU model, the next steps will be:

- to insert some new technologies into the model database and modify some existing technologies (Italy/UK lists...)
- to review the model structure with focus on user-defined constraints
- to check the model calibration and use the features of MARKAL Elastic Demand
- to set the analytical framework in order to introduce the same assumptions into the 4 Markal models that we want to use

In particular, while it is relatively easy to simulate CO2 Emission Trading with MARKAL models (CAP & Trade scheme), we have to think about how to simulate Smart Regulation Policies/Interventions

Thank you.