Arthur D Little

Innovationsmotor unter Spannung

Smarte Netze in Österreich 2014-2020

13. Symposium Energieinnovation

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Die Studie erhebt den Status und die Herausforderungen für Smart Metering und Smart Grid in Österreich

Studienziel

1. Status und Pläne für Smart Metering und Smart Grid in Österreich 2014-2020
2. Herausforderungen und Verbesserungspotentiale
3. Sicht von Meinungsführern aus Politik, Interessensvertretungen und Industrie

Vorgehen

- Interviews mit 8 der 11 größten Verteilnetzbetreiber (vorwiegend Geschäftsführungs-/Vorstandsebene)
- Interview mit Politikern, Regulator und Interessensvertretern
- Analyse & Recherche im internationalen Vergleich

Smarte Meter sind langfristig ein Innovationsmotor für Österreich – Kosten/Nutzen-Verhältnis sollte durch verstärkte Zusammenarbeit aller Beteiligten verbessert werden

Kernergebnisse - Smart Metering (1/2)

1 Smart Meter sind aufgrund der gesetzlichen Vorgaben am Anrollen – Tarife werden steigen

- Bei allen Verteilnetzbetreibern laufen die Vorbereitungen für den Smart Meter Rollout ab 2014/2015 auf Hochtouren
- Investitionen werden durch Kunden mit höheren Netz-Tarifen bezahlt
- Die Opt-Out Möglichkeit wird vermutlich von sehr wenigen Haushalten genutzt werden, wenn die Netzbetreiber positiv kommunizieren und es keine negative Medienkampagne gibt

2 Smart Meter sind der erste Schritt in die Digitalisierung der Energieinfrastruktur beim Endkunden – Nutzen zeigt sich jedoch erst langfristig

- Erwartungen auf kurzfristigen Nutzen (z.B. effizientere Prozesse, Einsparung von Energie) sind überhöht
- Direkter Nutzen können variable Tarife sein – bei bekannt niedriger Wechselbereitschaft wird die Auswirkung gering sein
- Langfristig sind Smart Meter ein Innovationsmotor – Heimautomatisierung, Energieeffizienz , verbesserte Lastprofile, etc.

Smarte Meter sind langfristig ein Innovationsmotor für Österreich – Kosten/Nutzen-Verhältnis sollte durch verstärkte Zusammenarbeit aller Beteiligten verbessert werden

Kernergebnisse - Smart Metering (2/2)

3 Derzeit gibt es nur begrenzte Zusammenarbeit zwischen den beteiligten Spielern

- Derzeit Divergenzen zwischen Gesetzgeber, Exekutive, Regulator und Netzbetreibern
- Chance auf Zusammenarbeit der Verteilnetzbetreiber, um Kostensynergien zu erzielen, wurde nicht genutzt
- Österreich-weites Funknetz in Planung – Zeitplan und Realisierungschancen unklar

4 Kosten/Nutzen-Relation kann durch gemeinsames Vorgehen optimiert werden

- Österreichische Projekte sind im internationalen Vergleich sehr klein – führt zu Kostennachteilen und Ineffizienzen
- Mix aus verschiedenen Technologien, Implementierungen und Prozessen erschwert Innovationen in der Zukunft
- Investition in offene (Kommunikations-)Technologien sind wichtig – Sicherheitsbedenken sind dabei nicht begründet
- Gemeinsames Vorgehen von Gesetzgeber, Regulator, Netzbetreibern und Interessensvertretern, um die Probleme zu beseitigen und den Nutzen zu maximieren

Smart Grid ist eine wichtige Zukunftstechnologie für die Netze – derzeit noch im Anfangsstadium. Netzbetreiber sind sehr aktiv, um sich auf großflächigeren Einsatz vorzubereiten

Kernergebnisse - Smart Grid

1 Smart Grid-Anwendungen erleichtern Einspeisung von erneuerbaren Energien und können helfen, die Qualität zu steigern

- Erneuerbare dezentrale Erzeugungskapazitäten (Photovoltaik, Wind, Kleinwasserkraft) ist volatil - intelligentes Management in Niederspannungs- und Mittelspannungsebene notwendig
- Intelligente Schaltungen ermöglichen die generelle Hebung der Versorgungsqualität (Ausfallsicherheit durch „Selbstheilende Netze“)
- Derzeit noch im Anfangsstadium – nur wenige Anwendungen

2 Derzeit werden die Smart Grid-Komponenten teilweise noch nicht als konkurrenzfähig wahrgenommen – dienen heute oft auch als Übergangslösungen bevor große physische Investitionen in das Netz getätigt werden

- Kosten für Komponenten sind noch nicht konkurrenzfähig
- „Robustheit“ der Komponenten ist noch nicht ausreichend, um mit den Erwartungen der Netzbetreiber Schritt halten zu können

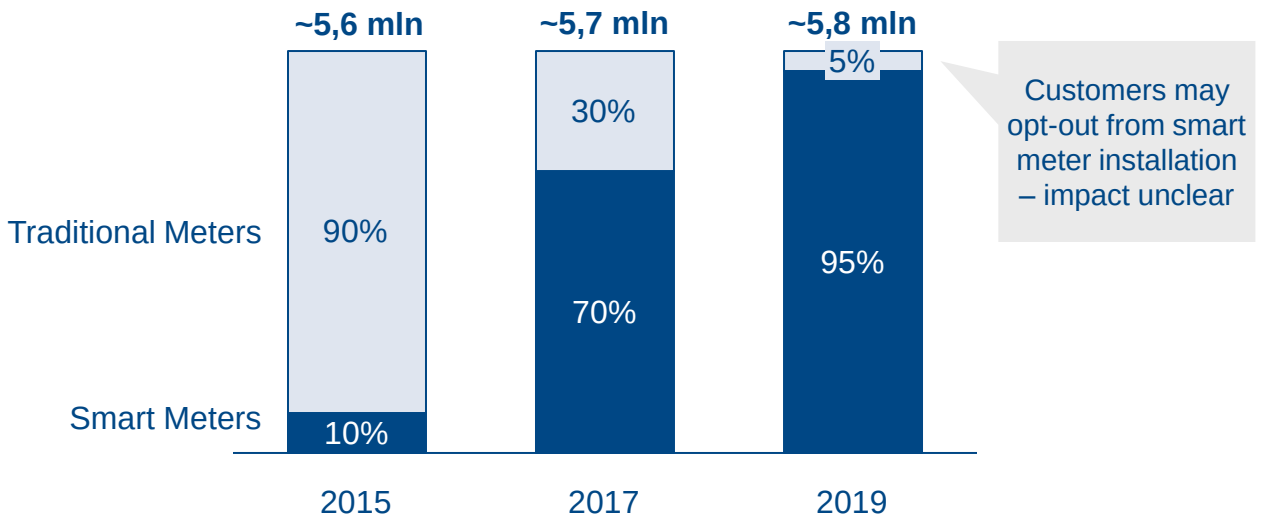
3 Investitionen in Smart Grid-Projekte sind jetzt wichtig, um durch „Lernkurven“ Kosten zu senken und Zuverlässigkeit zu heben

- Vielzahl an Pilotprojekten in Österreich – Förderungen sind hier wichtiger Treiber
- Umfassende Kooperationen zwischen Netzbetreibern und mit Forschungseinrichtungen

Austria's legislation and regulator introduced an ambitious schedule for Smart Meter roll-out. Uncertainties in legal requirements impose challenges for DSOs

Smart Meters - Legal requirements for Rollout

Penetrations requirements



Technology specifications

- Specific requirements for smart meters
  - Measurements in 15min intervals
  - Storage capacity
  - Bi-directional communication
- Uncertainty in regulation regarding communication security ("state-of-the-art")
- Existing meters & infrastructure may be used in the future

Unclear technology specifications lead to uncertainties of DSOs, which (operating) costs will be accepted by regulator in future tariff calculations

Source: ELWOG 2013, IME-VO, IMA-VO, DAVID-VO

All major DSOs in Austria have started pilot projects for smart metering. Linz Stromnetz and Netz Oberösterreich are already rolling out on full scale

Region		Distribution System Operator	Meter Points[1]		Smart Meter Pilot Projects	Technology preferences	Roll-out plans
			Power	Gas			
1	Burgenland	Netz Burgenland Strom / Erdgas	200.000	n.a.	150	Favor for proprietary	In preparation
2	Kärnten	Kärnten Netz	300.000	n.a.	400	Favor for proprietary	In preparation
3	Niederösterreich	EVN Netz	810.000	290.000	300	Unknown	On hold
4	Oberösterreich	Netz Oberösterreich	617.000	n.a.	1.000	Proprietary (rollout)	Started
5	Linz	Linz Stromnetz / Gasnetz	250.000	n.a.	3.000	Proprietary (rollout)	Started
6	Salzburg	Salzburg Netz	420.000	34.000	500	Favor for Open Standards[2]	In preparation
7	Steiermark	Stromnetz Steiermark	450.000	n.a.	400	Favor for proprietary	In preparation
8	Graz	Stromnetz Graz	120.000	n.a.	100	Favor for proprietary[2]	In preparation
9	Tirol	TINETZ-Stromnetz Tirol	216.000	n.a.	6.000	Favor for Open Standards	In preparation
10	Vorarlberg	Vorarlberger Energie-Netz	175.000	n.a.	500	Favor for proprietary	In preparation
11	Wien	Wiener Netze	1.500.000	700.000	3.000	Favor for Open Standards	On hold
12	Others	15 medium sized DSOs	869.000	n.a.		Unknown	Unknown
	Total		5.927.000	n.a.			

Source: Company information, Report 3/2013

[1] Approximate values [2] Assumption based on desk research
[3] SGMS: Smart Grid Modellregion Salzburg

As a result of the low interest of Austrians in their power infrastructure, we believe that the rate of opt-out will be low – probably far below 10%

Impact of opt-out legislation

- Due to the ElWOG amendment of 2013 customers have to be granted the right to refuse having a Smart Meter installed
- Communication & information obligations by DSOs and the regulator
  - The regulator E-Control is obliged to inform customers especially in relation to cost situation, grid situation, data privacy and data security
  - This is equally true for DSOs who are furthermore compelled to provide detailed information on the development of consumption

Drivers

Increasing Opt-out	Decreasing Opt-out
Technical avoidance (including health issues)	Lack of individual interest in energy topics[1]
Technical security	Currently almost no opt-out in rollout projects (Oberösterreich and Linz)
Cost allocation	
Lack of understanding of purpose and benefits	

Managing the opt-out risk

- Mitigate the risk of a negative media campaign
  - Proactively inform all media in Austria of the high security standards in data communication
  - Visibility in public discussions (e.g. panel discussions, information campaign events)
- Stay informed on developments in legal or regulatory framework
  - Engage in relationships with opinion leaders, regulator and DSOs to stay on track of current adaptions
  - Observe current political proceedings of government negotiations – although all major parties currently support the Smart Meter rollout
- Comprehensive and positive communications for rollout

[1)] Annual churn of energy suppliers in Austria: 1,7%

Two competing companies have acquired licenses for 450MHz frequency bands on which they want to build a CDMA network for Smart Meter and Smart Grid communication

Alternative: Nationwide CDMA service provider

- Two companies, Schrack Mediacom and Kapsch received licenses for 450MHz frequency bands on CDMA basis
- Both companies aim at building a nationwide CDMA network for Smart Meter and Smart Grid data communication (back-haul or direct communication)
- DSOs have shown interest due to economical and technological advantages, the regulator's position however is not yet clear
  - CDMA on 450 MHz allows to reach meters in sub-terrain locations (basement, etc.)
  - Network roll out would require approx. 300 – 350 base stations nationwide – providing a relatively low-cost option [1]
  - Schrack licences are sufficient to run two physically separate communication networks, e.g. to separate Smart Metering and Smart Grid [1]

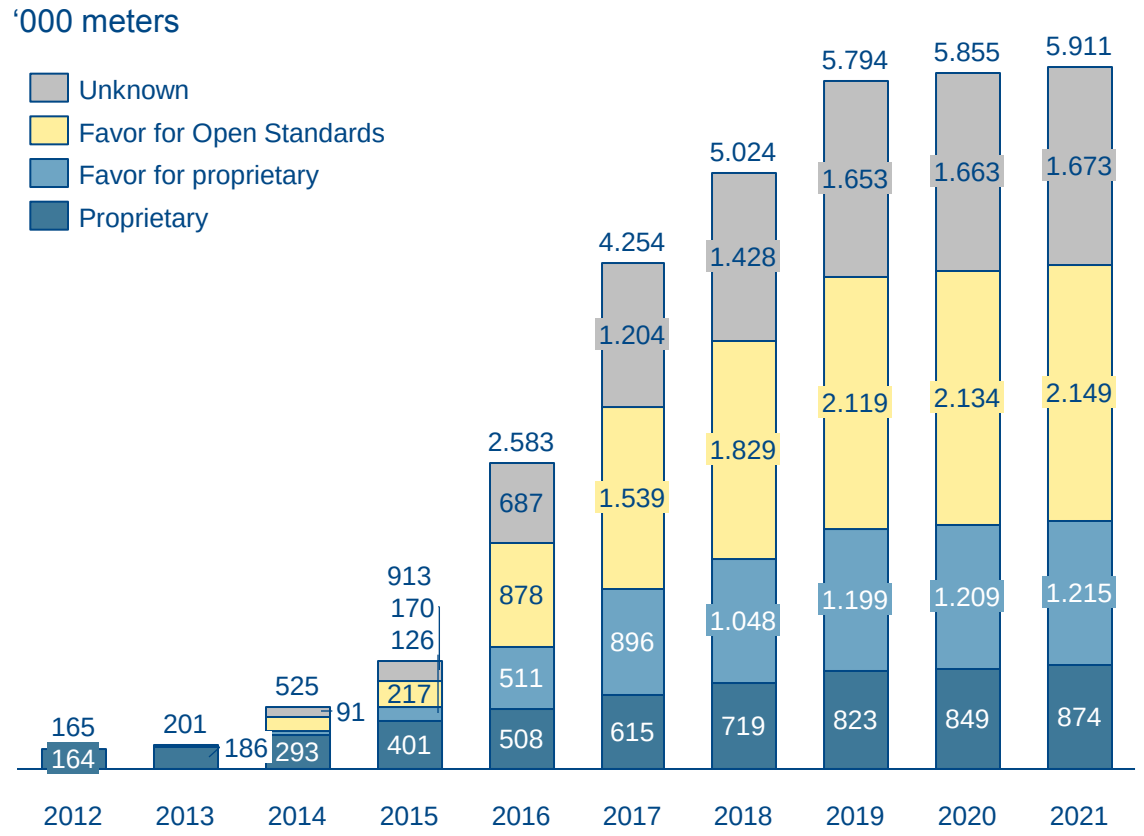
SCHRACK MEDIACOM

kapsch

[1)] Company information by Schrack Mediacom

Technology preferences by Managing Directors often follow the "Security by obscurity" approach, hence they favor proprietary protocols. Three DSOs clearly expressed a Favor for Open Standards

Installed Smart Meters
by Communication Technology Preference



Comments

Proprietary technology
- Two DSOs have already decided to use proprietary technology (Oberösterreich and Linz)
- Roll-Out projects have started when open standards technology was not offered by Smart Meter suppliers

Favor for proprietary technology
- Majority of DSOs favor proprietary technology due to perceived security advantages
- Tenders are in preparation – no information on consideration of IP-protocols

Favor for Open Standards
- The largest DSO, Wiener Netze, expressed a Favor for Open Standards protocols, although the managing director still sees security concerns
- Tinetz Stromnetz Tirol AG favors IP-protocols

Unknown
- No information available for EVN Netz and smaller DSOs (<100k metering points)

Source: Company information, Arthur D. Little calculation

Remark: Calculation does not include Opt-out

By 2021 all DSOs aim at equipping 95% of their metering points with meter infrastructure, allthough several DSOs have put start of rollout-programs on hold

Smart Meter Rollout Projection

In '000 meters	Technology preference	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Netz Burgenland	Favor for proprietary	0	0	0	21	86	151	176	201	202	204
Kärnten Netz	Favor for proprietary	0	0	15	30	122	213	252	292	293	294
EVN Netz[1]	Unknown	0	0	41	82	331	581	689	798	803	807
Netz Oberösterreich	Proprietary (rollout)	100	100	185	271	356	442	524	606	609	613
Linz Stromnetz	Proprietary (rollout)	64	86	108	130	152	174	196	217	239	261
Salzburg Netz	Favor for IP[2]	1	1	21	42	171	300	356	412	414	416
Stromnetz Steiermark	Favor for proprietary	0	1	1	45	183	320	378	437	439	440
Stromnetz Graz	Favor for proprietary[2]	0	0	6	12	49	85	90	94	99	99
TINETZ	Favor for IP	0	0	11	22	88	155	184	213	214	215
Vorarlberger Energienetze	Favor for proprietary	0	0	9	18	72	127	151	175	176	178
Wiener Netze[1]	Favor for IP	0	0	76	152	618	1.083	1.289	1.494	1.506	1.518
Others (smaller DSOs)	Unknown	0	13	50	88	355	623	739	856	861	866
Total		165	201	525	913	2.583	4.254	5.024	5.794	5.855	5.911

Source: Company information, Arthur D. Little calculation

Remark: Calculation does not include Opt-out

[1)] Rollout schedule put on hold

[2)] Assumption based on desk research

Proprietary protocols do not provide stronger security over a publicly known standard such as IP. It is rather possible that they provide a false perception of security

Security approaches	
Security by Obscurity	■ Uses proprietary standard for communication ■ Attempts to use secrecy of design or implementation to provide security ■ May have theoretical or actual vulnerabilities that designers believe are not known and therefor unattractive for hackers
Security by Design	■ Uses publicly known standard for communication ■ Security is ensured through encryption technology – access to system can be gained through a secret key (which is not publicly known) ■ Since it is secure everyone is allowed to know and understand the design (flaws will be detected earlier - Linus' Law)
Open Security	■ Is the use of open source philosophies and methodologies to approach computer and information security challenges ■ Suggests that security breaches and vulnerabilities can be prevented better due to open source philosophy ■ Users need to be able to collaborate legally on source codes (software has to be widely accepted as open source)

Conclusions

- Some DSOs in Austria pursue a false perception of security
  - Favouring proprietary protocols over open standards as they perceive them more secure – application of "Security by Obscurity" approach
  - False perception of security
- Regardless of protocols, security in Smart Meter systems can only be guaranteed by security by design approach
- A publicly known communication and security standard rather increases security aspects as loopholes are easier identified and closed

„A cryptosystem should be secure even if everything about the system, except the key, is public knowledge."
Auguste Kerkhoffe - 1883

„System security should not depend on the secrecy of the implementation or its components."
United States National Institute of Standards and Technology

Source: Princeton University, Arthur D. Little

Smart grid projects in embryonic phase with slow uptake expected. Communication used in parallel with Smart Metering

Smart Grid Status

Region		Distribution System Operator	Connected Stations[1]		Preference regarding communication
			Distributed generation	Distribution automation	
1	Burgenland	Netz Burgenland Strom / Erdgas	n.a.	40	Proprietary protocols are preferred but cost analysis
2	Kärnten	Kärnten Netz	n.a.	n.a.	Proprietary protocols are preferred
3	Niederösterreich	EVN Netz	n.a.	n.a.	Unknown
4	Oberösterreich	Netz Oberösterreich	<10	160	Proprietary protocols are used
5	Linz	Linz Stromnetz / Gasnetz	<10	n.a.	Proprietary protocols are used
6	Salzburg	Salzburg Netz	n.a.	n.a.	Favor for Open Standards[2]
7	Steiermark	Stromnetz Steiermark	n.a.	50-80	Favor for proprietary
8	Graz	Stromnetz Graz	n.a.	n.a	Favor for proprietary[2]
9	Tirol	TINETZ-Stromnetz Tirol	n.a.	n.a.	Favor for Open Standards
10	Vorarlberg	Vorarlberg Energie Netz	16	tbd.	Favor for proprietary
11	Wien	Wiener Netze	~0	0	Favor for Open Standards

Comments

- Integration of distributed generation in MV and LV grids is main smart grid functionality
- Rollout / migration plans at small scales only – mainly for limited functionalities and with clear positive business case indication for DSOs
- Communication parallel to Smart Meter communication (e.g. via fiber, copper, GPRS, PLC, etc.) – partially separated physically

[1)] Medium and low voltage grids, number of connected substations, transformer stations or other sensor nodes

[2)] Assumption based on desk research

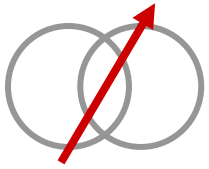
In Austria, several options are being tested to manage volatility in the grid

Selection

Approaches for Integration of Distributed Generation

Linear regulator

- Controls voltage levels along a grid line



- Keeps voltage levels low even in remote grid lines
- Example: Netz Oberösterreich

Remote Voltage Monitor

- Controls the feed in voltage of small PV plants

- Reduces feed – negative reception with PV owners
- Example: EVN Netz

Adjustable Distribution Transformer

- Controls voltage levels at the transformer station

- Potential problem with remote grid lines
- Example: Stromnetz Steiermark, Salzburg Netz, others

Wind generation capacity is often directly linked to DSO's (sometimes TSO's) SCADA systems (Example: Netz Burgenland)

Most opinion leaders see benefits from Smart Meter roll out in the long-run. Data security and a push for open standards in communication is seen as key

Opinion Leader Overview


Michael Fuchs
Industriellenvereinigung


Martin Graf
E-Control


Peter Haubner
ÖVP


Dorothea Herzele
Arbeiterkammer


Wolfgang Katzian
SPÖ


Nadja Shah
Mietervereinigung


Ursula Tauschek
Österreichs Energie


Hansjörg Tengg
Smart Tech


Bernd Vogl
Stadt Wien, MA 20 - Energieplanung

Smart Meter – Benefits and Disadvantages

- Smart Meters are perceived as enabler for innovative developments in the energy and utility sector
- Smart Meters will help to strengthen energy awareness
- Several opinion leaders believe that actual benefits will be lower than estimated in study conducted by regulator

Data Security & Communication

- Data privacy and security is an issue of high interest for all opinion leaders
- Legal framework is perceived as vague and might lead to stranded costs (“technological standard”)
- Views differ on how and who has to ensure data security and data privacy and on how trustworthy DSOs are handling information

- No shared view on opt-out rate, estimates range from almost zero to 90%
- All opinion leaders agree that legal requirement of 95% penetration does not set a limit for a 5% cap for opt-out
- Different views on cost allocation for opt-out
- Time schedule is perceived as to ambitious and cost inefficient. Mag. Shah goes as far as calling it an industrial subsidy

Legislation and Regulation - Concerns on customer opt-out and stranded costs

Arthur D Little

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