International SAP Conference for Utilities

Workshop 3: SAP Smart Metering – Deployment Options, New Technologies and Industry Trends

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THE BEST RUN SAP

Workshop 3:
SAP Smart Metering

01	**Welcome and Introduction**	**30 min** - All
02	**Market Observation**	**15 min** – HS
03	**SAP Solution Overview: Meter, Energy, and Water Data Management**	**60 min** – HS
04	**Break**	**30 min** - All
05	**SAP Cloud for Energy**	**90 min** – MD, HS
06	**Q&A, Feedback etc.**	**15 min** - All

MD: Michael Dobler; HS: Holger Schweinfurth

Welcome and Introduction

Market Observation

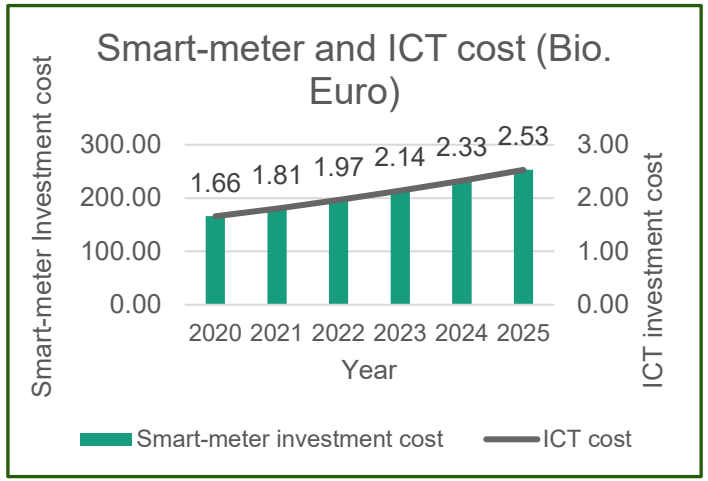
Market Observation: Installed Base and ICT investment

Smart-meter market is very fragmented worldwide

- The global penetration rate is 38% —relatively slow compared to the smart-meter adoption rate in the EU i.e. 72%.
- Nearly 80% of the installed base of smart-meter is owned by China and USA.
- The estimated installed base of smart-meter is 1.27 Bio. by 2025 (8.8% CAGR).

Smart-meter requires investment in ICT infrastructure

- Estimated €253.08 Bio. investment requires in smart-meter infrastructure (assuming 200€/installed unit cost)
- €2.53 Bio. ICT investment by 2025 (assuming 1% investment in ICT)
- Leading global actors in smart-meter sectors, Landis+Gyr, Itron, Sagemcom, EDMI, Enel, Honeywell

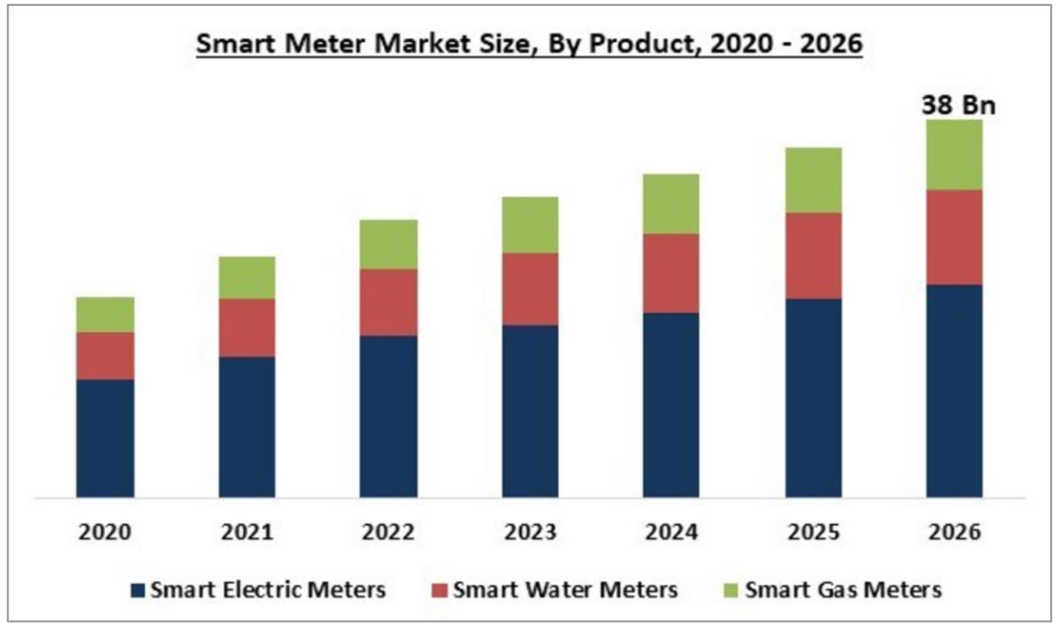


	House holds (Mio.)	No. of Smart-meter (Mio.)
EU-27 average	195.4	140.7 (~72% penetration rate)
World average	2146.9	830 (~38% penetration rate)

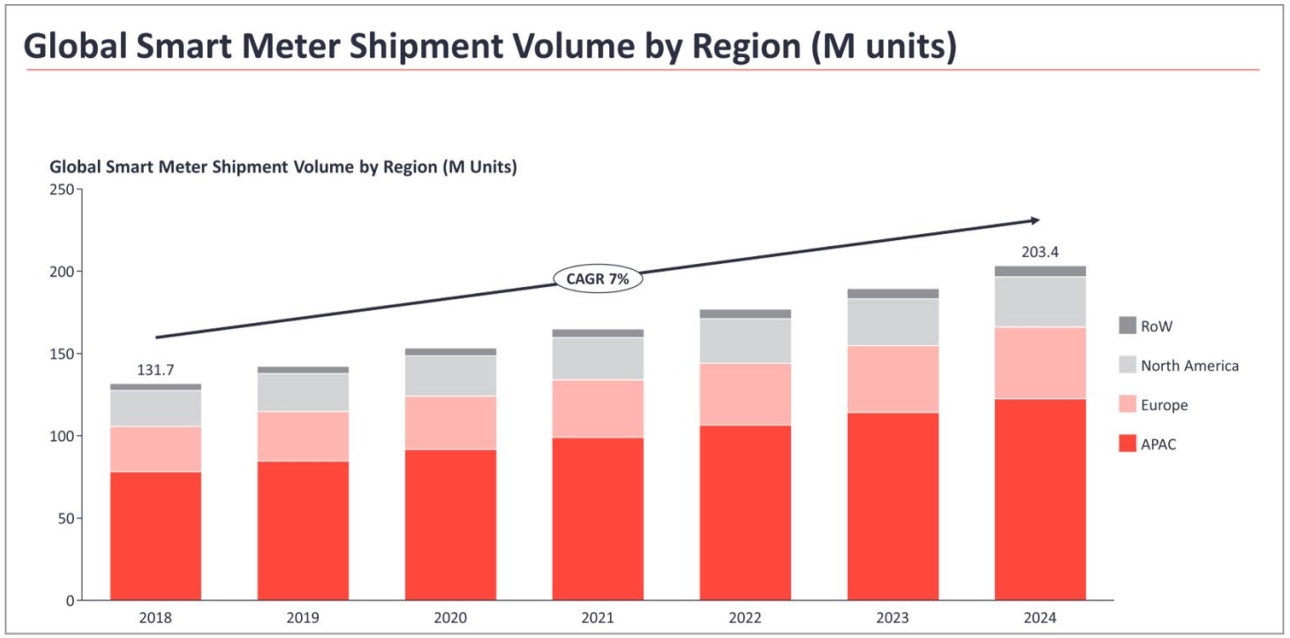
Smart-meter installed base (in %)	
1. China	52.7
2. USA	15.9
3. Japan	7.07
4. France	4.25
5. Italy	4.05

Source: IEA WEO 2021, EU Com 2021

Market Observation – Some Facts and Figures



Source: https://www.kbvresearch.com/smart-meter-market/



Source: https://iot-analytics.com/smart-meter-market-2019-global-penetration-reached-14-percent/

Market Observation – SAP Perspective I

… data management is one area that needs maximum focus for the sector to reap the full benefits of digital transformation initiatives.

Source: https://www.smart-energy.com/industry-sectors/data_analytics/energy-data-sharing-management-and-role-in-europes-climate-neutrality/

…more access to insightful information about your household energy usage.

Source: https://www.duke-energy.com/Our%20Company/About%20Us/Smart%20Grid

… energy data are used for other purposes too, notably transport and climate change

Source: cf121393-919f-4b84-9059-cdf0f69ec045 (europa.eu)

competitive advantage by exploiting the power of data

Source: https://www.rolandberger.com/en/Expertise/Solutions/Exploiting-the-power-of-data-and-algorithms.html

Market Observation – SAP Perspective II

- Reliable and high availability
- Integration and Interoperability
- Enable intuitive and secured applications

- Security and GDPR compliance
- Embedded Analytics
- One source of truth and sharing of data
- Industry standards

Market Observation – SAP Perspective III

Meter Lifecycle Management	Discrete Meter Reading Processing	Handling of Time Series Data	Energy Settlement and Regulatory Compliance	Metering Analytics
Purchasing, serialization, inventory and warehouse management	Planning and scheduling	Upload of time series data	Planning and scheduling of energy settlement	Master Data Analytics
Meter Operations: installation, removal, replacement	Upload of discrete meter readings	Validation, estimation, editing	Execution, monitoring and exception handling of settlement processes	Discrete Meter Reading Analytics
Meter inspection and certification	Validation and correction of data import	Time series management	Communication of results to market participants	Time Series Data Analytics
Operational reporting	Further processing of discrete meter reading data	Formula and synthetic load profiling		
		Further processing of time series data		

SAP Solution Overview: Meter, Energy, and Water Data Management

Market relevancy through extended collaboration

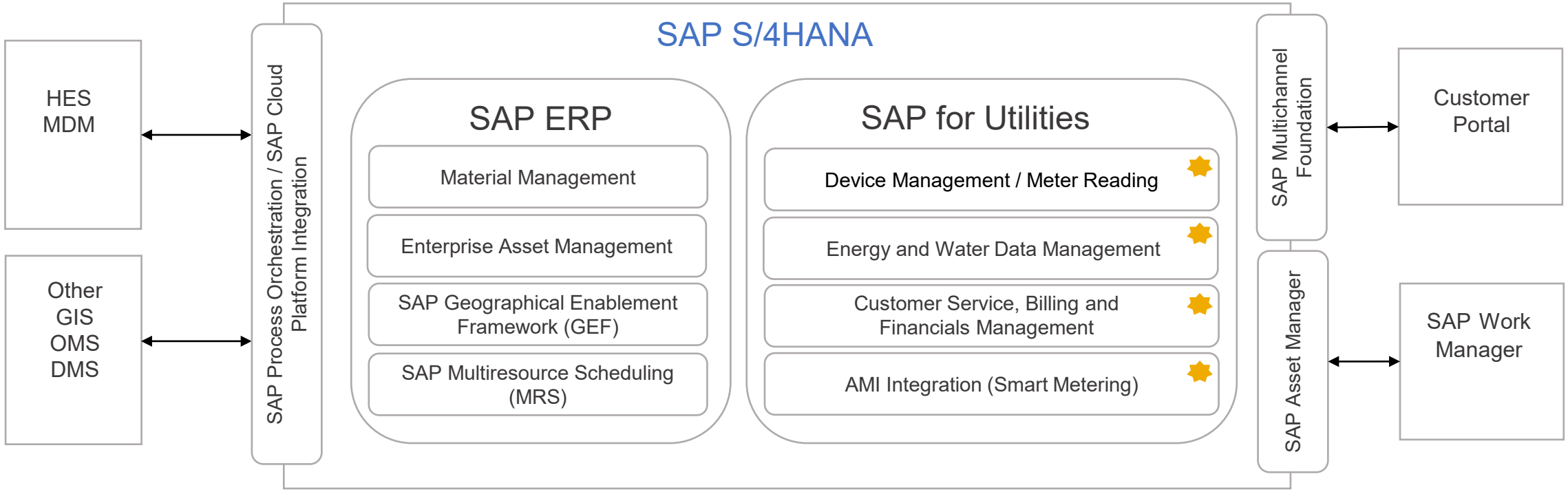
The SAP Smart Metering Eco-System

The AMI@SAP Lighthouse Council

Extended ACCU AMI Workgroup

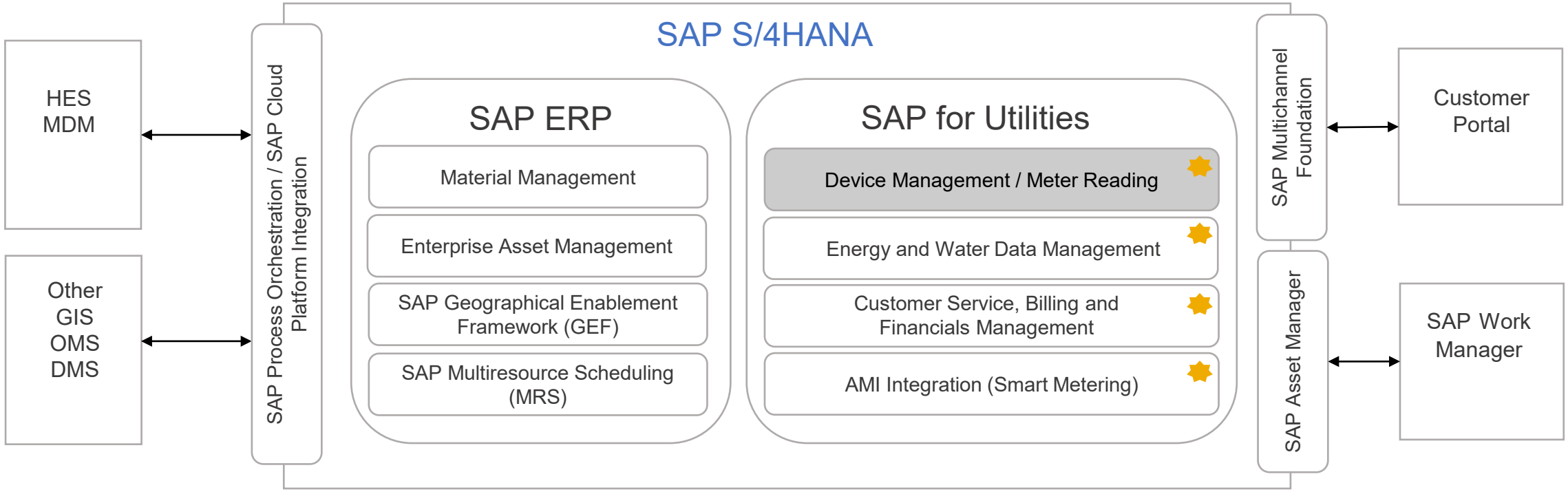
Exchange of information on technology, market trends and strategies for AMI and Smart Grids	Composition and discussion of architectures and use cases	Definition and prioritization of common software requirements	Timely feedback from SAP on new product developments (system demos)	Early customer engagement in the software-development-process (specs, etc.)

Simplified Architecture and Building Blocks of S/4HANA Utilities



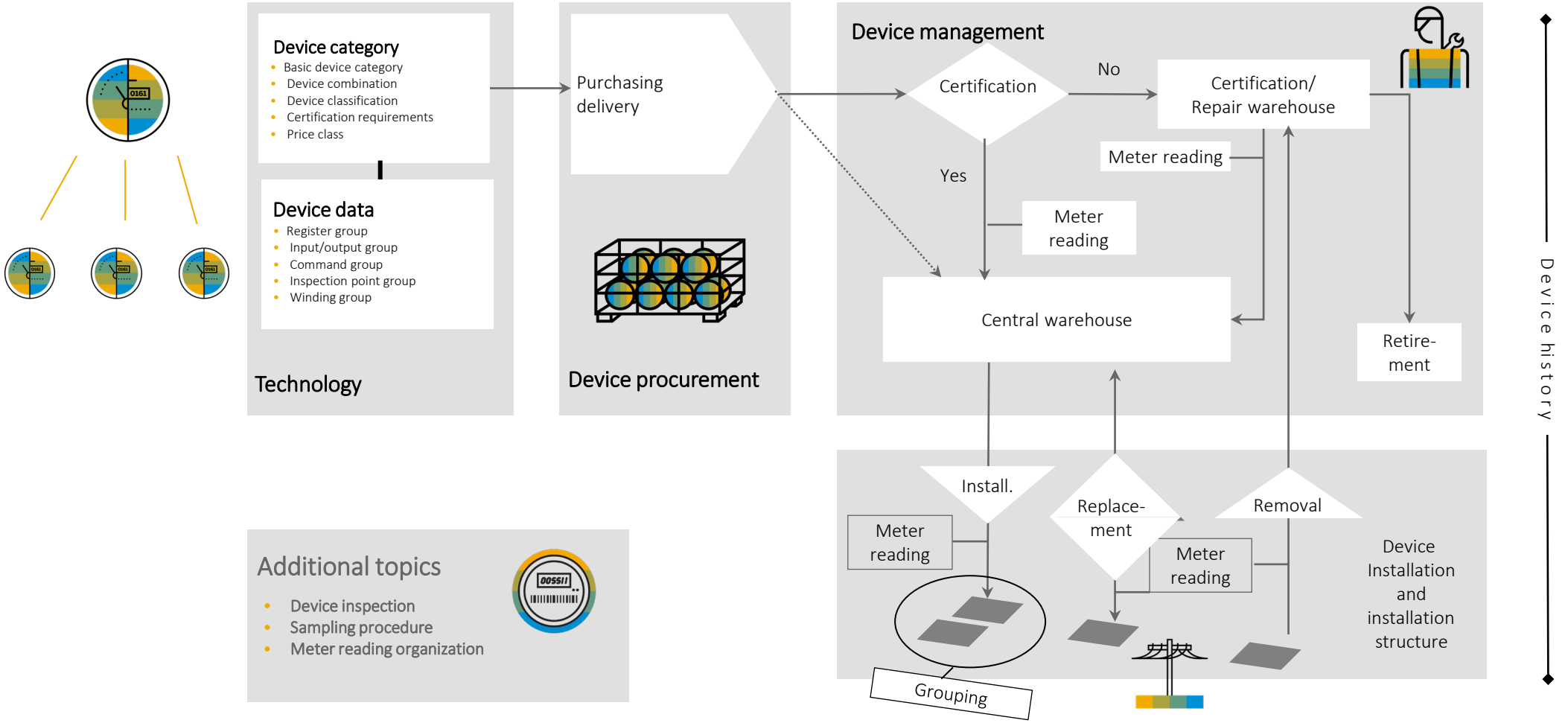
Relevant / Impacted by Smart Metering

Simplified Architecture and Building Blocks of S/4HANA Utilities



Relevant / Impacted by Smart Metering

Device Management / Meter Reading – Overview



Smart Metering Enhancements in Device Management / Meter Reading I

Device Management

Enhancement Device Category and Device

Enhancement Installation/Change of Meters

Automatic Master Data Exchange to MDM/HES (e.g. Device, Location, Device Allocation details)

Enhancement BW Content, BOR Objects etc.

Regional structure and Grid: Assignment of Smart Metering Systems

Enhancement to the Replication procedure

Simplified master data synchronization

Gateway device category to assist with smart meter communication

Meter Reading

Enhancement Meter Reading Order

Receiving of Meter Readings (triggered by SAP/Smart Metering)

On-Demand Meter Reading

Enhancement Monitoring of Meter Reading Results

Cancellation of Meter Reading Requests

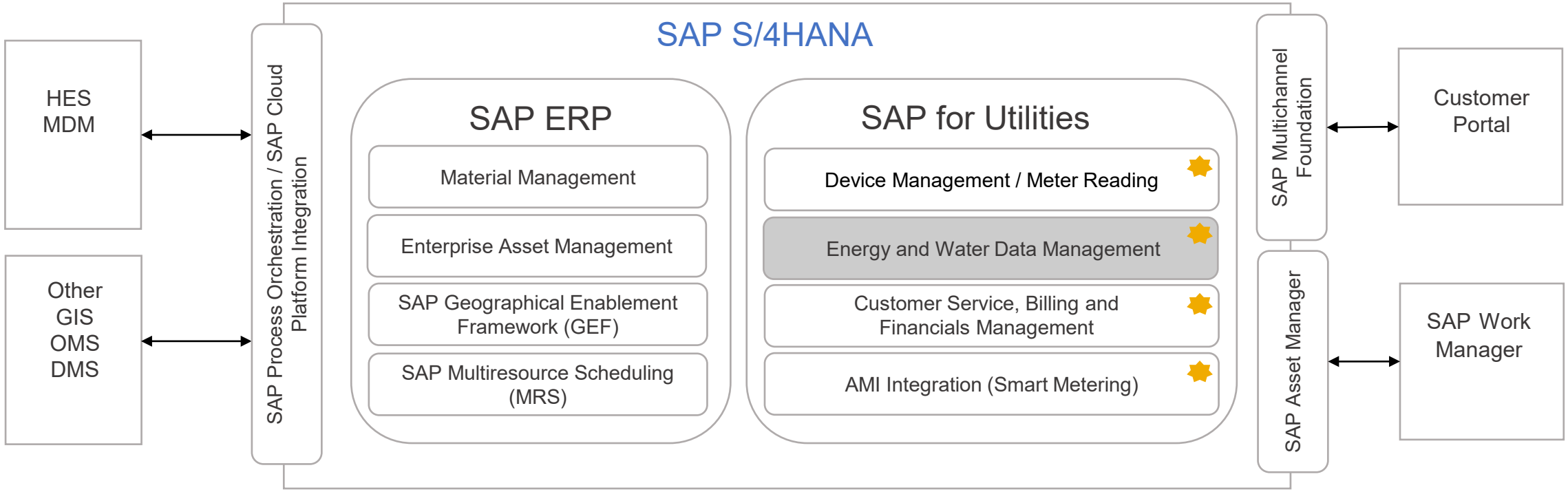
Push install/remove meter reads to MDM/HES

Smart Metering Enhancements in Device Management / Meter Reading II

Event Management

Flexible Enterprise service that provides the ability to add additional attributes
Receiving and prioritization of event data from the MDUS-System
Triggering of follow-up activities based on utility-specific rules
Monitoring of event processing

Simplified Architecture and Building Blocks of S/4HANA Utilities



Relevant / Impacted by Smart Metering

Energy and Water Data Management – Overview

Master data processing (e.g. creation of profile header)

Single or mass process upload (incl. Monitoring)

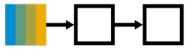
Validation, Estimation, Editing (VEE) of profile data

Status administration

Versioning

Visualization of profile data (tabular, graphic)

Extrapolation



Formula handling / profiling

Synthetic profiling (pattern)

Archiving

Smart Metering Enhancements in Energy and Water Data Management I

Profile Processing

New enterprise Services for the upload of profile data (e.g. from MDM or HES)

Enhanced AMI monitoring functionality with regard to the upload of profile data from MDM or HES

Market Communication

Intercompany data exchange via enterprise services.

Enhanced data exchange framework supports IDoc and enterprise SOA-based interfaces in the same client for execution of data exchange tasks

New data exchange basis processes for export of profiles.

New functionality for parallel and efficient generation of data exchange tasks

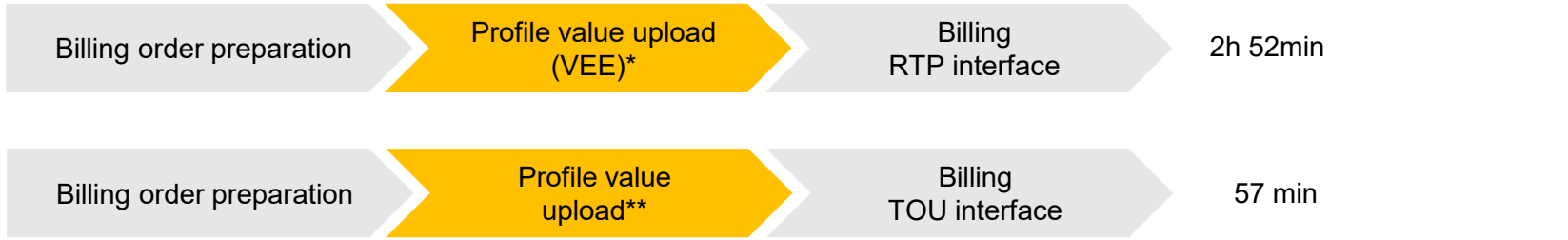
New functionality for bulk processing of data exchange tasks

Smart Metering Enhancements in Energy and Water Data Management II

Advanced Metering Infrastructure Performance

SAP load test Energy Data Management:

- Billing order preparation for 500,000 installations
- Upload of 96 * 10,000,000 interval values
- Billing of 500,000 installations with four time-of-use blocks each



SAP load test Market Communication:

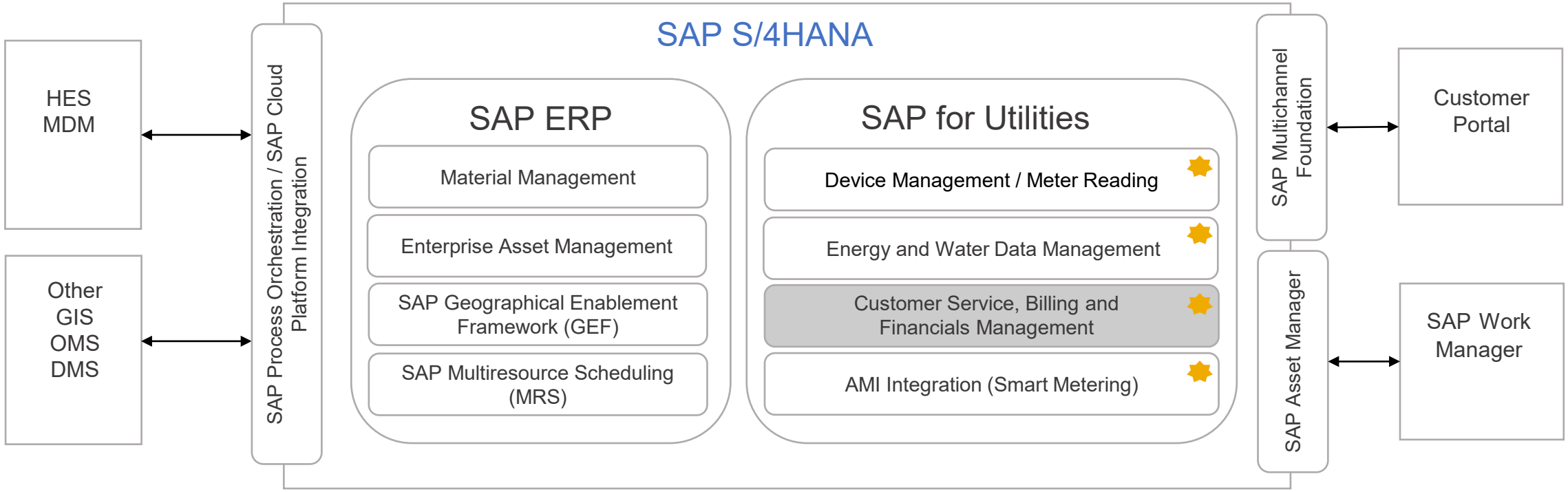
- Upload of 1.000.000 profiles and generation of data exchange tasks for 5.000.000 profiles
- Data exchange task execution and sending of 4.000.000 profile values
- Import of 4.000.000 profile values

Link to official documentation

*ID via profile and import of values with checks and replacement values

**ID via metering point and copy of interval values w/o checks

Simplified Architecture and Building Blocks of S/4HANA Utilities



Relevant / Impacted by Smart Metering

Smart Metering Enhancements in Customer Service

Disconnection/Reconnection

Integration in the Dunning Process

Notification Process (Work list Item)

Scheduling of Disc./Rec. Orders

Mass Activity for Sending Disc./Rec. Orders

Cancellation of Disc./Rec.

Monitoring of Disc./Rec. Orders

Send Disc./Rec. Orders status for devices that do not have remote capability

Text Messaging

Sending of text messages from CRM or ERP (free editable text or templates)

Integration in the dunning process

Report to send out messages

Automatically check each message before sending (e.g. offensive language)

Operational Status (Ping)

Enhancement of the device to store the operational status

Sending of operational state from CRM or ERP

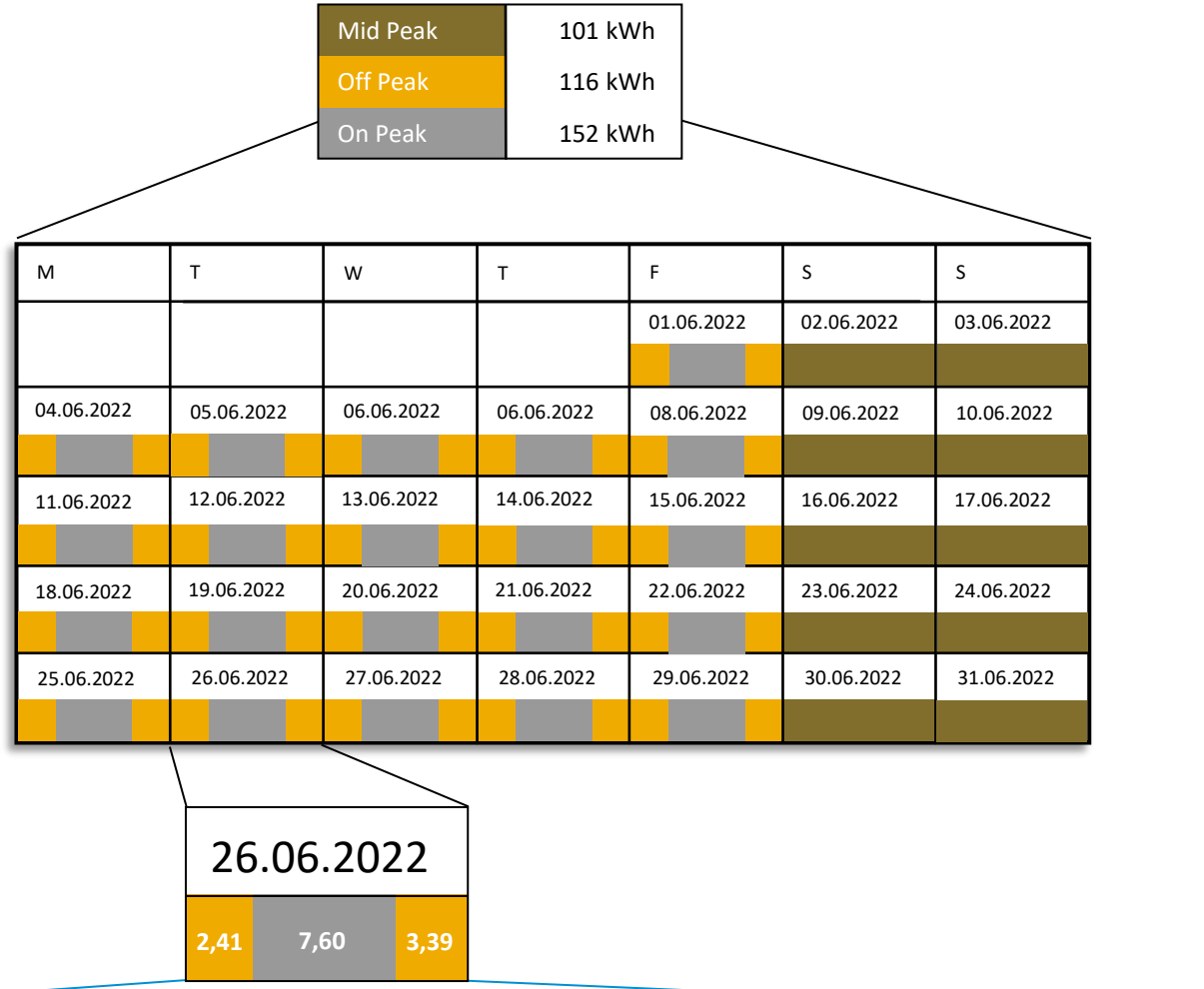
Monitoring of operational status

Smart Metering Enhancements in Billing

Time-of-Use Energy Product

Weekdays:
7:00pm – 08:00am: 12ct
08:00am – 7:00pm: 30ct

Weekend/Holiday:
Whole day: 18ct



Time series data

Time of Use - 1							Time-of Use - 2											Time of Use - 1					
01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
0,35	0,36	0,34	0,36	0,35	0,31	0,34	0,94	0,88	0,48	0,48	0,84	0,71	0,54	0,54	0,64	0,74	0,81	0,55	0,67	0,72	0,68	0,39	0,38

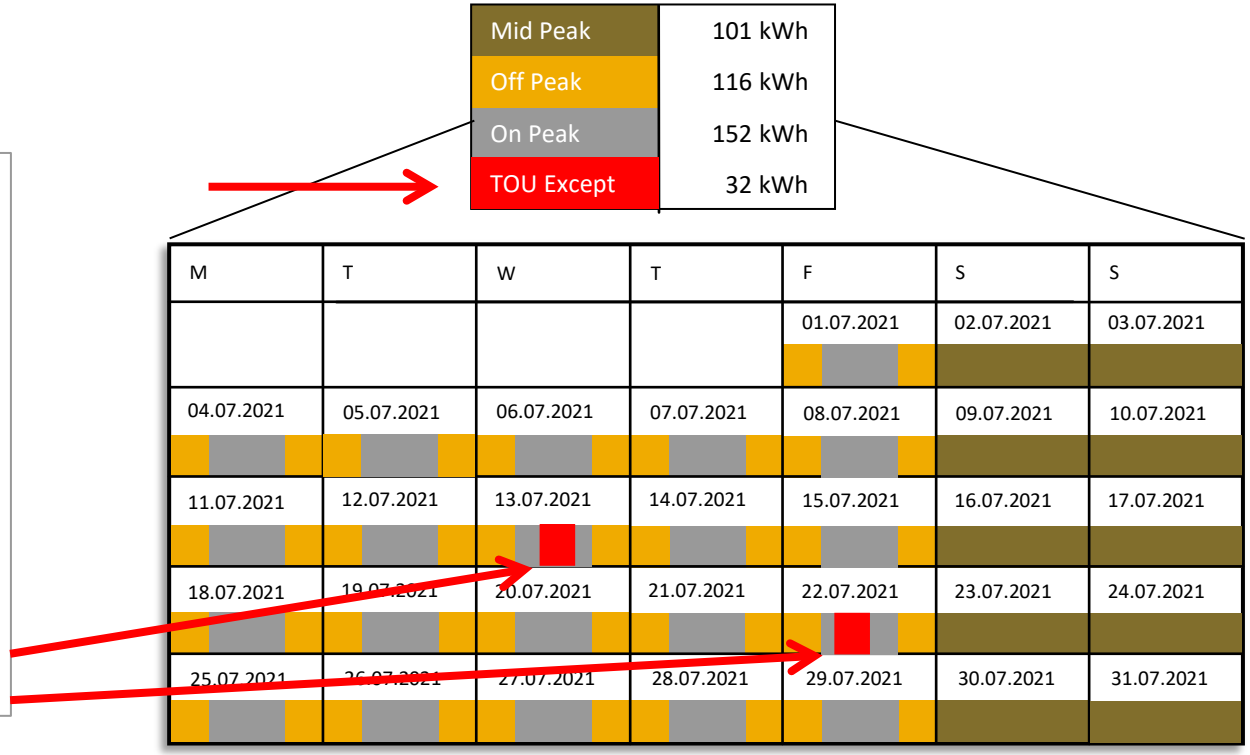
Smart Metering Enhancements in Billing

Time-of-Use Energy Product

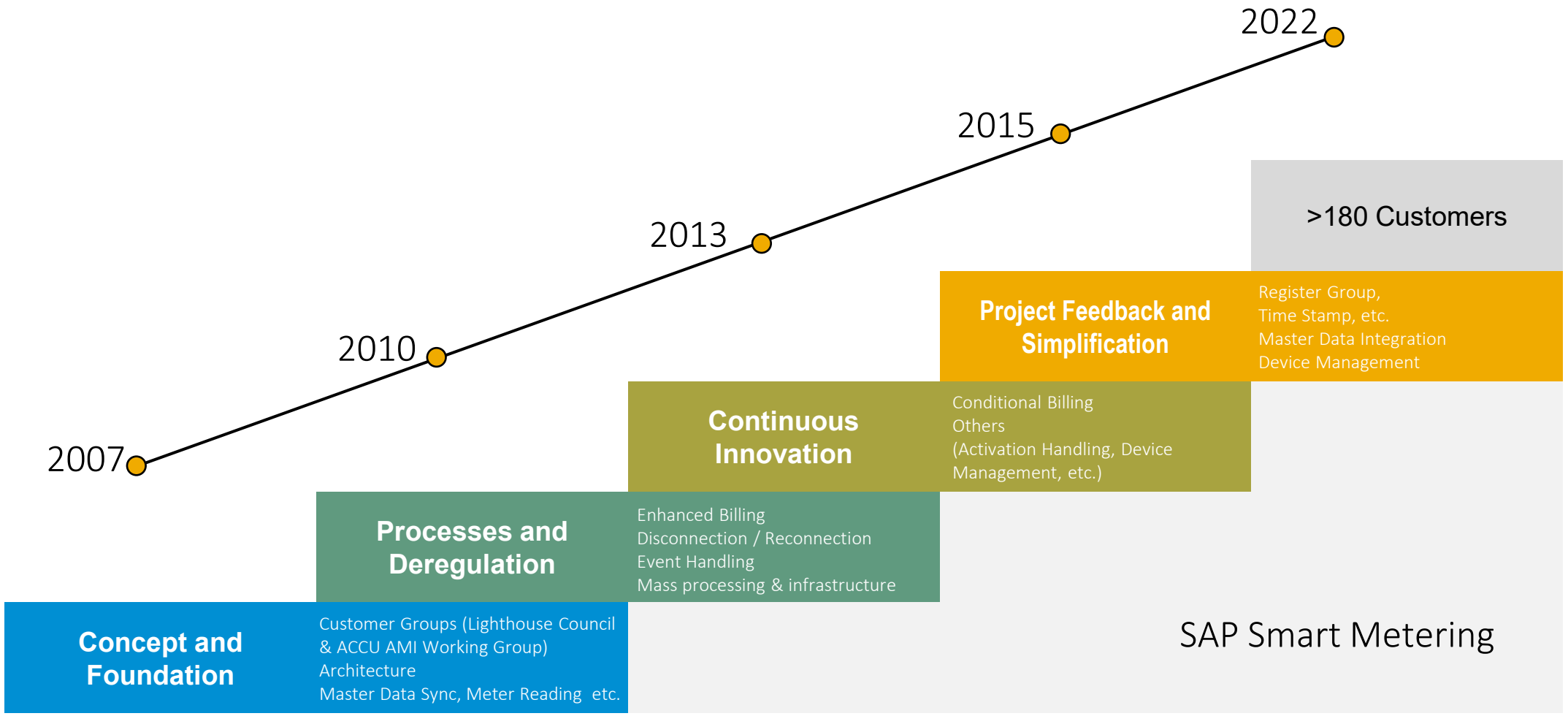
Weekdays:
7:00pm – 08:00am: 12ct
08:00am – 7:00pm: 30ct

Weekend/Holiday:
Whole day: 18ct

TOU Exception Program XY:
Critical Peak Pricing during
TOU Exception in July:
JUL-13 at 12:30 – 15:00
JUL-22 at 11:45 – 14:30

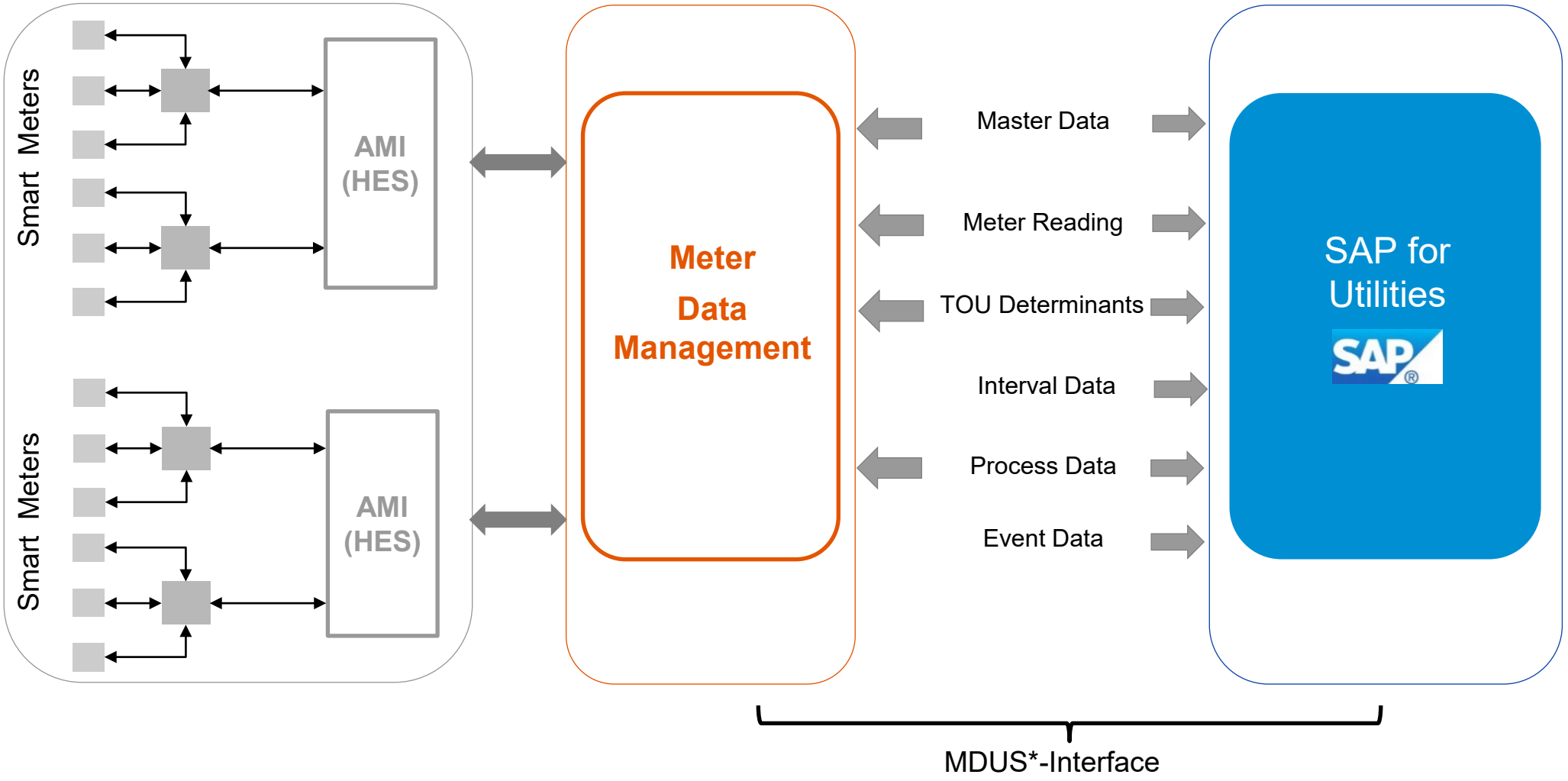


SAP Smart Metering – Evolutionary steps of a Comprehensive Solution



SAP Smart Metering

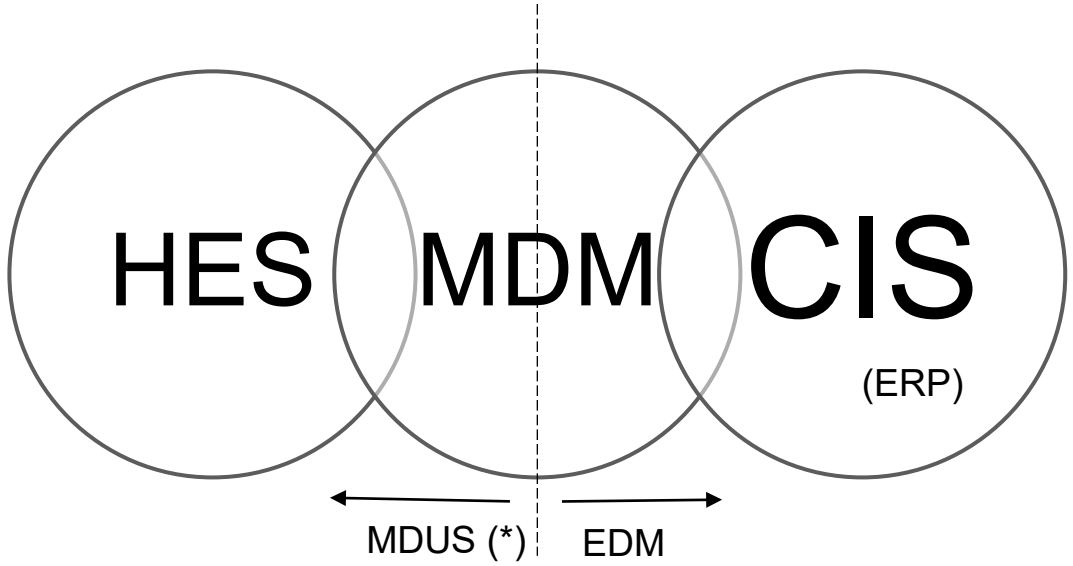
Traditional Three-Tier-Architecture (Lighthouse Council 2007)



*Meter Data Unification and Synchronization

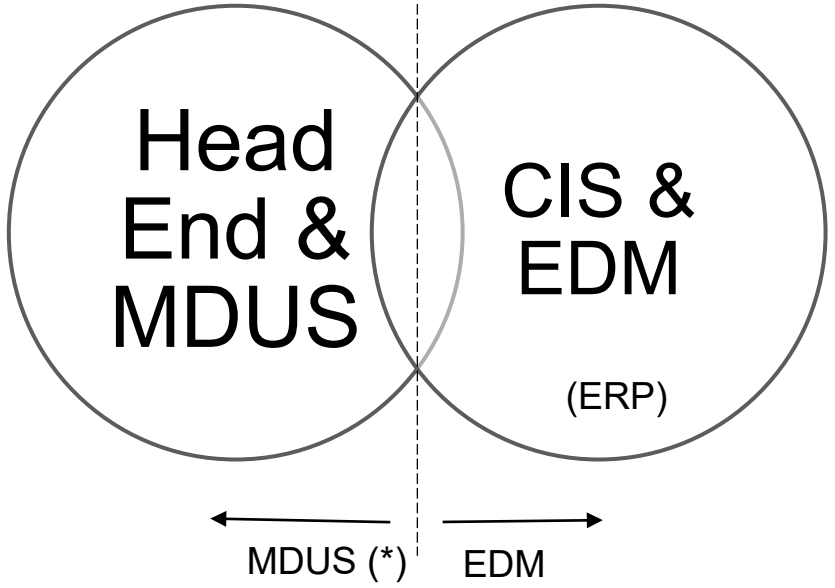
The SAP Approach to Smart Metering Projects and the Alternative

3-TIER ARCHITECTURE

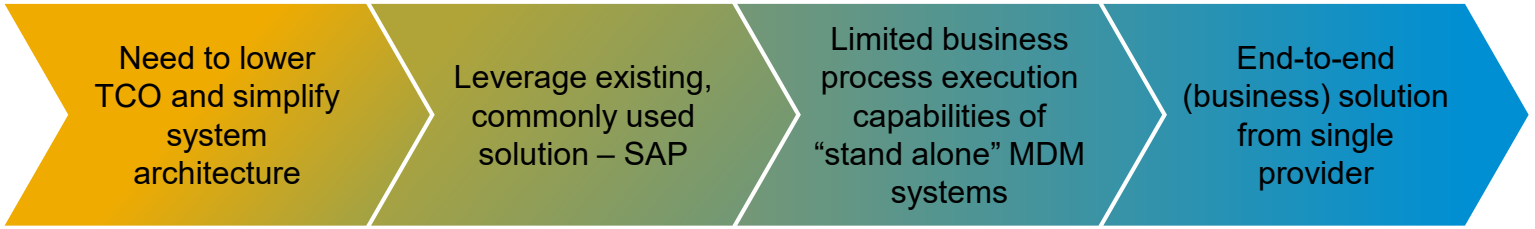


Technical Processes **Business Processes**

2-TIER ARCHITECTURE



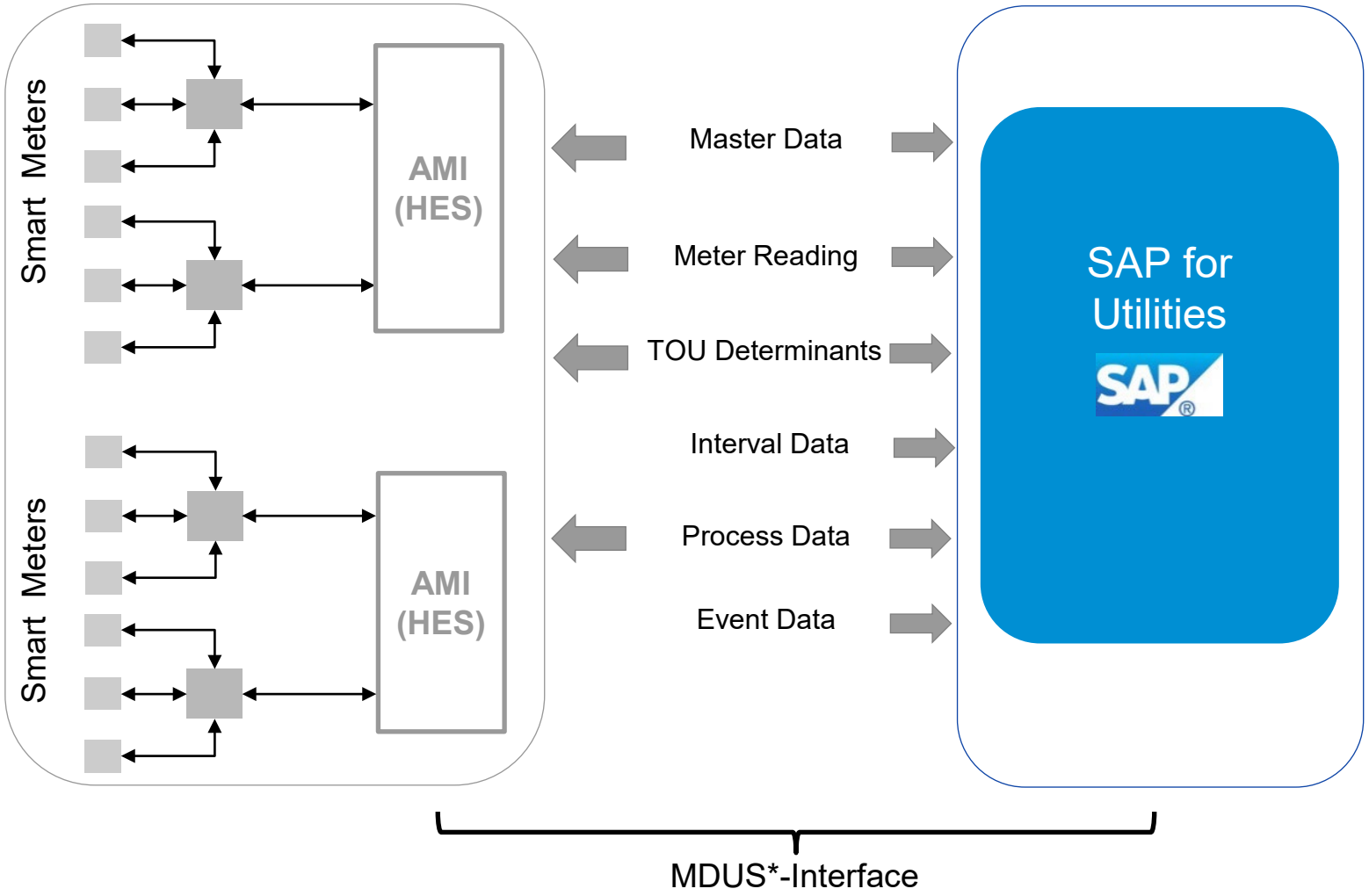
Technical Processes **Business Processes**



(*) Leveraging Partnerships

SAP Smart Metering

Two-Tier-Architecture



*Meter Data Unification and Synchronization

SAP Smart Metering

Two-Tier-Architecture

3x data replication

HES MDM CIS DW

One single repository

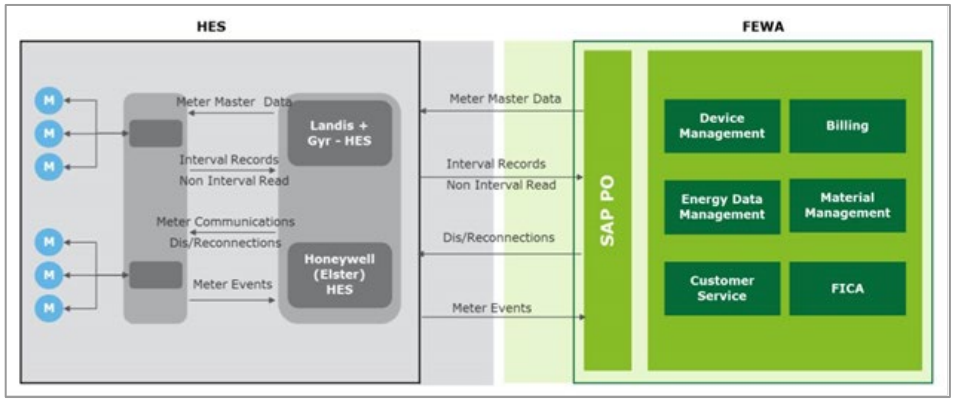
Integration Project

SAP S/4HANA Utilities

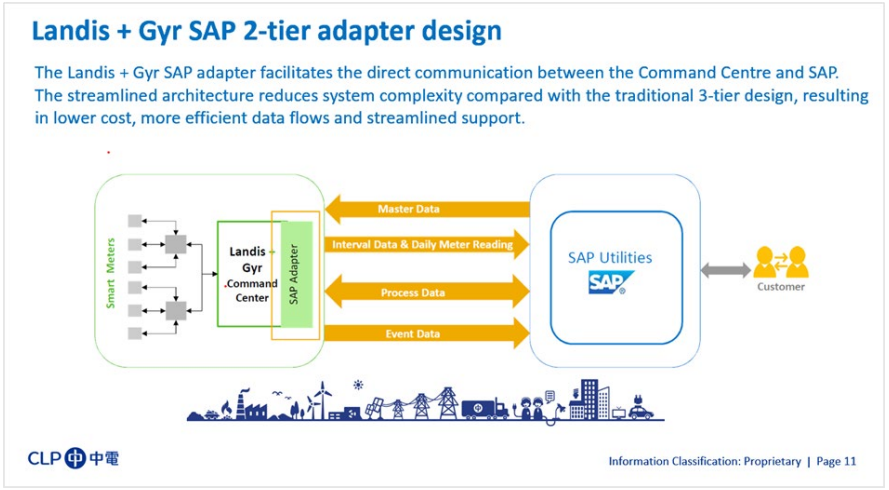
(Meter-to-Cash, Market Communication, Advanced/Operational Analytics)

SAP Smart Metering

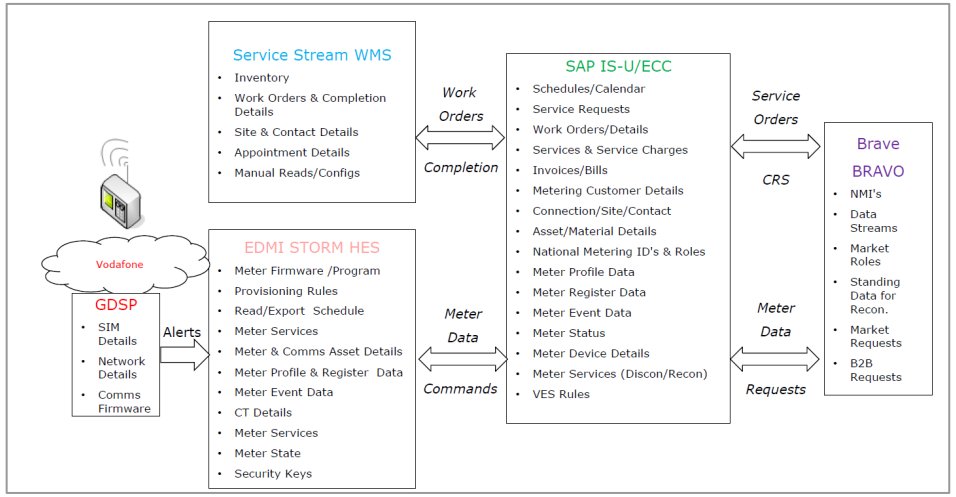
Two-Tier-Architecture – Selected Customer Examples



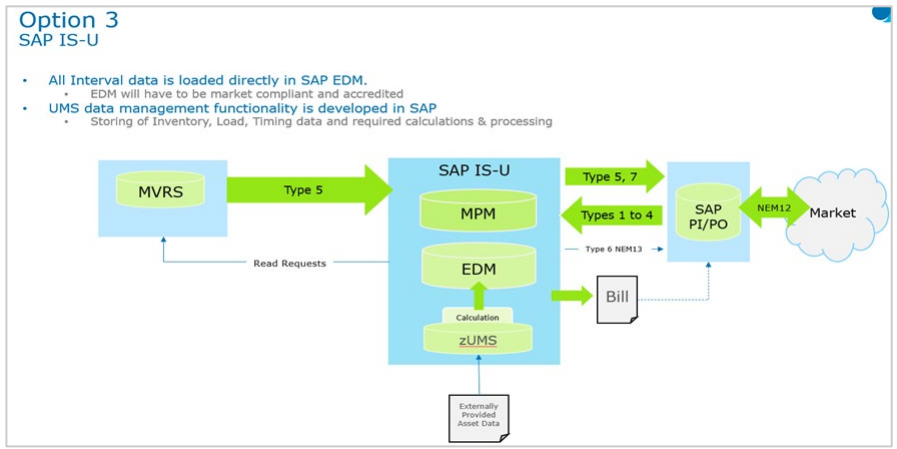
Customer in UAE: 800k productive customers



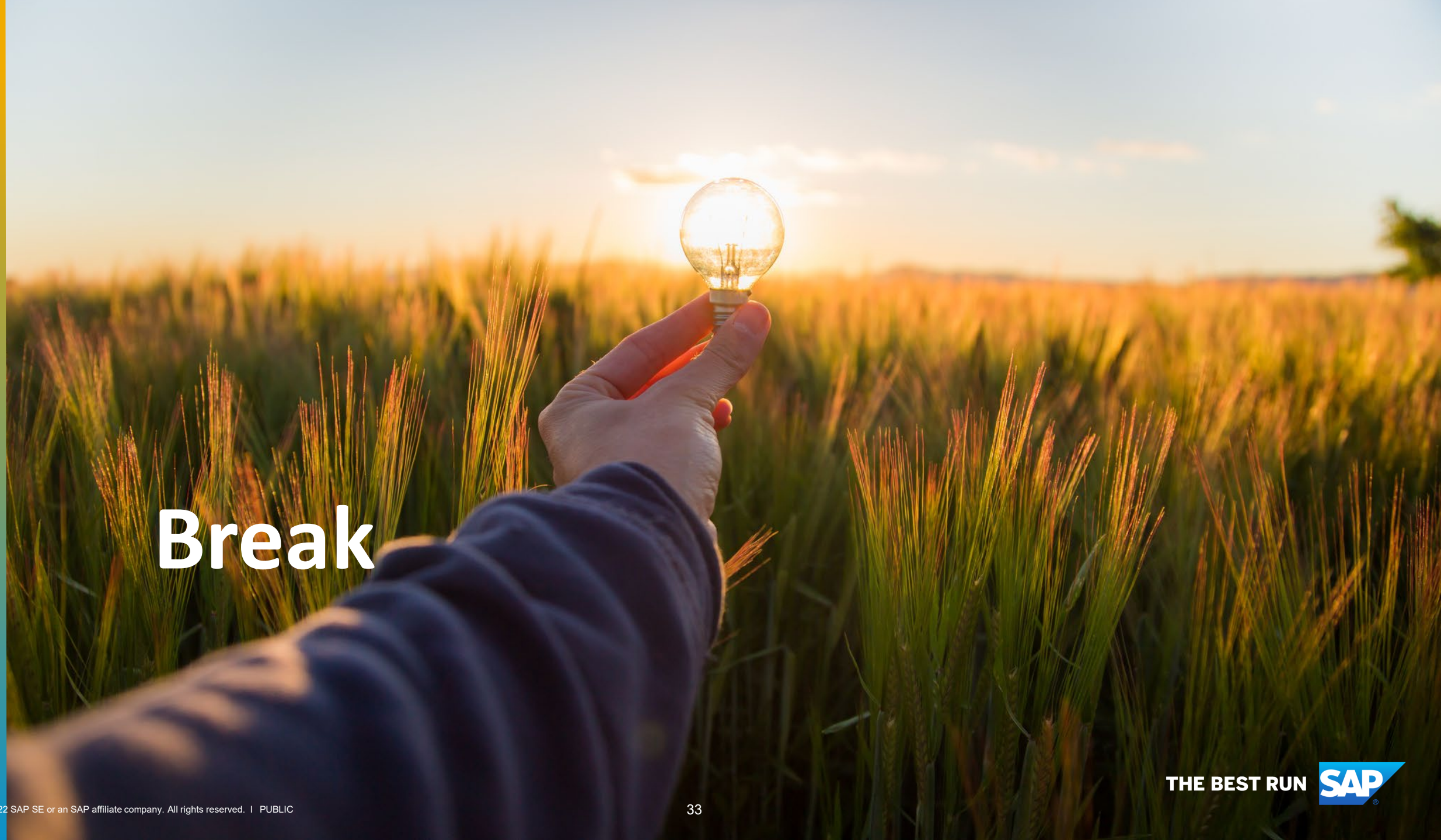
Customer in HK: 2.0 Mio. productive customers



Customer in AUS: +1 Mio. productive customers



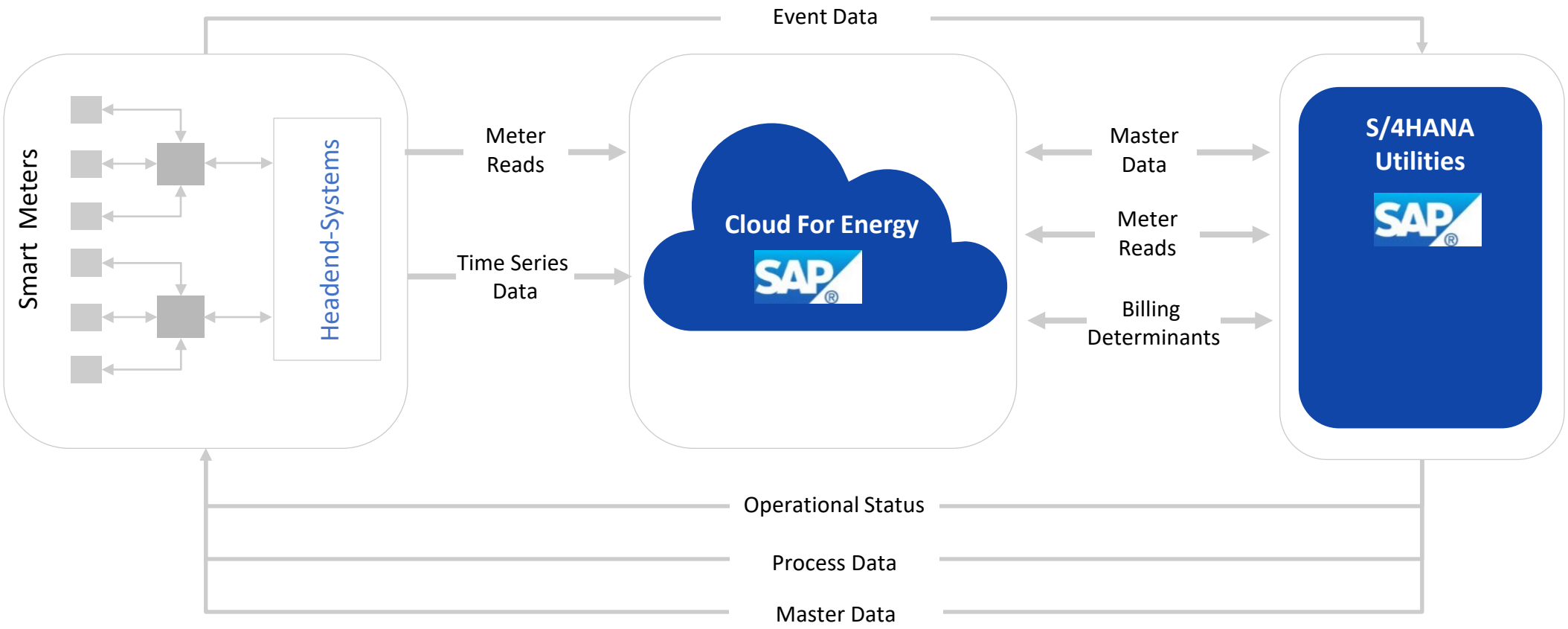
Customer in AUS: 900k productive customers



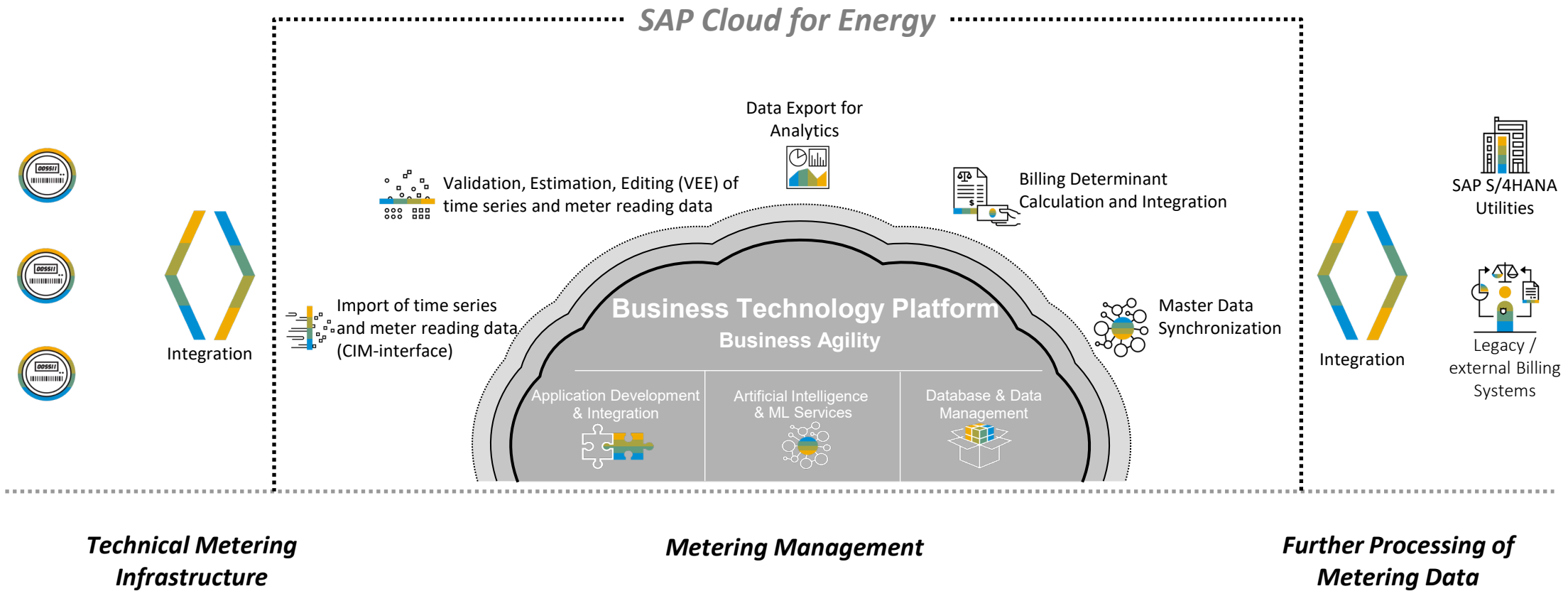
Break

SAP Cloud for Energy

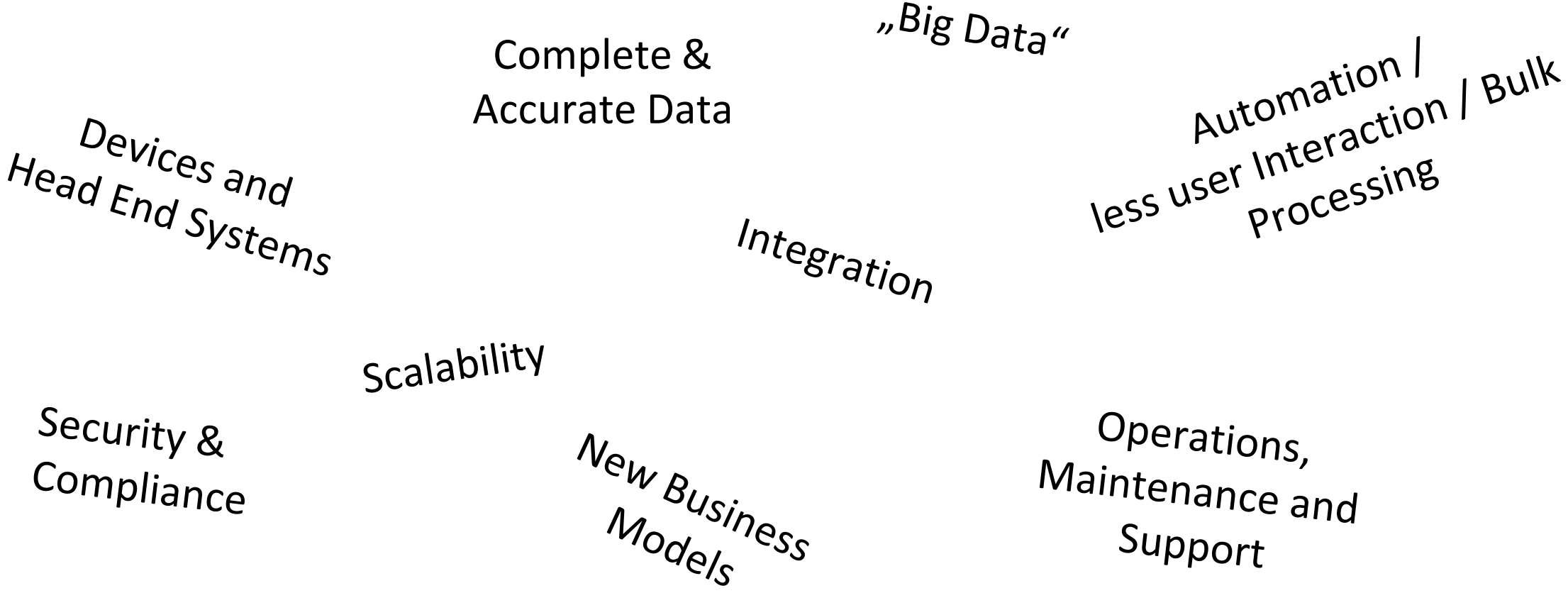
SAP Smart Metering – The Big Picture with SAP Cloud for Energy



SAP Cloud for Energy: The Metering Platform for Managing Energy and Water Data in the Cloud



Smart Metering - A few keywords



Keywords mapped to SAP Cloud for Energy (see next slides)

Big Data

Requirement / Fact	SAP Cloud for Energy
Smart metering is the processing of big data.	Example: 1 Mio Smart Meters 1.000.000 15min interval data, 96 value per day * 96 2 registers, Meter Reading & Cons. * 2 Raw Data and Validated Data * 2 ======= Records **per day**: 384 Mio records You need to store data for several years!
Large amounts of data are produced, processed and securely persisted every day.	SAP Cloud for Energy follows big data principles and guidelines • Meter readings are stored in various places such as Warmstore (fast access), Data lakes • For processing asynchronous processing with help of message queues is fully implemented
All processes and process parts, as well as target systems, must be able to handle the large amounts of data.	From an end-to-end process, all components need to support the big data scenario. If a single component does not perform well, the entire process will slow down or even crash and fail. Big Data principles ensure stable processes. Other/Third party components also need to support this principles. Example: If you want to export big data, e.g. export 500 GB of data in a very fast manner – the target system needs to be able to consume the data in this volume and frequency.

Security & Compliance

Requirement / Fact	SAP Cloud for Energy
Security has the highest priority	SAP Cloud for Energy as cloud offering on top of SAP BTP works with the highest security standards. (SAP BTP = SAP Business Technology Platform)
Meter readings are identified as personal related data and needs to be protected (DPP/GDPR)	As all other data, also meter readings are protected by SAP BTP Security measures. Data Protection and Privacy (DPP)/GDPR is fully implemented to ensure compliance accordingly
Separate Data	Each customer works with his own SAP Cloud for Energy tenant. Tenants separate data and do have their own monitoring and credential management.
Connection between Utilities Owned On-Premise solution and SAP BTP based application needs to be protected	SAP offers „Cloud Connector“ as a component for safe and secure data integration and exchange. SAP Cloud for Energy leverages the Cloud Connector to combine SAP for Utilities (on Premise) with SAP Cloud for Energy Software as a Service (SaaS) Tenants
Security Checks	Security is continuously checked and monitored from internal and regularly from external parties.
Compliance (Certificates)	Certified by: • ISO-22301 • ISO-27001, ISO-27017, ISO-27018 • SOC 1 Type II, SOC 2 Type II • C5 • TISAX • CSA STAR • EU Cloud CoC • HDS

Operations, Maintenance & Support

Requirement / Fact	SAP Cloud for Energy
Software needs to be up and running all the time	High availability is based on SAP BTP capabilities, multiple backup components and blue/green deployment which allows to add new features and functions without any downtime
New features shall be available without disruption of existing functionality	SAP ensures that software changes do not disrupt existing functionality. No surprises! Compatibility to existing and shipped functionality is always given. If for some reasons a change is required there is a process in place to ensure the end-to-end process still runs smooth.
Support	Standard SAP processes (ticket system) is available to support customers in case of any software issue. Multiple organizations and teams care about the support tickets. (Primary support and secondary support)
Maintenance & Support	Maintenance is taken over by SAP development teams. The team which developed the software is also resonsible for maintenance and support.
Operations	Operation teams are responsible to keep the SaaS up and running. Manual and automated processes are in place to ensure a healthy SaaS offering
Scalability	Resources (Memory, CPU, Storage, ..) are added on demand by SAP operations

Complete & Accurate Data / Automation and less user interaction

„Data is the new oil“ But – data needs to be in a perfect quality! Detect and solve problems automatically.

Requirement / Fact	SAP Cloud for Energy
Data is used for various purposes such as billing, forecasting, ML/AI,….	Data is available for various processes and also accessible via API.
What if … You have **gaps** within your data?	SAP Cloud for Energy runs validation for gaps and provides replacement values (Linear interpolation)
What if… You have data **below or above** a **threshold**?	SAP Cloud for Energy can run validations to check if data is above or below a threshold. Thresholds are flexible e.g. by data type and/or customer type. Min/Max values can be defined for various validity periods (“seasons”)
What if… You have data **outside** of an expected **range**? (Backflow, Overflow)	SAP Cloud for Energy can run validations to check if imported data is outside of the expect range. For example, you have meter reading time series and you expect numbers are increasing. In case of overflow or Backflow (water management) the numbers will decrease and this anomaly is automatically detected.
What if… You have data for **inactive** accounts and/or **deactivated** devices?	SAP Cloud for Energy can run validations to check if there is data for empty / vacant premises. Also, if data for disconnected devices is there.
What if… Meters did **not** send **data** for **entire day**/multiple days?	If a meter is installed and AMI is activated - it is expected to receive interval data. If data is not received, Cloud for Energy will create the corresponding information to ensure awareness.

Integration & new Business

Requirement / Fact	SAP Cloud for Energy
Integration	
Support industry standard for integration	SAP Cloud for Energy uses CIM (IEC 61968-9) as standard to exchange meter readings. CIM API to ingest meter master data and readings is developed as REST based API.
Allow easy integration to HES	CIM Standard defines the objects to be exchanges. Many HES vendors also follow CIM. Any format can be transformed into CIM.
Integration between SAP for Utilities on Premise with SAP Cloud for Energy	Out of the box integration as part of SAP Cloud for Energy. Integration to exchange and replicate Meter Master Data, exchange meter readings and for pre-billing
Support new business models	
	Offer API to read/change/delete/write data
	Export all data for e.g. Analytics, ML/AI,…

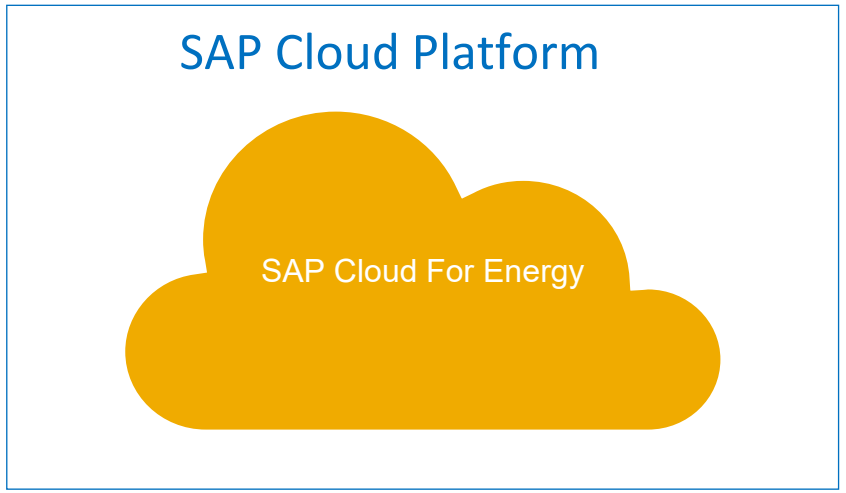
Demo

Launchpad

- Solve Issue App
- Operational Monitoring App
- View Meter App
- View Measurement App
- Configuration – Validation Configuration App

SAP Cloud for Energy

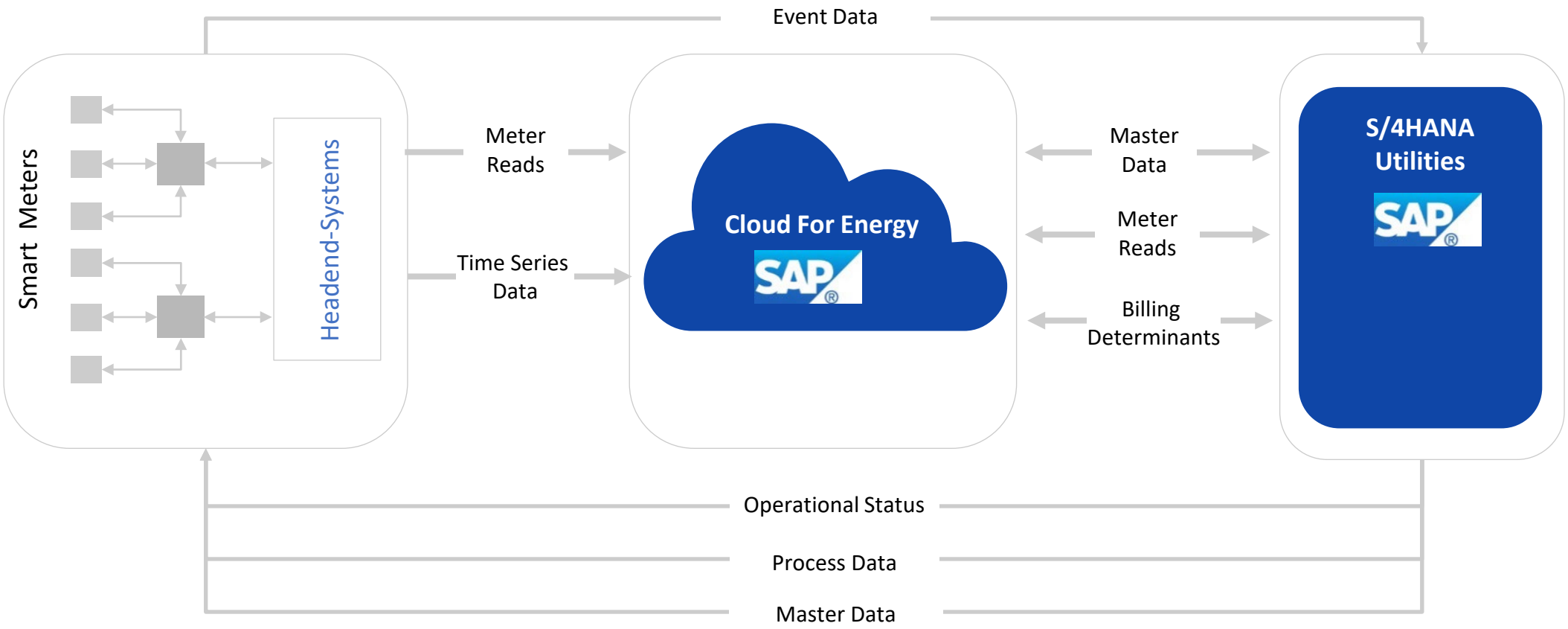
Key Facts



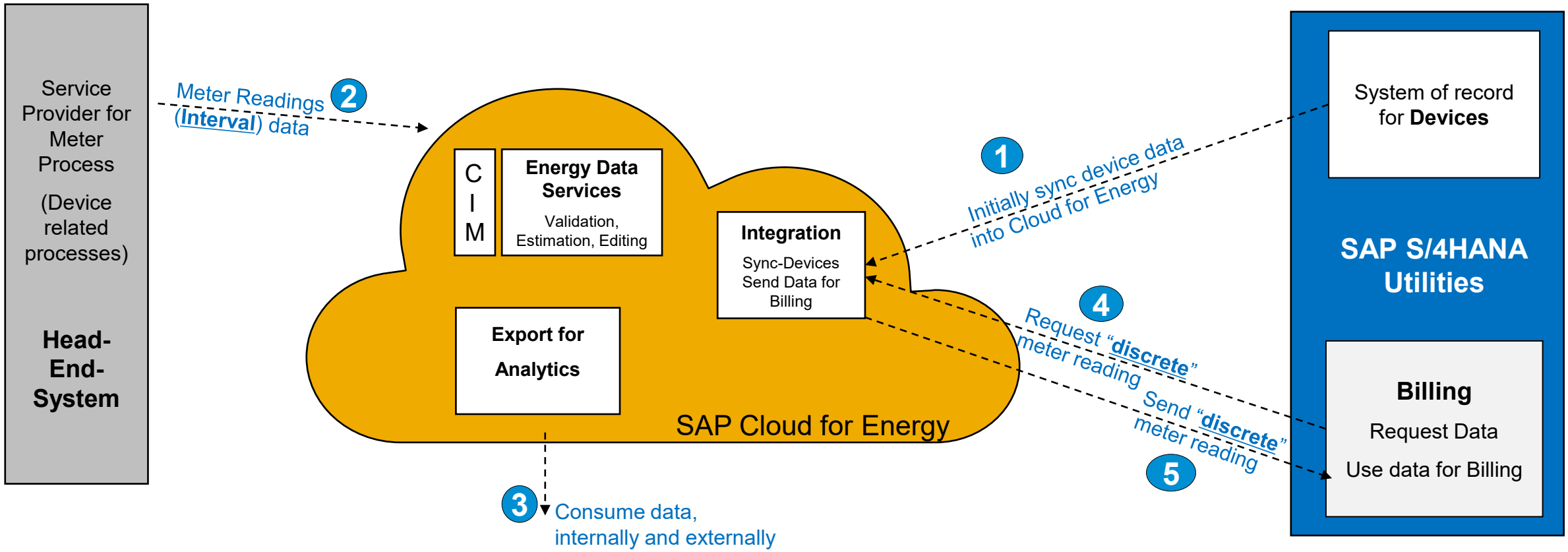
Key Functions

- Capturing of consumption **time series data** (delta) and **meter reading timeseries** (index) from external HES systems
- Performs **Validation, Estimation and Editing** on the Energy & Water Data
- Review data completeness and quality via Operational Monitoring
- **Calculates billing determinants** from billing requests
- Provides Data for **Analysis** on the Energy and Water Data
- Fully **Integrated** with SAP Utilities Solution
- Utilizes the CIM model for Meter, Energy and Water data
- Designed to manage **big data**
- Handles multiple **Time zones**
- Fully support **DPP/GDPR (Data Protection & Privacy)**
- **SOC2** compliance
- **SaaS**: Fully managed and operated by SAP
- User interfaces supporting multiple languages
  (Dutch, English, French, German, Japanese, Portuguese, Simplified Chinese, Spanish)

SAP Smart Metering – The Big Picture with SAP Cloud for Energy



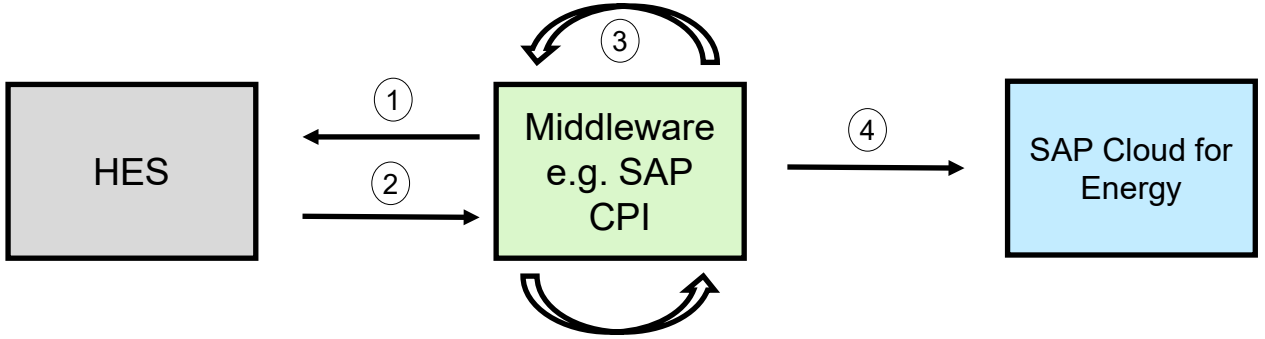
SAP Cloud for Energy: Customer Simplified Scope & Scenario (Initial Scope)



3rd Party	Cloud	On Premise
Industry Standard Interface	Big Data, Fast Innovation Cycles, extensions with other components such as IoT. Extend on premise offering	Relational data, small data volumes, existing and robust processes

Experience - Integration

Integration to Head End Systems (HES)

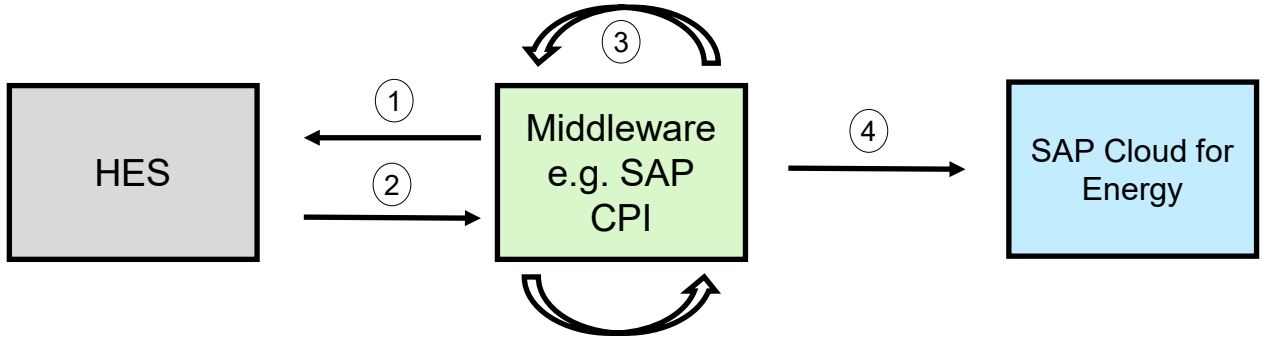


1) Request Meter Readings from Head End System
2) Send Meter Readings to Middleware
3) Convert/Transform HES Export format into CIM Format
4) Send CIM Format to Cloud for Energy

Note: CIM Format: SAP Cloud for Energy follows IEC 61968-9 industry standard

Experience - Integration

Integration to Head End Systems (HES) – Challenges and Design Questions



- Do we understand all status attributes such as information to indicate gaps, estimations, ..?
- Understand timestamps if e.g. Local time incl. or without Summer/Wintertime vs. UTC. What does 12 AM mean, is it the begin of the day?
- Do we have all data available (all meters) and when?
- Retention. How long is data stored in HES and available to re-query? Does HES drop data?
- How long does it take to have all data complete in HES? When is “HES processing” finished?
- Are there updates on data in HES which have been sent to target?
- Does HES delete any data? Is this delete also relevant for target systems? (retention vs. real deletion of records)

- Does the Middleware initiate the export from HES?
- What is the frequency of data transfer, e.g. once a day? Multiple times a day?
- Middleware as tool to extract data from HES and transform to target format
- Heterogenous HES landscape.
  Usually leads to multiple configurations or small developments in the middleware to adopt to the specific export formats (more different HES leads to more initial effort)
- Does Middleware store any data? (e.g. temporary). Where to store?
- Does Middleware do any key mapping, how can we store/give access to keys and attributes?
- Security: how to access HES and target?

- Are all meter master data (device data) available? Where does data come from?
  SAP for Utilities: Out of the box integration, no effort on SAP Cloud for Energy side
  Any other source: Data is created via API, data needs to be transformed into CIM format.
  (Effort is outside of Cloud for Energy)
- Are the reading types (kind of data) are available in Cloud for Energy? (see list of supported reading type in e.g. help.sap.com)
- Think about what kind of validation rules shall be executed. Do we check all registers/channels for missing data? Do we plan to check vs. thresholds (min/max)?
- Multiple channels/registers
  Which is your preferred register e.g., for billing? (e.g. if you have 15min, hourly and daily data, which data is preferred for billing)

SAP Cloud for Energy: Free Trial for our Customers and Partners

Definition Free Trial **:**
Allows users to self register to use software at **no cost for a specific period of time** (usually up to a month) and then decide to purchase

SAP Cloud for Energy Trial

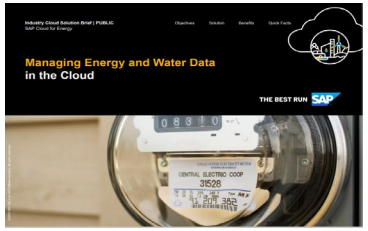
- Get hands-on experience on a live SAP Cloud for Energy system
- Dive into SAP Cloud for Energy through role based guided tours
- Explore the key capabilities and learn how to optimize the monitoring of imported energy data (profiles)
- Get first impression how profile data validation and analysis help to improve subsequent processes
- Test drive SAP Cloud for Energy at your own convenience

Meter Data Specialist

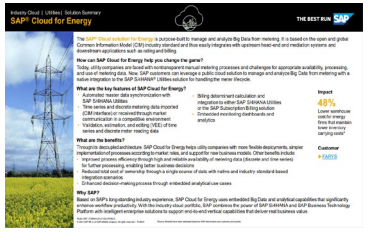
SAP Cloud for Energy: Additional Information, Videos etc.

The Solution

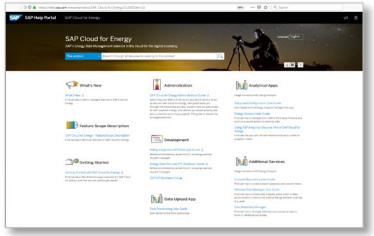
[Overview Video]



[SAP Solution Brief]

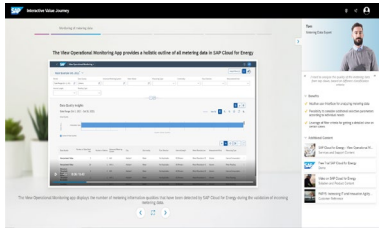


[SAP Solution Summary]



[SAP Documentation]

The Value



[Interactive Value Journey]

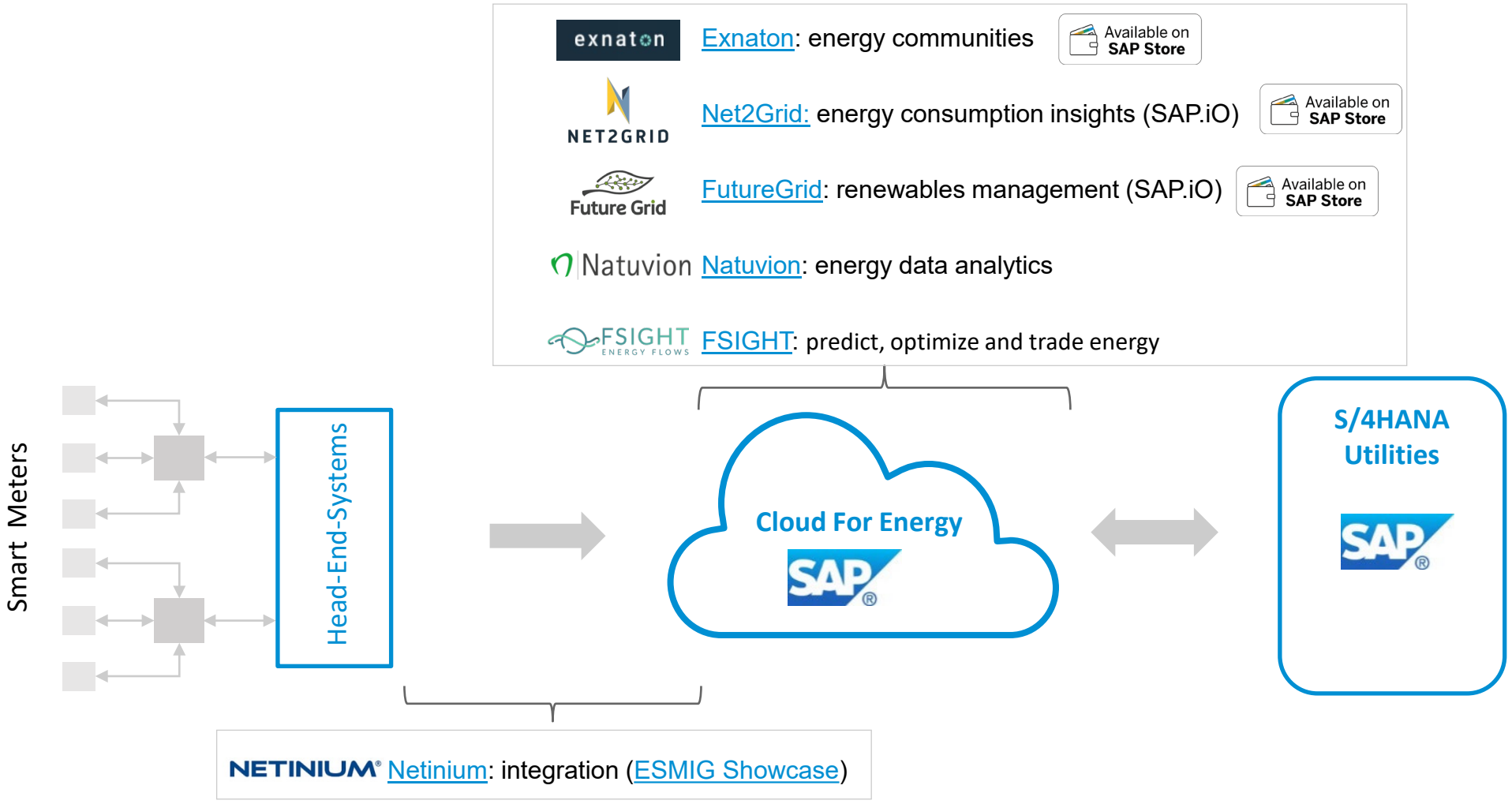
The Customers

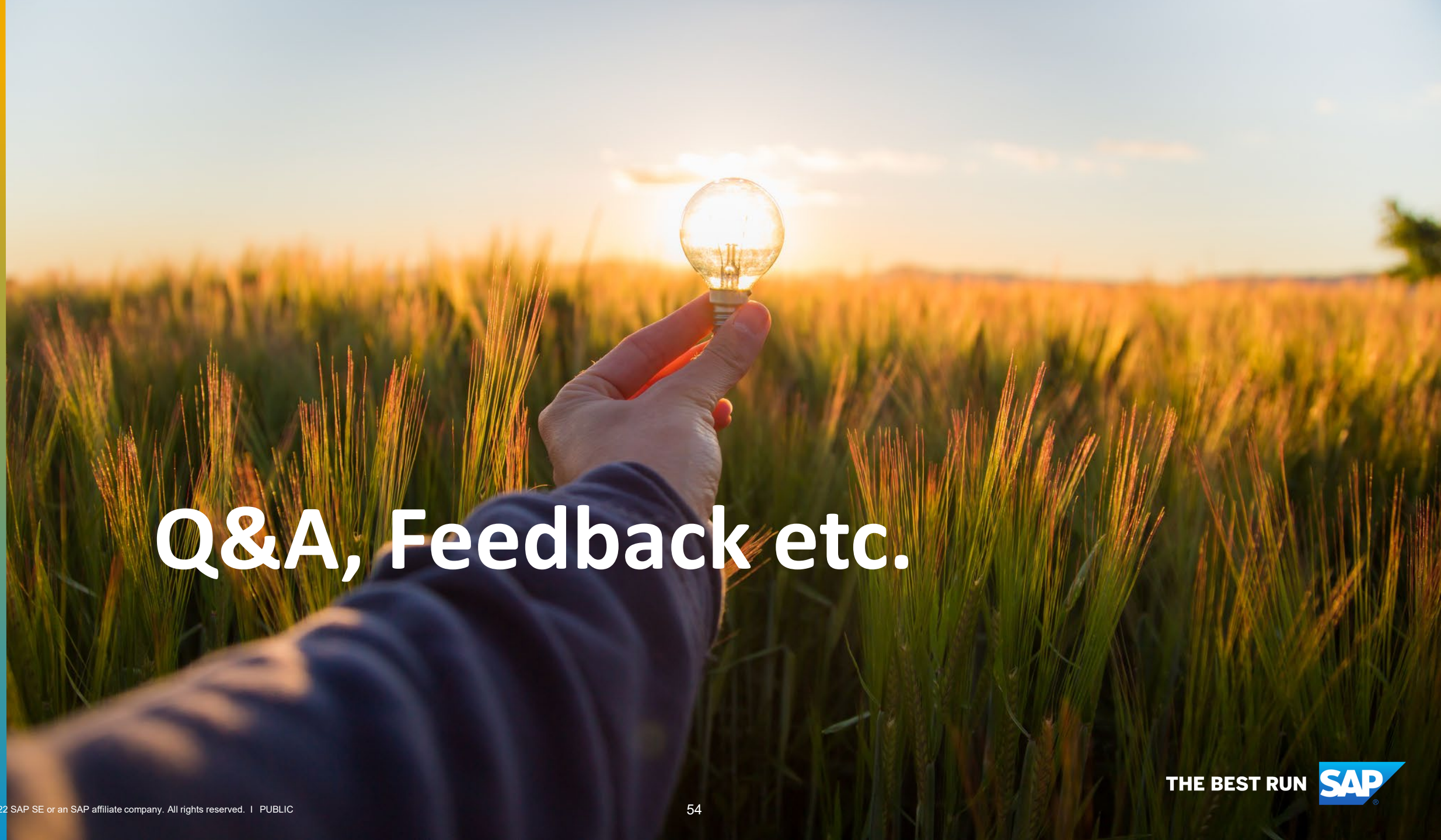
[SAP Success Story FARYS]

[Customer FARYS Video]

[Co-Innovation: Interview with Farys, Capgemini and SAP]

SAP Cloud for Energy – Overview of complementary Partner Solutions





Q&A, Feedback etc.

Thank you.

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SAP Cloud for Energy: Latest and Planned Innovations

H1 2021 Innovations

Foundation

- API for supporting measurement data versions
- Enhancements to synthetic load profile management
- Water data management – new reading types and units of measurement (UoMs) for the division of water

Processing:

- Enhancements to the Estimation Service API for calculating missing meter readings or interval data

Application:

- Extensions to the operational monitoring app
- Further details and navigation options in the View Operational Monitoring app
- Additional details in view operational monitoring and the possibility to handle additional reading types

Integration:

- Extensions to meter reading management and billing integration APIs
- Improved integration into SAP Subscription Billing – transfer forecasted consumption data for a specified period

H2 2021 Innovations

Foundation:

- Prosumer scenario – support for reading types for feed-in energy
- Additional attributes for the UsagePoint with the Energy Data Services API*
- Energy Data Services API - Meter enabled check*

Processing:

- Validation – maintain processing status and use the status as a filter criterion
- New SAP Fiori app “Configure Validation Rules”: configure validation rules that verify and label incoming metering data
- Estimation Services API – respond to deletion, ingestion, or validation of non-equidistant consumption data or values

Application:

- Operational monitoring – new option for filtering according to data quality

Integration:

- Integration with SAP S/4HANA Utilities – communication of AMI capabilities

Planned Innovations

Measurement Data Management
(equidistant and non-equidistant readings)
Billing Integration into SAP Subscription Billing (extended)
Device and Measurement Data
Energy Schedule Management (foundation and extended)
Market Communication Integration
Data Export to Analytics
Manage Additional Data

*Innovation not published yet