

Workshop on Case Studies of Current European Schemes for the Measurement & Verification of Energy Efficiency Improvements

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Italian Energy Efficiency Obligation and White Certificates: Measurement and Evaluation

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Autorità per l'energia elettrica e il gas

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1. The Context: the Energy Efficiency Obligation and Energy Efficiency Certificates



The legislative process

- ◆ **Concept/notion introduced** with the implementation of the European Directives on the liberalisation of the electricity and gas market
- ◆ **First Ministerial Executive Orders in 2001**
- ◆ **Technical revision of the 2001 Executive Orders and definition of regulation throughout 2002 and 2003**
- ◆ **New legislative provisions in July 2004**
- ◆ **Entered into force in January 2005**
- ◆ **Definition of the technical rules, administration, monitoring and enforcement of the whole mechanism under the Regulator's (AEEG) responsibility**
- ◆ **Coherent with the framework set out in the Proposal for a Directive on energy end-use efficiency and energy services COM (2003)739**



The Energy Efficiency Obligation

◆ **National** quantitative energy efficiency **targets**:

- annual
- 2005-2009
- primary energy savings (toe);
- 2,9 Mtoe in the fifth year (cumulative)

◆ **Obligated actors**:

- electricity and gas distributors >100.000 customers at 31.12.2001, on the basis of their market share

◆ **Target sectors**:

- all energy end-use sectors (plus intermediate uses in the gas sector)
- but at least 50% via a reduction of electricity and gas end-uses



The four compliance options

- ◆ **Compliance with targets is achieved via the implementation of energy saving projects**

- ◆ **Obligated distributors have 4 options to comply with their Energy Efficiency Obligation:**
 1. develop **“in-house” energy efficiency projects**
 2. develop **energy efficiency projects jointly** with third parties (e.g. product manufactures, installers, financial institutions, ESCOs)
 3. **buy** on the market or via bilateral contracts **tradable Energy Efficiency Certificates which attest energy savings achieved by third parties** (i.e.: other distributors, companies controlled by distributors or energy service companies), via the implementation of energy efficiency projects
 4. **pay the sanction** for non compliance with the obligation



Eligible projects

◆ Eligible projects:

➤ illustrative list of “hard” (i.e. vertical) measures (cf. Appendix)

◆ Projects are **not subject to approval before** their implementation, although proponents may ask for an *ex-ante* “qualitative” eligibility check

◆ Projects must be **designed, implemented and evaluated according to criteria established by AEEG** following consultation of all interested parties



The Energy Efficiency Certificates

- ◆ Projects **verification** as well as **energy savings certification** are under AEEG's responsibility
- ◆ **Verification** is carried out via:
 - control of projects **documentation** prepared according to a predefined reporting format and sent to AEEG by interested parties
 - random on-site **audits** (i.e.: control of more detailed project-related documentation as well as audit at customers' premises)
- ◆ The **certification of the energy savings** produced by each project is made via the issuing of **Energy Efficiency Certificates (EECs)** that can be traded in a specific market or through bilateral contracts



➔ **Project-based**

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2. The importance of Measurement and Verification to the Italian system



Why M&V is so important to the Italian system

◆ **Measurement and Verification is the key for an effective tradable certificates mechanism applied to the promotion of end-use energy efficiency:**

- Energy Efficiency Certificates (EECs) serve as an **accounting tool** to prove that the corresponding amount of energy has been saved
- EECs have an **economic value**:
 - non compliant distributors are subject to a **penalty**
 - distributors subject to the Energy Efficiency Obligation **can recover** a flat amount via electricity and gas rates for each EEC they surrender to AEEG

➔ **you want to be sure that EECs represent “real” savings**



Why is M&V so important to the Italian system/2

◆ What is “special” about M&V of energy savings in a **project-based** system like the Italian one?

- you can not measure at the meter the energy saving generated
- you have to measure the energy savings via a comparison between the consumption *before* (scenario BAU) and *after* the project
- but in some cases you do not have the scenario BAU and you need to make assumptions (“project baseline”)
- in other cases you the scenario BAU is known but you need to net out the impact on consumption trends of variables other than those on which the energy saving project have an influence
- in other cases measuring everything is not cost-effective

➔ you need to design proper M&V rules



Why is M&V so important to the Italian system/3

- ◆ **The technical regulation for the M&V of energy savings is defined by AEEG, via specific “Guidelines” on:**
 - projects preparation
 - measurement and evaluation of project’s results
 - documentation to be transmitted to AEEG to allow for projects **verification** and **validation** (on a project-by-project basis)
 - issuing of EECs
- ◆ **AEEG is also in charge of energy savings **verification** and **certification****



3. Major Measurement and Verification issues



M&V issues

◆ Technical issues:

- **baseline setting:** what is the reference scenario? (cf. following slide)
- **adjustments** to take into account changing framework conditions
- **treatment of free-riders:** do we take into account savings that would have been achieved by **project participants** even in the absence of the project? If yes, how?
- **impact of different delivery mechanisms**
- **treatment of free-drivers:** do we take into account – and, if yes, how – positive impact on **non-participants**? And what about extensive positive impacts on **participants**?



M&V issues/2

◆ Baseline setting (options other than the “real” baseline when it is not known):

- average installed
- average sold
- average offered on the shelves
- technology that meets mandatory standards
- average produced
- BAT



+

Energy Savings

-

◆ The baseline is dynamic → need for regular updating



M&V issues/4

◆ Technical issues (cont):

- **project lifetime and persistence of savings over time:** *coeteris paribus*, the savings produced during the first year of operation may gradually reduce over time
- **Market Transformation projects e.g. information campaigns, training programs:** do we include them? How do we measure and verify the savings produced?
- **Documentation** requirements



4. AEEG Approach



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Guiding criteria

◆ **Project-based mechanism** → **Bottom-up**

◆ **General criteria:**

- simple and transparent rules and procedures
 - certain and reliable reference framework for operators
 - promotion of economic efficiency and technological innovation
 - consumers protection and promotion of competition
- search for a balance btw robustness and reliability of savings vs simplicity and cost-effectiveness

◆ **Regulation is always defined following a thorough consultation of all interested parties**



M&V procedures: AEEG's approach

◆ 3 types of M&V methods are considered:

- 1) **deemed** savings (no on-field measurement)
- 2) engineering **estimates** (partial on-field measurement)
- 3) energy **monitoring** plans (subject to pre-approval)



project/M&V complexity

◆ **Market Transformation measures** (e.g. **information campaigns, training programs**) are eligible **only if they are associated to “hard” measures**

- provided they meet specific qualification requirements they entitle the hard measure to a **5% “premium”** on the amount of certified energy savings

◆ **Only additional savings are considered**, i.e. over and above spontaneous market trends and/or legislative requirements



Deemed savings

◆ Main Characteristics:

- **totally *ex-ante*** (→ certainty of results, limited “risk”)
- **simplified energy savings calculation** (both for users and AEEG)
- **limited reporting documentation** to be provided
- **simplified control and certification** procedures (both for users and AEEG)

◆ **Suitable for** projects for which expected savings and reasonably well understood and direct measurement would therefore be not cost-effective

◆ **For each type of project a specific amount of saved energy is defined *ex-ante* for each installed unit (toe/unit/year)**

◆ **Assumptions are made on a number of variables** (e.g. baseline, working conditions and working hours)

◆ **Default factors are used for:** free-riding (net-to-gross ratio), delivery mechanism and persistence

◆ **Developed on the basis of public consultation on proposals put forward by AEEG; regularly updated**



Engineering estimates

◆ Main Characteristics:

- **relatively simplified energy savings calculation**
 - **reduced reporting documentation to be provided**
 - **simplified control and certification procedures**
- ◆ **Suitable for** projects whose saving impact is quite well understood but varies depending on a limited number of identifiable parameters (e.g. number of working hours).
- ◆ For each type of project a **specific evaluation algorithm** is defined, with pre-defined values for some parameters while other parameters have to be measured case by case
- ◆ **Default factor** for net-to-gross ratio
- ◆ **Measurement** of persistence
- ◆ Developed on the basis of **public consultation on proposals put forward by AEEG; regularly updated**



Energy Monitoring Plans

◆ Main Characteristics:

- **direct measurement** of energy usage **before and after the project**
 - **extended documentation** to be provided for *ex-post* validation and certification
 - **extended control and certification** procedures
- ◆ **Suitable for** projects whose energy performance crucially depends on variables and parameters that change from case to case and is therefore less predictable
- ◆ **Methodological proposal** to be developed for each project according to **pre-determined criteria and format**



Deemed savings: Compact Fluorescent Lamp (CFL)

◆ **Baseline Technology**

- incandescent lamp

◆ **Efficient Technology**

- Class “A” Compact Fluorescent Lamp

◆ **Major Assumptions**

- number of **substitutions** for each house: max 3 lamps
- **probability** of installation in each room
- number of **working hours** per year per room
- **power** needed in each room
- **power difference** (W) between Incandescent lamps and CFL

➔ **Weighted average**



Deemed savings: A, A+, A++ Domestic Refrigerators

◆ **Baseline Technology**

- average sold (weighted average): energy consumption: 417,8 kWh/year

◆ **Efficient Technology**

- A, A+, A++ appliances
- energy consumption (fridge): 299,6 kWh/year (A); 237,9 kWh/year (A+); 169,9 kWh/year (A++)

◆ **Major Assumptions**

- installation in “first” houses
- purchase for substitution (end of life) or new installation
- parameters for the calculation:
 - energy consumption (kWh/year)
 - volume (l)
 - Energy Efficiency Class



Deemed savings: Electric Outside Air Heat Pumps

◆ **Baseline Technology**

- 1-2 stars gas boiler (efficiency: 80%; about 99% of the sales on the domestic market)

◆ **Efficient Technology**

- Electric Outside Air Heat Pumps with Coefficient of Performance (COP) > 3 (up to 4,5)

◆ **Major Assumptions**

- Applicable only in the case of installations in new or restructured residential buildings (that meet national insulation standards)
- Parameters for calculation:
 - Season thermal needs
 - Average apartment (82 m²)
 - Climate Zone
 - Form Factor (Surface/Volume)
 - Heat Pumps consumption: f (Climate Zones, COP)



Examples of “Quantification Charts”: CFL

Scheda tecnica n.1 - Sostituzione di lampade ad incandescenza con lampade fluorescenti compatte con alimentatore incorporato

1. ELEMENTI PRINCIPALI

1.1 Descrizione dell'intervento

Tipologia di intervento:	sistemi per l'illuminazione
Decreto ministeriale elettrico 24 aprile 2001 ¹ :	tabella A, tipologia di intervento n. 3
Decreto ministeriale gas 24 aprile 2001 ² :	tabella B, tipologia di intervento n. 8
Sotto-tipologia di intervento:	installazione di sistemi e componenti più efficienti (corpi o apparecchi illuminanti, alimentatori, regolatori)
Settore di intervento:	domestico
Tipo di utilizzo:	illuminazione interni ed esterni

1.2 Calcolo del risparmio di energia primaria

Metodo di valutazione ³	Valutazione standardizzata
Unità fisica di riferimento:	lampada fluorescente compatta integrata con alimentatore incorporato nella lampada
Risparmio specifico lordo di energia primaria conseguibile per singola unità fisica di riferimento:	RSL= $14,6 \cdot 10^{-3}$ tep/anno/unità di riferimento
Nel caso di realizzazione dell'intervento tramite invio di buoni di acquisto agli utenti, il valore del risparmio specifico lordo per singola unità fisica di riferimento viene ridotto del 50%. (coefficiente correttivo b^4)	
Tipi di Titoli di Efficienza Energetica riconosciuti all'intervento ⁵	Tipo I



Examples of “Quantification Charts”: Domestic Refrigerators

Scheda tecnica n. 12 - Sostituzione di frigoriferi, frigocongelatori, congelatori, lavabiancheria, lavastoviglie con prodotti analoghi a più alta efficienza

1. ELEMENTI PRINCIPALI

1.1 Descrizione dell'intervento

Tipologia di intervento:

Decreto ministeriale elettrico 24
Decreto ministeriale gas 24 april
Sotto-tipologia di intervento:

Settore di intervento:
Tipo di utilizzo:

1.2 Calcolo del risparmio di energia primaria

Metodo di valutazione ³	Valutazione standardizzata
Unità fisica di riferimento:	Frigorifero, frigocongelatore, congelatore, lavabiancheria, lavastoviglie
Risparmio specifico lordo di energia primaria conseguibile:	
frigorifero, frigocongelatore (FRG) di classe A congelatore (CNG) di classe A	RSL = $26,0 \times 10^{-3}$ [tep/anno] RSL = $29,0 \times 10^{-3}$ [tep/anno]
frigorifero, frigocongelatore (FRG) di classe A+ congelatore (CNG) di classe A+	RSL = $39,6 \times 10^{-3}$ [tep/anno] RSL = $39,8 \times 10^{-3}$ [tep/anno]
frigorifero, frigocongelatore (FRG) di classe A++ congelatore (CNG) di classe A++	RSL = $54,5 \times 10^{-3}$ [tep/anno] RSL = $51,6 \times 10^{-3}$ [tep/anno]
lavabiancheria (LVB) di classe A lavastoviglie (LVS) di classe A	RSL = $7,9 \times 10^{-3}$ [tep/anno] RSL = $9,2 \times 10^{-3}$ [tep/anno]
Tipi di Titoli di Efficienza Energetica riconosciuti all'intervento ⁴	Tipo I



Examples of “Quantification Charts”: Heat Pumps

Scheda tecnica n. 15 - Installazione di pompe di calore elettriche ad aria esterna in luogo di caldaie in edifici residenziali di nuova costruzione o ristrutturati

1. ELEMENTI PRINCIPALI

1.1 Descrizione dell'intervento

Tipologia di intervento:	climatizzazione ambienti edifici climatizzati con l'energia non rinnovabili
Decreto ministeriale elettrico 24 aprile 2001 ¹ :	tabella B, tipologia di intervento
Decreto ministeriale gas 24 aprile 2001 ² :	tabella B, tipologia di intervento
Sotto-tipologia di intervento:	installazione di pompe di calore ad aria esterna in luogo di caldaie in edifici di nuova costruzione o ristrutturati
Settore di intervento:	domestico
Tipo di utilizzo:	riscaldamento dei locali

1.2 Calcolo del risparmio di energia primaria

Metodo di valutazione ³	Valutazione standardizzata
Unità fisica di riferimento:	Appartamento tipo riscaldato
Risparmio specifico lordo di energia primaria per unità fisica di riferimento (RSL):	Risparmio medio annuo di energia per appartamento tipo. Per valori intermedi del fatto di riferimento, per valori intermedi del COP in caso di risparmio di energia prima approssimando entrambi i valori e arrotondamento commercialmente

Pompa di calore elettrica con COP nominale pari a			
S/V	Zona A/B	Zona C	
[m ⁻¹]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]
0,20	11	20	23
0,30	14	28	31
0,40	18	36	41
0,50	23	44	50
0,60	29	54	60
0,70	35	63	70



Pompa di calore elettrica con COP nominale pari a 4,0			
S/V	Zona A/B	Zona C	Zona D
[m ⁻¹]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]
0,20	21	42	63
0,30	27	56	83
0,40	36	71	104
0,50	45	88	126
0,60	55	105	148
0,70	65	123	170
0,80	77	142	193
0,90	88	161	216

Pompa di calore elettrica con COP nominale pari a 4,5			
S/V	Zona A/B	Zona C	Zona D
[m ⁻¹]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]	[10 ⁻³ . tep/app.to/anno]
0,20	24	49	76
0,30	32	65	100
0,40	41	83	125
0,50	52	102	151
0,60	63	123	177
0,70	76	143	204
0,80	88	165	230
0,90	101	186	257

Tipi di Titoli di Efficienza Energetica riconosciuti all'intervento⁴

	Per impianti autonomi	Per impianti centralizzati
Tipo I	0%	0%
Tipo II	100%	70%
Tipo III	0%	30%

A user friendly system

Indirizzo  <http://www.autorita.energia.it/ee/index.htm> 

CHE COSA È L'AUTORITÀ
ATTIVITÀ ISTITUZIONALE
COMUNICATI STAMPA
RELAZIONE ANNUALE
PUBBLICAZIONI

efficienza energetica

LA PROMOZIONE DEL RISPARMIO ENERGETICO

I decreti ministeriali 20 luglio 2004

L'attività dell'Autorità

Riferimenti normativi e legislativi

IL SISTEMA EFFICIENZA ENERGETICA

Presentazione e istruzioni

Accreditamento (società di servizi energetici e società controllate dai distributori)

Società di servizi energetici accreditate per l'utilizzo del sistema **NEW**

Accesso al sistema:

- > distributori energia elettrica
- > distributori gas
- > società di servizi energetici
- > società controllate dai distributori



efficienza energetica

Electricità
Gas
Consumatori

cerca contatti link

HOME

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 Elettricità  Internet

A user friendly system/2



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Sistema Efficienza Energetica

Benvenuto **Cariati Roberto** (Utenza di test Autorita per l'energia)

A) Send requests

B) Check and print


C) Questions

Dati anagrafici	<ul style="list-style-type: none">• Visualizza e modifica i dati archiviati
Inoltro di nuove richieste	<ul style="list-style-type: none">• Richiesta di verifica preliminare di conformità alle Linee guida• Proposta di progetto e di programma di misura• Richiesta di verifica e certificazione risparmi
Richieste Presentate	<ul style="list-style-type: none">• Visualizza e stampa il contenuto delle richieste già presentate e verificane lo stato di avanzamento
Altro	<ul style="list-style-type: none">• Invia segnalazione all'Autorità• Cambia password



Autorità per l'energia elettrica e il gas

A user friendly system/3

Modulo 3: Informazioni generali sull'intervento 

Informazioni quantitative sull'intervento					
		Zona climatica - Destinazione d'uso dell'edificio	Impianto di riscaldamento alimentato a		
Seleziona il valore dei parametri da utilizzare per il calcolo e premi il tasto "Aggiungi" per inserire una nuova combinazione		A, B Abitazioni	gas	AGGIUNGI	
Si ricorda che per la richiesta in oggetto il periodo di riferimento su cui vengono calcolati i risparmi indicati nel seguito è pari ad un semestre.					
3.1	3.2	3.3	3.4	3.5	3.6
Superficie di vetro sostituita [m ²]	Zona climatica - Destinazione d'uso dell'edificio	Impianto di riscaldamento alimentato a	Risparmio Specifico lordo annuo [tep/anno/m ²]	Coefficiente	Risparmio netto conseguito [tep]
s			RSL	a	
30000	A, B Abitazioni	gas	.002	100%	30
					Calcola Tutti
3.7 Risparmio totale netto conseguito [tep]					30
3.8 Eventuale risparmio aggiuntivo riconosciuto per campagna di supporto [tep]					1.5
3.9 Risparmio totale netto di cui si richiede la verifica e certificazione [tep]					32



Autorità

5. Final remarks: feasibility and transferability of bottom-up M&V calculations



Final remarks

- ◆ **Bottom-up M&V methods are capable of producing reliable energy saving measures in a relatively simple, transparent and cost-effective way**
- ◆ **For “proven” technologies, *ex-ante* or partially *ex-ante* savings can/should be applied**
 - input data and parameters have to be **country-specific**
 - but the general M&V framework rules to tackle common methodological issues **can be transferred across countries** and **need to be harmonized** (e.g. baseline selection)
- ◆ **For less mature technologies, *ex-post* monitoring plans have to be developed according to a pre-defined framework and pre-determined rules**
- ◆ **Market transformation measures (campaigns) are important and need to be promoted but**



APPENDIX



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Eligible projects (1)

- ◆ **Rephasing of electric systems**
- ◆ **Electric motors and their applications** (e.g. inverters installation, installation of high efficient industrial motors)
- ◆ **Lighting systems** (public and private: e.g. installation of compact fluorescent lamps, automatic lighting systems)
- ◆ **Reduction of electricity leaking** (e.g. reduction of stand-by losses)
- ◆ **Switching from electricity to other fuels when this produces primary energy savings** (e.g. substitution of electric water heaters with gas water heaters, district heating)
- ◆ **Reduction of electricity consumption for heating purposes** (e.g. installation of more efficient electric heating systems or water heating systems)
- ◆ **Reduction of electricity consumption for air conditioning** (e.g. wall insulation, double glazing, heat pumps)



Eligible projects (2)

- ◆ **High efficient electric appliances** (e.g. installation of A-rated fridges, dishwaters, washing machines)
- ◆ **High efficient office equipment** (e.g. installation of high efficient computers, printers, faxes)
- ◆ **Switching from other fuels to electricity when this produces primary energy savings** (e.g. various types of so-called electro-technologies)
- ◆ **Reduction of primary energy consumption for domestic heating, ventilation and air conditioning system** (e.g. district heating, cogeneration, fuel cells, electric or gas-fuelled heating pumps)
- ◆ **Promotion of end-use technologies fuelled by renewable sources** (e.g. solar systems for water heating, small photovoltaic systems, biomass cogeneration of domestic heating)
- ◆ **Electric and gas-fuelled vehicles**



Deemed savings (1)

Developed so far

- 1) **Compact Fluorescent Lamp**
- 2) **Replacement of electric water heaters with gas water heaters (residential)**
- 3) **Replacement of gas water heaters with more efficient gas water heaters (residential)**
- 4) **Installation of efficient (i.e. 4 stars) gas water heater (residential)**
- 5) **Double glazing (residential, offices, commercial, hospitals, schools)**
- 6) **Wall insulation (residential, offices, commercial, hospitals, schools)**
- 7) **Small PV plants (residential, offices, commercial, hospitals, schools)**
- 8) **Thermal solar for water heating**
- 9) **White goods: fridges, frizers, dishwashers, whashing machines**
- 10) **Low-flow showers' water taps**
- 11) **Low-flow water taps**



Deemed savings (2)

Developed so far

- 12) High efficiency electric motors (industrial uses)**
- 13) Heat pumps**
- 14) Light-flow regulators (public lighting)**
- 15) Na lamps (public lighting, substitution of HG lamps)**
- 16) Inverter application on hydraulic systems (small)**
- 17) Air conditioning (residential sector)**
- 18) High efficient (4 stars) boilers for condominium**

...and others to come



Engineering estimates

Developed so far

- 1) Energy recovery from natural gas de-compression
- 2) Inverter application on hydraulic systems (big)
- 3) CHP
- 4) District Heating

...and others to come



Summary of AEEG's tasks (1)

To kick start the whole mechanism:

◆ **Guidelines on:**

- projects **preparation**
- **evaluation** of project's results
- documentation to be transmitted to AEEG to allow for projects **verification** and **validation** (on a project-by-project basis)
- issuing of **tradable white certificates**

◆ **Criteria and rules for:**

- **cost recovery** via electricity and gas tariffs
- **sanctions** for non-compliance

◆ **Definition of TWC market rules** (upon proposal by the Electricity Market Operator)



Summary of AEEG's tasks (2)

Every year:

- ◆ **project conformity check** with legislative as well as *Guidelines* rules
- ◆ **approval of energy monitoring plans** for projects for which no simplified evaluation approach (i.e. deemed or engineering) has been defined
- ◆ **ex-post evaluation and certification of energy savings for each project**
- ◆ **annual report and proposals** to the Government concerning possible modifications of the system
- ◆ **compliance check** (with annual targets) + **sanctions for non-compliance**
- ◆ **cost recovery**



Supportive documentation in English

- ◆ Pavan, M. - *What's up in Italy? Market liberalisation, tariff regulation and incentives to promote energy efficiency in end-use sectors.* In Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings, August 2002
- ◆ Pavan, M. - *Tradable White Certificates: new instruments to promote energy efficiency and reliability of supply in a liberalised market context, Metering, Billing and CRM/CIS Europe 2003 (slide presentation)*



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(in Italian)**



Autorità per l'energia elettrica e il gas