AN OVERVIEW OF THE INTRODUCTION AND APPLICATION OF SMART METERING IN SWEDEN

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RISE Research Institutes of Sweden

Safety & Transport
Measurement Science & Technology

ISGAN
international smart grid action network

CENTRAL POWER RESEARCH INSTITUTE
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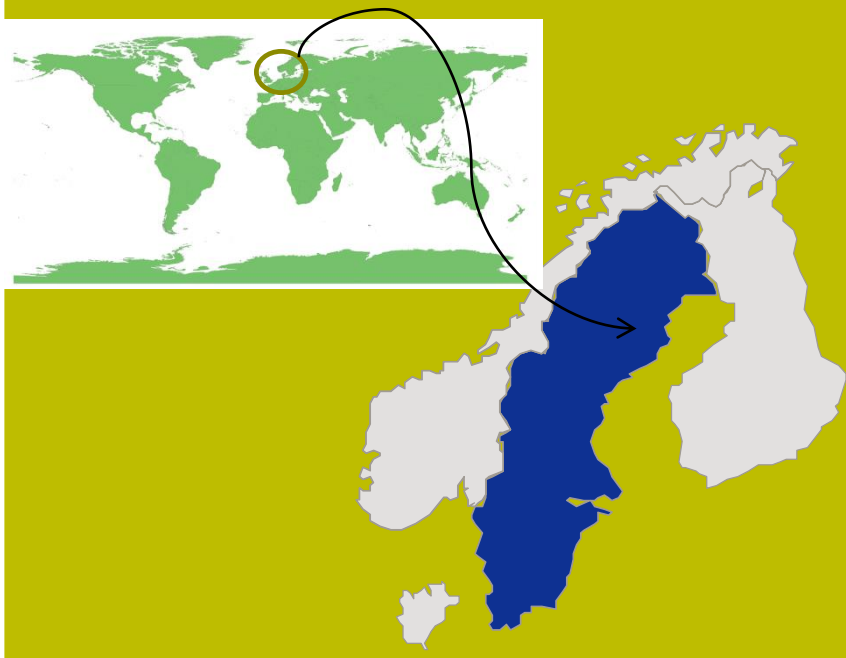
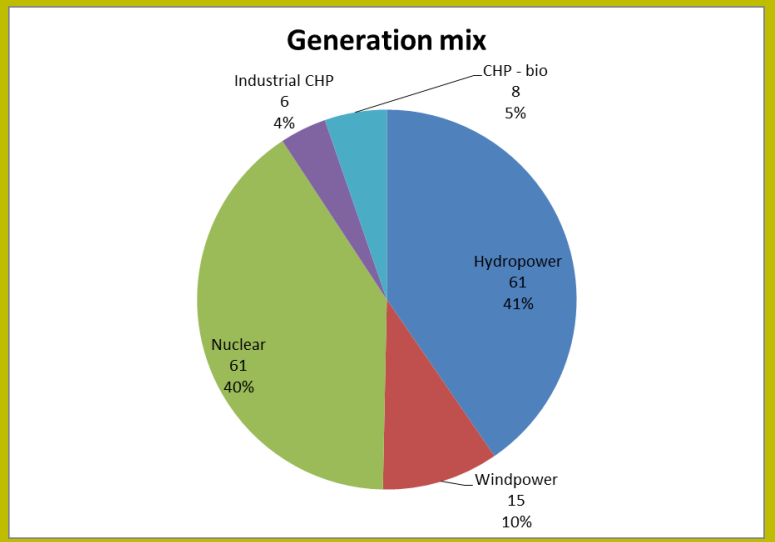
सत्यमेव जयते

National Smart Grid Mission
Ministry of Power
Government of India

Sweden and the electricity landscape

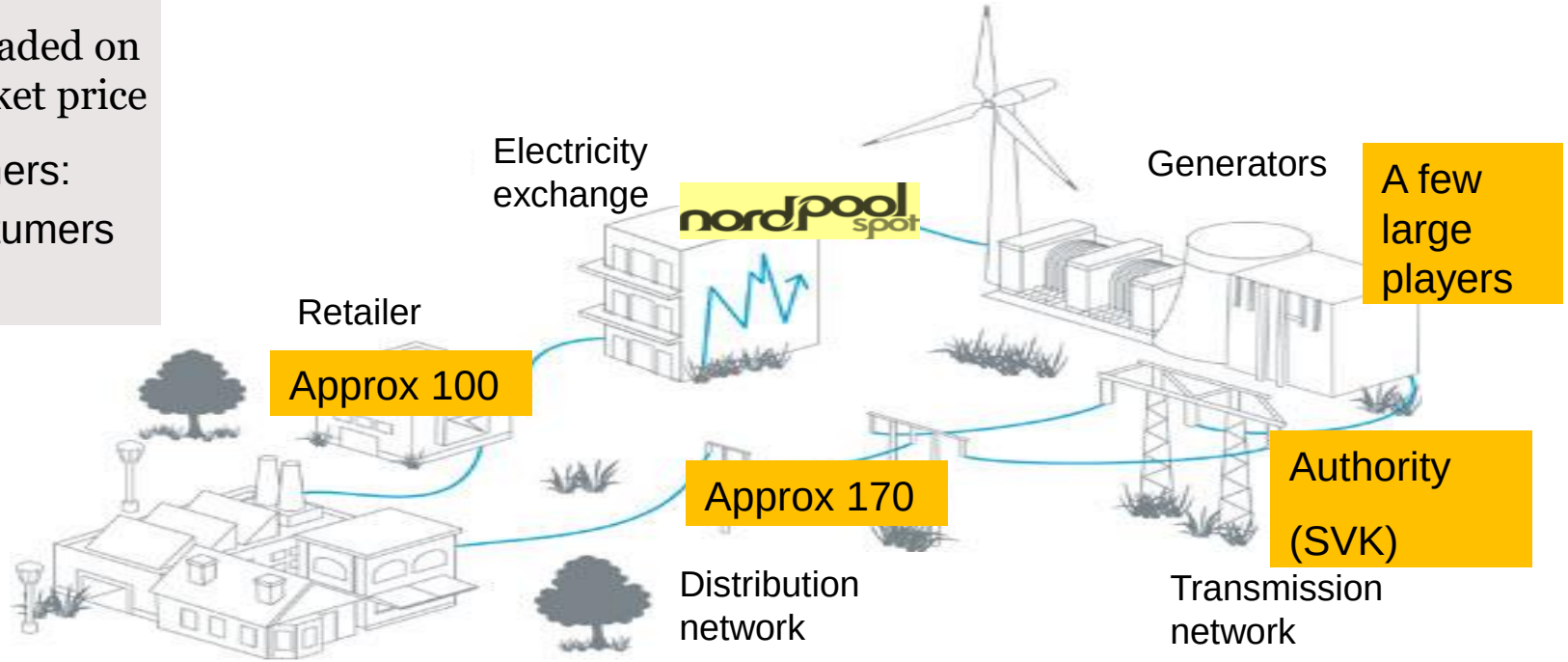
- 10 million inhabitants
- Total yearly electricity consumption approximately 155 TWh
- Consumption strongly driven by heating demand
- Approx. 15 000 KWh/person annually
- Most years net export of electricity
- Close collaboration with the other Nordic countries
- Nuclear reactors closing down, no new investments
- No new Hydropower
- Wind power growing rapidly





Overview of the Swedish electricity market

- Market liberalised since 1996
  - Unbundled and deregulated
  - Competition on generation and retail
  - +100 retailers, 170 distribution system operators, 1 transmission system operator
- 75% of Nordic power generation is traded on Nordpool, enabling transparent market price
- “Dynamic market” with active customers:
  - Approx. 30 percent of private costumers are active



Time line smart metering in Sweden

Driver for smart meter roll out

- Support deregulation from1996
- Boost competition on the retail side
- Monthly billing for all customers
- No meter functionality requirements

Some large DSO starts Smart Meter Rollout

Electricity Act:
1999 hourly metering
for +200A Fuse

Electricity Act:
demands monthly billing for all customers until 2009

Electricity Act:
1.7.2006 hourly metering for +63A Fuse

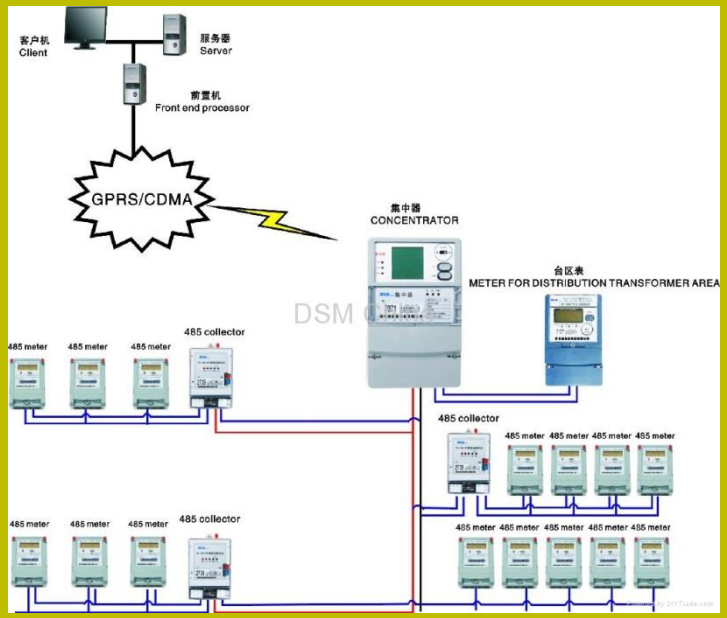
2002 2003 2004 2005 2006

Deregulation 1996

EU DIRECTIVE 2006/32/EC
demanding “meters that reflect […] actual energy consumption and […] information on actual time of use

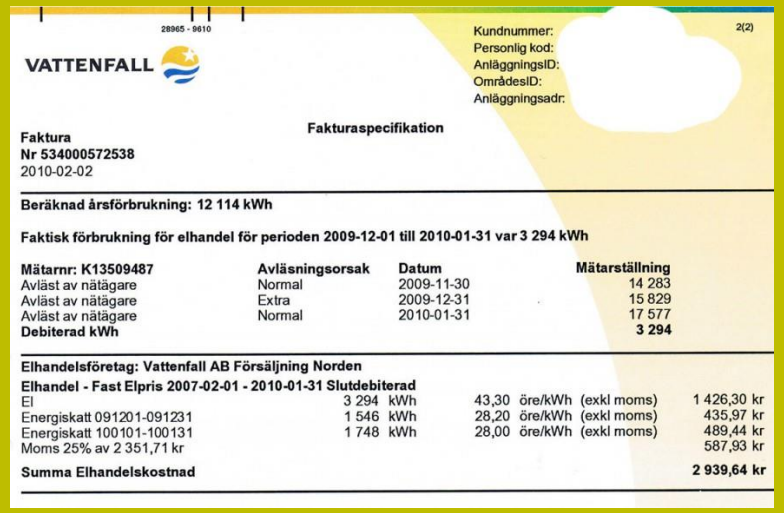
First generation smart meters 2009

- Only functionality to report monthly consumption
- Possible to realise this by manual readings – but to expensive
- Requirements for metering capabilities
- No standards for compatibility on meter communication
- Sweden second country in Europe with full roll out of meters
- Early realization that added functionality was very valuable
- Power line communication secondary substation to home
- GPRS/GSM from substation to DSO



First generation smart meter services

- Services for the Customer
  - Exact monthly bill
  - “On line” consumption data via the web
- Services Distribution system operator
  - Customer service tool
  - Remote reading: Retailer change, move in/move out
  - Tamper alarms
- First generation services generates most benefits for the DSO



VATTENFALL

Kundnummer:
Personlig kod:
AnläggningsID:
OmrådesID:
Anläggningsadr:

2(2)

Fakturaspecifikation

Faktura
Nr 534000572538
2010-02-02

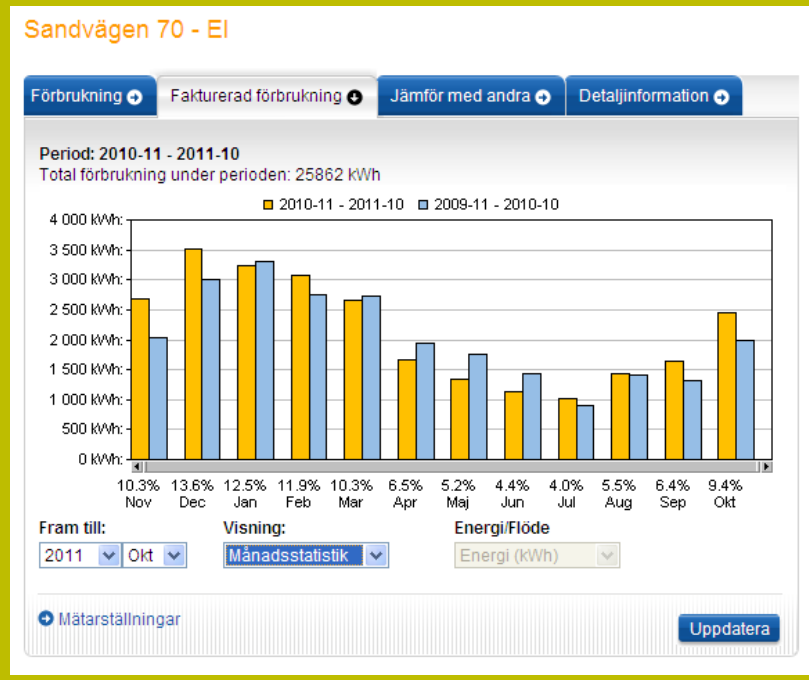
Beräknad årsförbrukning: 12 114 kWh

Faktisk förbrukning för elhandel för perioden 2009-12-01 till 2010-01-31 var 3 294 kWh

Mätarnr: K13509487	**Avläsningsorsak**	**Datum**	**Mätarställning**
Avläst av nätägare	Normal	2009-11-30	14 283
Avläst av nätägare	Extra	2009-12-31	15 829
Avläst av nätägare	Normal	2010-01-31	17 577
Debiterad kWh			**3 294**

Elhandelsföretag: Vattenfall AB Försäljning Norden
Elhandel - Fast Elpris 2007-02-01 - 2010-01-31 Slutdebiterad

El	3 294 kWh	43,30 öre/kWh	(exkl moms)	1 426,30 kr
Energiskatt 091201-091231	1 546 kWh	28,20 öre/kWh	(exkl moms)	435,97 kr
Energiskatt 100101-100131	1 748 kWh	28,00 öre/kWh	(exkl moms)	489,44 kr
Moms 25% av 2 351,71 kr				587,93 kr
Summa Elhandelskostnad				**2 939,64 kr**



Time line smart metering in Sweden

2009 Monthly billing
to all customers

Electricity Act:
Oct 2012 Hourly metering

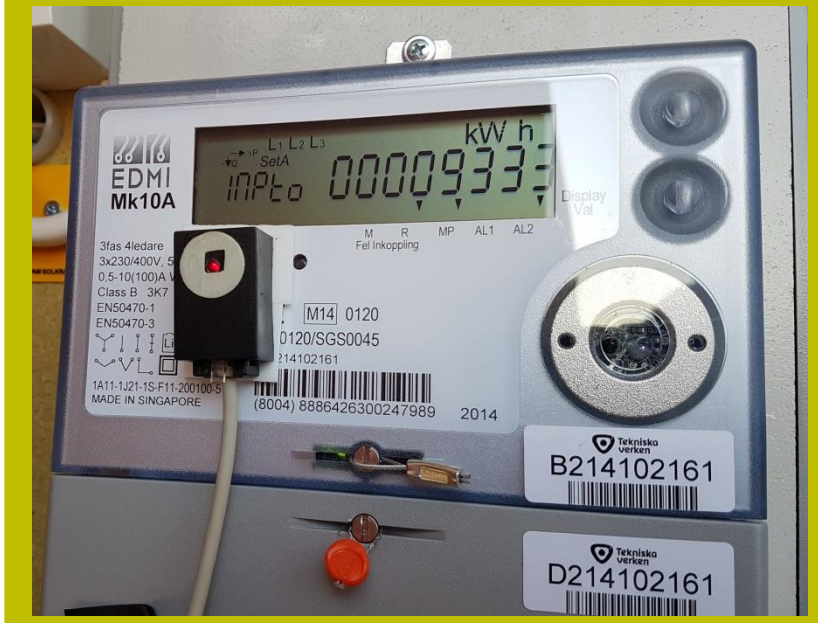
- Spot price tariffs feasible
- Must be provided, if customer demands from supplier

2007 2008 2009 2010 2011 2012

EU DIRECTIVE 2009/72/EC
Demanding 80% ‚intelligent Metering Systems' by 2020 for all cases being assessed positively

Second generation smart meters, post 2009

- No new requirements but anticipation of hourly metering
- Upgrading rather than replacing
- More European countries testing Smart Meter
- Unlocking added functionality
- Some remote control capabilities (switch on and off)
- Third party service development
- No HAN interface but local services developed anyway

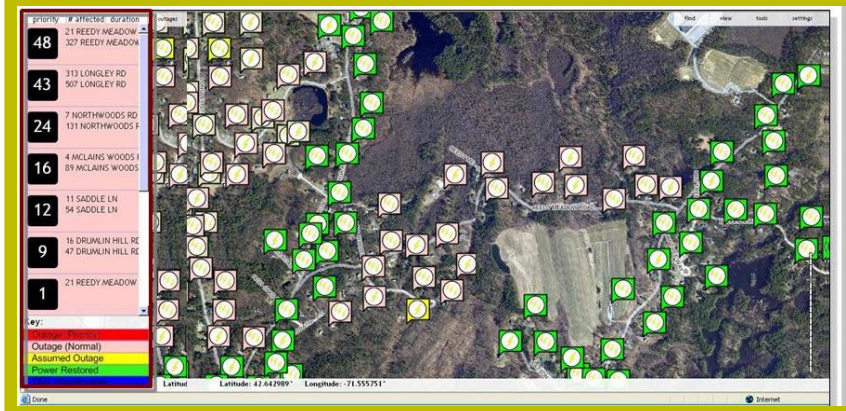


Second generation smart meter services

- Services for the Customer
  - Smart phone interface
  - Integration with smart home equipment
  - Third party developers
  - Energy use optimasation, passive

- Services Distribution system operator
  - Developed customer service tool
  - Load profiles – Daily/hourly resolution
  - Outage management (fault location)
  - Detection of zero lead faults
  - Remote switching off – inactive premises
  - More advanced Fraud detection

- Second generation services still most benefits for the DSO



Time line smart metering in Sweden

New generation smart meters tested in large scale replacement of 2009 generation

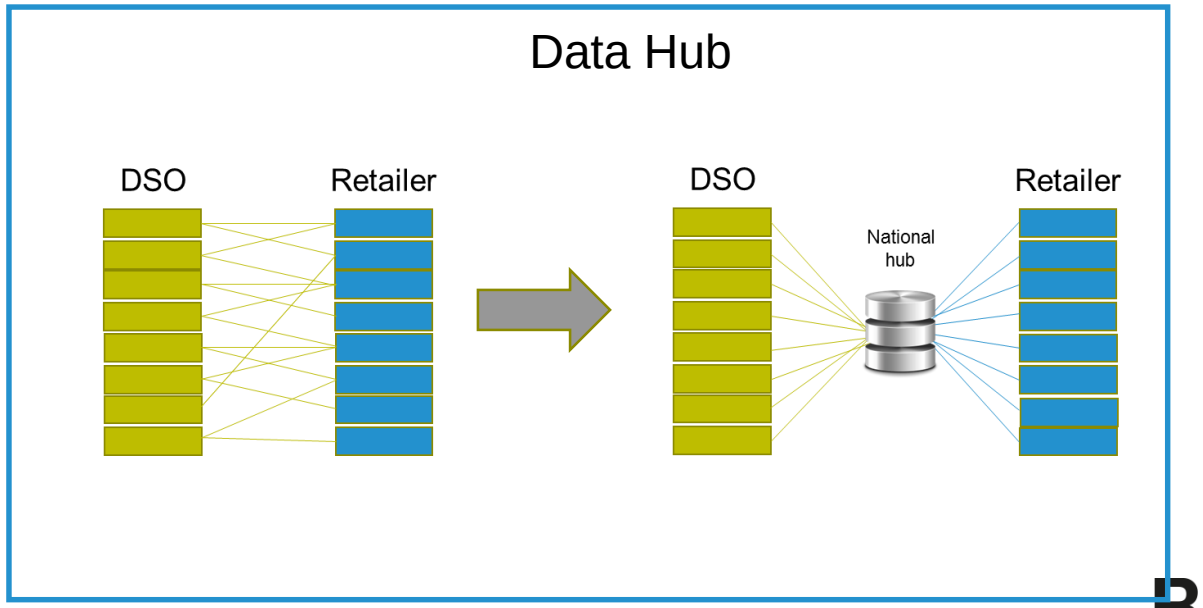
Smart Meters in secondary substations

Proposed New functional requirements for meters in Sweden

Swedish data hub for electricity metering

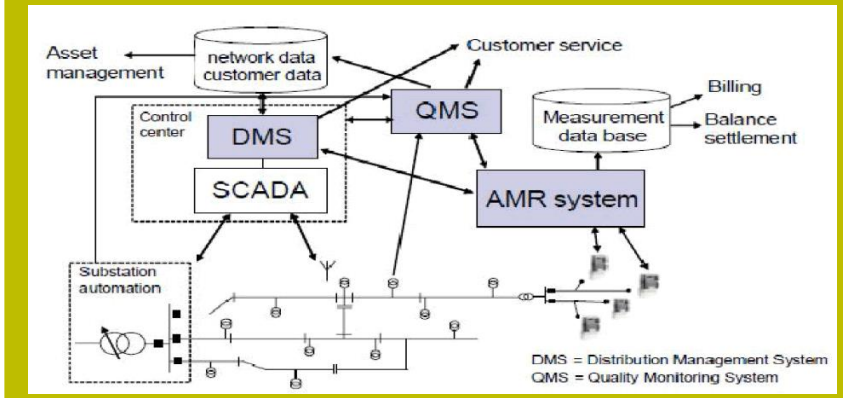
2015 2017 2019 2021 Future

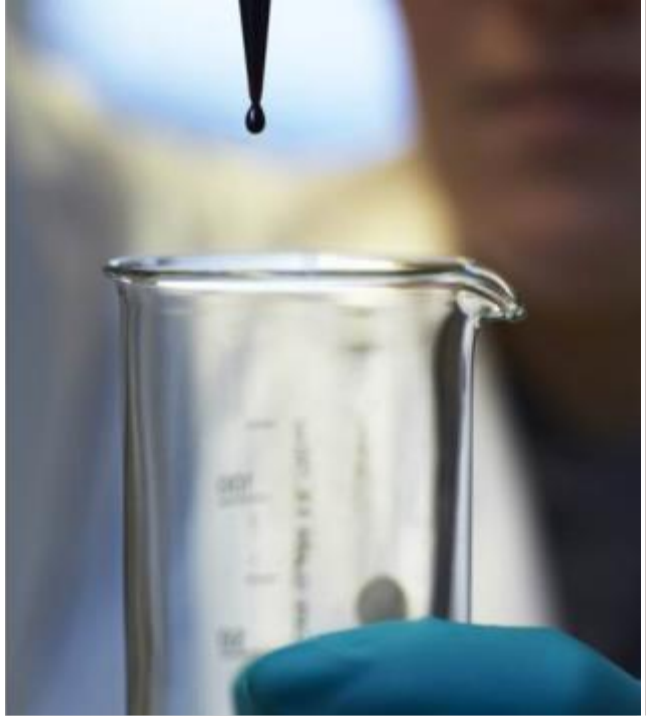
- Proposed Functional requirements
  - Extended meter data (V, A P, Q etc)
  - Public customer interface
  - Remote reading (!)
  - Hourly (15 minutes) recording of active energy
  - Outage recording
  - Remote upgrade
  - Remote switching
  - Zero fault detection and alarm



Next generation smart meter services

- Services for the Customer
  - Full integration with Demand Response Services
  - Full integration with smart home functionality
  - Market integration for prosumers
  - Tailored retail contracts
  - ….
- Services for Energy Service Companies
  - Energy declarations
  - Energy consultations
  - Aggregation of end customers
  - Electric Vehicle charging support/control
  - ….
- Services Distribution system operator
  - Integration of customer data in Network Planning Tools
  - Integration of customer data in Distribution Management Systems
  - Integration of customer data in Outage Management Systems
  - ….





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