

E-privacy 2012

Smart Grids – Il Contatore ti spia?

Roberto Leone

- Cosa sono le Smart Grids
- Smart Grids - Sicurezza vs. Privacy
- Smart Grids e Smart Meter: Attacchi e Difese
- Esempi e Casi di Studio

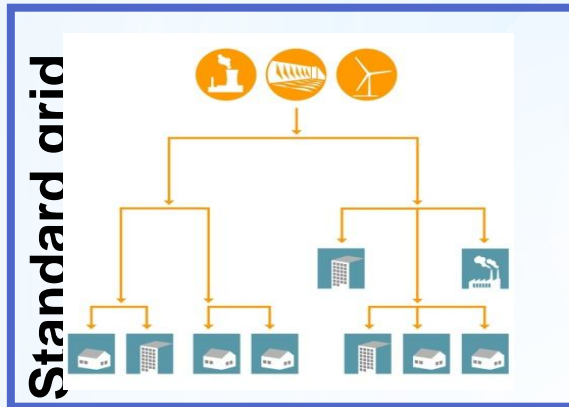
Il termine **Smart Grid** si riferisce alla modernizzazione del sistema di produzione, trasmissione, distribuzione e gestione dell'energia elettrica.

L'obiettivo è di ottimizzare l'efficienza e l'affidabilità del sistema attraverso il monitoraggio ed il controllo automatico delle operazioni svolte dagli elementi interconnessi facenti parte del sistema stesso.

Una Smart Grid è **caratterizzata** non solo da un **flusso** di elettricità **bidirezionale**, ma anche da un flusso di **informazioni** distribuite in tempo reale tra i dispositivi della rete, che permettono il bilanciamento istantaneo e automatico dell'offerta e della domanda

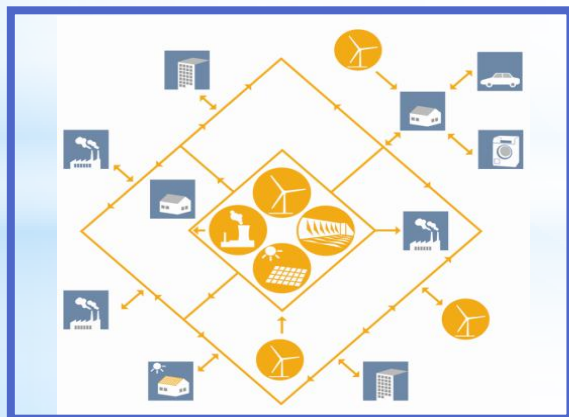
"ENERGYLAB 2011"
www.energylabfoundation.org

Dalla standard grid alle smart grids



- * Generazione centralizzata
- * Flusso di potenza monodirezionale
- * La Generazione segue il carico
- * Top-down operations

Smart grids



- **Generazione sia centralizzata che distribuita**
 - **Adatta alla gestione delle rinnovabili**
 - **Flusso di potenza multidirezionale**
 - **Flessibilità nella gestione del carico**

Le Smart Grid gestiscono:

- grandi quantità di dati,
- mediante **flussi bidirezionali** (Home verso Centrali e viceversa),
- veicolati su reti geografiche.

1. Quali sono i dati trattati?
2. Quale livello di Sicurezza?

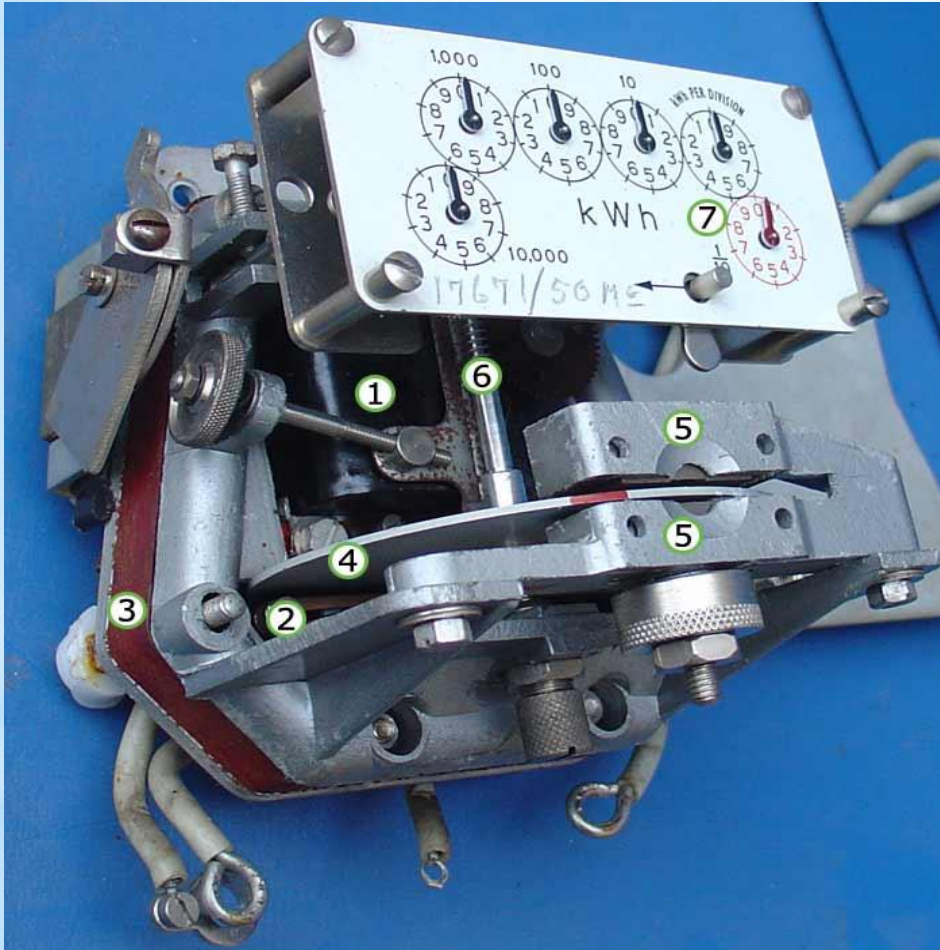
Sicurezza dei dati garantisce la Privacy?



Sicurezza è Condizione Necessaria ma NON sufficiente per garantire la Privacy

Sicurezza – aspetti peculiari delle Smart Grid

- Nuova Architettura
 - Sistemi altamente distribuiti
 - Sistemi di acquisizione intelligenti presso gli utenti (Smart Meter)
- Flussi Dati – circolazione dei dati degli utenti e di informazioni legate al *billing* (consumi e **rateo dei consumi**)
 - Circolano dati personali ???
- **Nuove tecnologie – vecchi problemi:**



Elettromeccanico



Stato Solido

Potenziali Problemi di Sicurezza per il Gestore

- Superficie di attacco molto più estesa:
 - +Minacce
 - +++Vulnerabilità
- Impatto rilevante in caso di attacco:
 - Alterazioni nella continuità operativa della grid
 - Perdita finanziaria - conseguenze legali per disservizi
 - Danno immagine

Superficie di attacco molto più estesa (Minacce e Vulnerabilità) +
Impatti rilevanti in caso di attacco



Rischi più elevati rispetto alle reti convenzionali

- **Motivazioni degli Attacchi**
 - Interferenza nell'erogazione (-> terrorismo /hacktivism)
 - Frode (simulare consumi minori/produzione maggiore)
 - Alterazione del Mercato (l'energia è un bene sul mercato)
- Casi di studio

2009 Puerto Rico -

A series of hacks perpetrated against so-called “smart meter” installations over the past several years may have cost a single U.S. electric utility hundreds of millions of dollars annually,

FBI - cyber intelligence bulletin -May, 27 - 2010

Electricity Grid in U.S. Penetrated By Spies

Cyberspies have penetrated the U.S. electrical grid and left behind software programs that could be used to disrupt the system, according to current and former national-security officials -

WSJ April, 8, 2009

Responsabilità del Gestore

- Possibili impatti:
 - Danni all'immagine aziendale
 - Contenzioso legale
 - Risarcimenti
 - Rifiuto da parte della clientela
 - Esempi nel seguito.....

"Corazzare" gli Smart Meter

- **Smart Meter Tamper Proof:**
 - Esempio: Protection Profile for the Gateway of a Smart Metering - System published by The German Federal Office for Information Security, v1.01.1

Proteggere i canali di comunicazione

- **Protocolli di Comunicazione Sicura:**
 - TLS/IPSec/SSH
 - Encryption con Algoritmi a Curve Ellittiche

FERC and Cyber Grid Security

FERC: Federal Energy Regulatory Commission

FERC Smart Grid Policy

- * NISTR 7628 - Guidelines for Smart Grid Cyber Security: Vol. 1, Smart Grid Cyber Security Strategy, Architecture, and High-Level Requirements, August 2010.
- * NISTIR 7628 - Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid, August 2010.
- * NISTIR 7628 - Guidelines for Smart Grid Cyber Security: Vol. 3, Supportive Analyses and References, August 2010.
- * Draft NISTIR 7628 Draft 1: Smart Grid Cyber Security Strategy and Requirements, September 2009.
- * Draft NISTIR 7628 Draft 2: Smart Grid Cyber Security Strategy and Requirements, February 2010.

- * Advanced Metering Infrastructure (AMI) System Security Requirement, 2008.

- * The National Infrastructure Protection Plan, 2009.
- * National Institute of Standards and Technology (NIST) Special Publication (SP), 800-39, DRAFT Managing Risk from Information Systems: An Organizational Perspective, April 2008.
- * Federal Information Processing Standard (FIPS) 200, Minimum Security Requirements for Federal Information and Information Systems, March 2006.

Smart Grid - Sicurezza per il Consumatore

Sicurezza – aspetti peculiari delle Smart Grid

- Flussi Dati – circolazione dei dati degli utenti e di informazioni legate al *billing* (consumi e **rateo dei consumi**)
 - Circolano dati personali ???

Smart Grid - Sicurezza per il Consumatore

Se la Grid è diventata permeabile ad attacchi esterni sono possibili attacchi specifici verso gli abitanti

Furto dei dati personali

Furto di identità

Profiling

- * Tracciamento dell'istante in cui i proprietari rientrano in casa
- * Individuazione di case vuote o temporaneamente non abitate
- * Stima del numero di persone che vivono in casa e dei loro movimenti

Analisi di marketing aggressive

- Valutazione del numero di elettrodomestici presenti in un'abitazione, delle loro caratteristiche e dei profili di utilizzo
- Analisi dell'utilizzo di tipologie di elettrodomestici

Esempio: individuazione con basso margine di errore degli utenti in possesso di TV

Paranoia?

Smart Grid - Sicurezza per il Consumatore



- * PRESS RELEASE
- * EDPS/10/12
- * Brussels, Monday 11 June 2012

The European Data Protection Supervisor (EDPS) is an independent supervisory authority devoted to protecting personal data and privacy and promoting good practice in the EU institutions and bodies. He does so by:

- monitoring the EU administration's processing of personal data;
- advising on policies and legislation that affect privacy;
- cooperating with similar authorities to ensure consistent data protection.

The [Opinion](#) is available on the EDPS website. For more information: press@edps.europa.eu

EDPS - The European guardian of data protection

www.edps.europa.eu



Follow us on Twitter: [@EU_EDPS](https://twitter.com/EU_EDPS)

Smart Grid - Sicurezza per il Consumatore



- * PRESS RELEASE
- * EDPS/10/12
- * Brussels, Monday 11 June 2012

Smart meters: consumer profiling will track much more than energy consumption if not properly safeguarded, says the EDPS

While the Europe-wide rollout of smart metering systems may bring significant benefits, it will also enable massive collection of personal data which can **track what members of a household do within the privacy of their own homes**, whether they are away on holiday or at work, if someone uses a specific medical device or a baby-monitor, how they like to spend their free time and so on. These patterns can be useful for analysing our energy use for energy conservation but together with data from other sources, the potential for extensive data mining is very significant. Patterns and profiles can be used for many other purposes, including marketing, advertising and price discrimination by third parties.

- **Daily Mirror – 9 giugno 2012**

"Government plans to install smart meters in our homes 'will leave us open to cyber attack'

Foreign computer hackers will be able to target individual homes

Campaigners say it goes to far and creates 'a spy in every home'

Home information could be 'sold' to burglars and identity thieves"

Read more: <http://www.dailymail.co.uk/news/article-2156648/Government-plans-install-smart-meters-homes-leave-open-cyber-attack.html#ixzz1xo9z93yw>

Smart Grid - Sicurezza per il Consumatore

*Preoccupazioni condivise anche negli USA!



Smart Meter Data: Privacy and Cybersecurity

Brandon J. Murrill
Legislative Attorney

Edward C. Liu
Legislative Attorney

Smart Grid - Sicurezza per il Consumatore

*Preoccupazioni condivise anche negli USA!

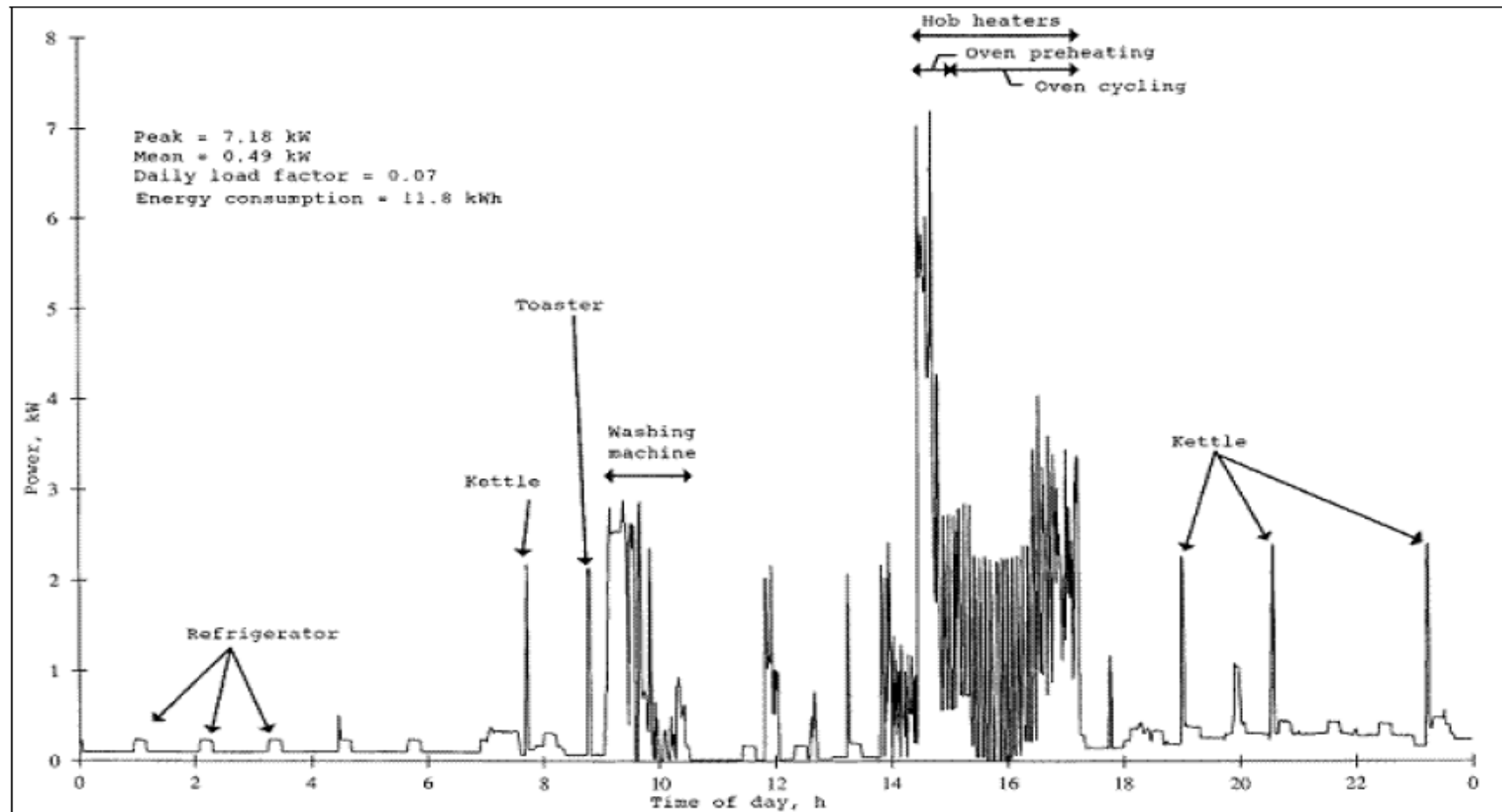
Smart Meter Data: Privacy and Security Concerns

Residential smart meters present privacy and cybersecurity issues¹⁹ that are likely to evolve with the technology.²⁰ In 2010, the National Institute of Standards and Technology (NIST) published a report identifying some of these issues, which fall into two main categories: (1) privacy concerns that smart meters will reveal the activities of people inside of a home by measuring their electricity usage frequently over time;²¹ and (2) fears that inadequate cybersecurity measures surrounding the digital transmission of smart meter data will expose it to misuse by authorized and unauthorized users of the data.²²

Sicurezza - Smart Grid - ANALISI REMOTA DEI CONSUMI

Figure 1. Identification of Household Activities from Electricity Usage Data

Unique Electric Load Signatures of Common Household Appliances



Source: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID 13 (2010), available at http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

Note: Researchers constructed this picture from electricity usage data collected at one-minute intervals using a nonintrusive appliance load monitoring (NALM) device, which is similar to a smart meter in the way that it records usage data. For a comparison of the technologies, see COLORADO PRIVACY REPORT, *supra* note 6, at A-1 to A-9.

- **Il problema Privacy**

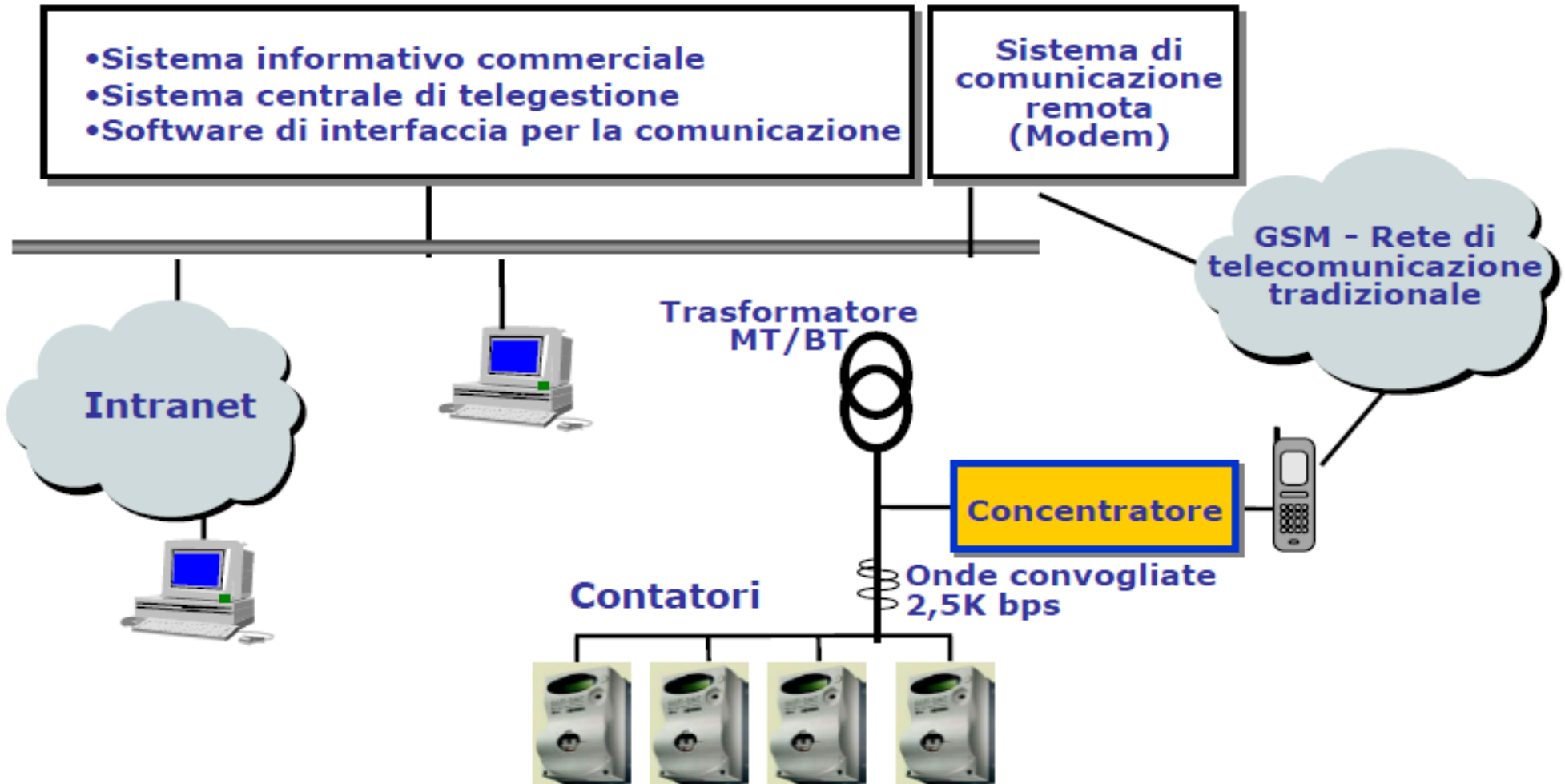
Privacy: la capacità di prevenire trasferimenti non voluti di informazione (mediante inferenza o correlazione) associati a **scambi legittimi di dati**

Il Gestore utilizza correttamente questi dati?

- Soluzioni: Adeguata Normativa e Compliance

Italian AMI - Advanced Metering Infrastructure

Architettura del sistema



- * NES - Networked Energy Services
- * <http://www.echelon.com/metering/>
- * Uses Power Line Carrier (PLC) for meter LAN
 - * All meters connect to a *data concentrator* which sits on the power line
 - * Repeater nodes are not necessary
- * Internet backhaul



Italian AMI - Advanced Metering Infrastructure

DOMANDA: i dati che transitano
sulla rete tramite
Telegestione garantiscono
la mia privacy?

RISPOSTA: "I dati rilevati tramite il sistema di
Telegestione sono unicamente quelli
essenziali per la gestione del contratto
di fornitura dell'energia elettrica,
in conformità alla normativa vigente"

**Smart Meter ENEL
Contatore Elettronico**



www.enel.it/it-IT/doc/reti/enel_distribuzione/FAQ_contatore.pdf

Italian AMI - Advanced Metering Infrastructure

DOMANDA: i dati che transitano sulla rete tramite Telegestione garantiscono la mia privacy?

Le funzionalità fondamentali del CE
Gestione dati relativi alla fornitura:

- anagrafica del Cliente
- potenza contrattuale, potenza disponibile, potenza limite
- data di fatturazione
-

Gestione dati relativi alle tariffe

- profilo tariffario settimanale
- struttura tariffa annuale
- prepagamento
- ...



http://ripamonticomo.it/corsi_indirizzi/progetto_telegestione.pdf

Funzionalità introdotte dal Contatore Elettronico

- **Effettuazione a distanza di transazioni commerciali che non richiedono interventi tecnici sulla presa (attivazioni, disattivazioni, ecc.)**
- **Gestione della riduzione del carico (morosità o per riduzione del carico)**
- **Autodiagnostica sulle corrette funzionalità del CE**
 - Protezione da manomissioni- antitamper
 - Dispositivo intrusione su porta ottica non autorizzata
- **Misura e memorizzazione dei dati per la fatturazione**
- **Visualizzazione messaggi personalizzati al Cliente**
- **Monitoraggio dei parametri della qualità del servizio (variazioni di tensione, interruzioni di tensione, curve di carico)**



http://ripamonticomo.it/corsi_indirizzi/progetto_telegestione.pdf

I sistemi di Smart Metering sono un potenziale punto di attacco per la Privacy degli utenti?

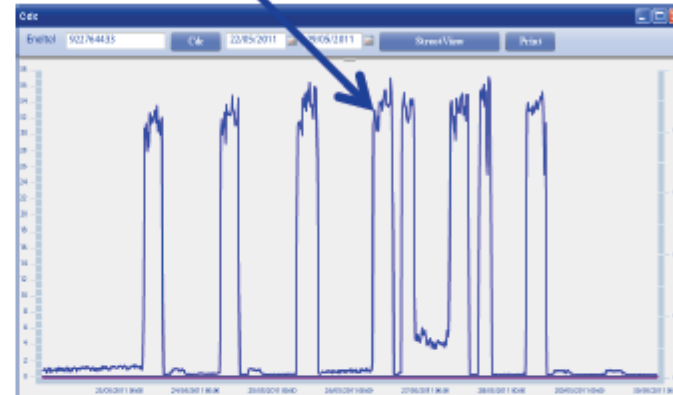
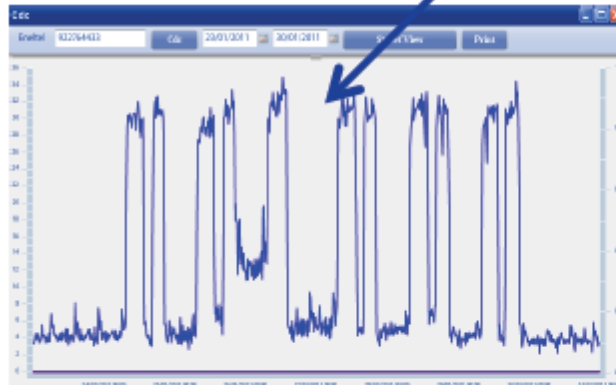
Potrebbero essere usati per:

- Determinazione del profilo comportamentale
 - Sorveglianza occulta
 - Profilazione dei consumi
 - Analisi dei comportamenti

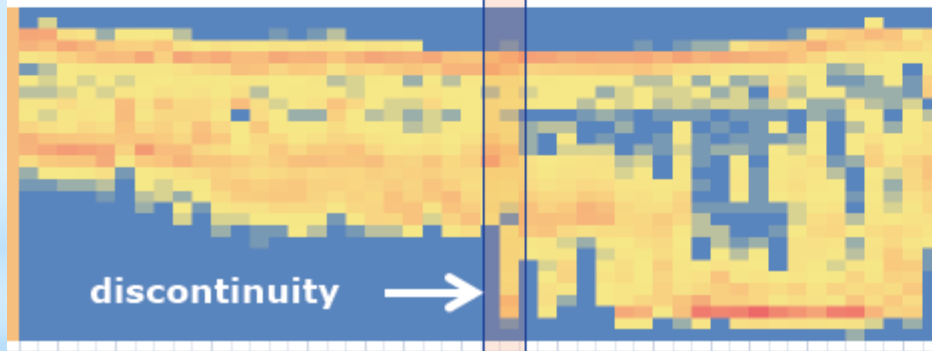
??

Protezione della Privacy - Smart Grid

Load profiles in two different weeks (avg. power in 15 min)



Daily power frequency distribution



Enel Smart Metering solution has

- not only robust antitampering
- but also advanced Mathematical and statistical modeling

to detect remotely
suspicious consumption behaviours

http://www.cez.cz/edee/content/file/o-spolecnosti/dcerine-spolecnosti/cez-mereni/konference_2012/ENEL_Buondonno_EN.pdf

Non solo Misuratori di elettricità: **Gas Smart Meter**



COD.080 - EG 2,5

max flow rate Q _{max} :	4 m ³ /h
min flow rate Q _{min} :	16 dm ³ /h
standard connection:	1" 1/4
max operating pressure:	0,5 bar g
operating temperature:	-20 a + 60 C

http://www.cpl.it/en/product_services/products_catalogue/natural_gas_smart_meter/eg4

I sistemi di Smart Metering sono un potenziale punto di attacco per la Privacy degli utenti!!!

C.V.D:

[TVs and Smartmeters - They know what you're watching](#)

At the 28th Chaos Computing Congress (28c3) hacker conference in Berlin, Germany researchers presented a talk titled "[Smart Hacking for Privacy](#)" where they looked into the privacy implications of "smart" electricity meters.

<http://www.youtube.com/watch?v=YYe4SwQn2GE&feature=youtu.be>

8 Gennaio 2012

TVs and Smartmeters - They know what you're watching

Dario Carluccio and Stephan Brinkhaus said they intercepted information sent between their smart meter devices and the servers of their energy supplier – German company Discovergy.

Because the data was unencrypted the researchers said they were able to analyse the information, which they said was sent at two second intervals, and determine intimate details about their energy consumption.

The researchers said the information could be used to establish details such as when houses are occupied, what appliances were being used and even what TV programme was being shown as a result of the traits revealed in the smart meter data associated with the energy used.

Smart Grid: mancata accettazione dei Clienti!

PG&E sued over new SmartMeters, soaring bills

[David R. Baker, Chronicle Staff Writer](#)

Tuesday, November 10, 2009

<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/11/09/BU851AHKGA.DTL#ixzz1vo8yJQLu>

Smart Grid: mancata accettazione dei Clienti!

<http://stopsmartmetersgr.wordpress.com/>

Stop Smart Meters Australia

Fighting for your financial & physical health, privacy, and safety in Australia



Home Actions you can take Contact Us Sign the Petition Like our Facebook Page Follow us on Twitter Forum Help spread the word

What are the issues? News Videos Share your Story How to use this site Health Issues Smart Meter Photos EMR testing & shielding info

Donate Contact details for letters Who's my power distributor?

Smart Grid: mancata accettazione dei Clienti!

Smart meter opt-out programs may be needed to “defuse” opposition, Chartwell report says

By [Matthew Burrows](#), January 25, 2012

Electric utilities across North America may need to gauge public sentiment and offer opt-out programs to opponents of [digital smart meters](#), according to an Atlanta-based research firm that works with the industry.

**Smart Grid Backlash
DEALING WITH AN ILLINOIS VETO**

Published In: [EnergyBiz Magazine November / December 2011](#)

**Maryland Smart Meter Awareness
MarylandSMARTmeterawareness.org**

"Privacy Concerns

Smart Meters are a **major invasion of privacy** as they transmit our energy use on an on-going basis. Our utilities will know when we are asleep, awake, home or away from home. As part of the Smart Grid, a new generation of “Smart Appliances” is being developed. These appliances will have chips that “talk” to our Smart Meter turning our homes into veritable microwave ovens. The meters will know what electronic appliances (including medical equipment) we have and how often we use them. While some utilities make assurances they will not release any of this data to third parties for marketing purposes, that may change as the value of this data to marketers soars. And there are currently no laws in place to prevent this. Police departments in Texas and Ohio have already obtained Smart Meter information from the utilities to verify alibis of criminal defendants despite the obvious constitutional issues.

Smart Grid: mancata accettazione dei Clienti!

**UPDATE (May 17, 2012) to PUC Activity regarding Stopping the Smart
Meter Installations**

Say NO to Privacy Invasion



BanTEXASsmartmeters.com

No to Smart Meters!

- **Contromisure: Normativa indirizzata alla protezione della Privacy**
- CALIFORNIA'S SB 1476 - "SMART METER PRIVACY STATUTE"
- "Prohibits any electrical or gas corporation, or any locally owned public utility that employs advanced metering (or "smart meters") from sharing, disclosing, or selling a customer's personal information data or consumption data, subject to certain exceptions, **and requires public utilities to adopt reasonable security measures to protect a customers personal information and consumption data from unauthorized access.**"

NISTIR 7628 Guidelines for Smart Grid Cyber Security

"Four dimensions of privacy are considered:

- (1) **personal information**—**any** information relating to an individual, who can be identified, directly or indirectly, by that information and in particular by reference to an identification number or to one or more factors specific to their physical, physiological, mental, economic, cultural, locational, or social identity;
- (2) **personal privacy** —the right to control the integrity of one's own body;
- (3) **behavioral privacy** —the right of individuals to make their own choices about what they do and to keep certain personal behaviors from being shared with others; and
- (4) **personal communications privacy** —the right to communicate without undue surveillance, monitoring, or censorship. "

IEA – International Energy Agency

Develop and implement consumer protection policies

The main consumer protection issues associated with smart grid deployments include:

- i) privacy, ownership and security issues associated with the availability of detailed customer energy consumption data;
- ii) customer acceptance and social safety net issues associated with new types of rates, especially dynamic pricing; and
- iii) consumer protection issues associated with remote disconnection functions made possible by smart grids.

Soluzioni Metodologiche - Privacy by Design – (Canada)

- **Privacy as the default** - Application of core principles expressing universal spheres of privacy protection;
- **Privacy embedded into design** - Addressing privacy concerns when developing information technologies and systems, throughout the entire information life cycle —end to end;
- Full functionality- positive sum not zero sum - Not trading off privacy for security in system design and instead ensuring both privacy protection and system functionality
- **End-to-end life cycle protection** – Recognition that protection of collected information must persist throughout the entire process from start to finish
- **Visibility and transparency** – Operating according to the stated promise and objectives, subject to independent verification;
- **Respect for users' privacy** – Keeping the interests of the individuals uppermost by offering such measures as strong privacy defaults, appropriate notice and empowering user friendly options.

Grazie dell'attenzione

Q/A

