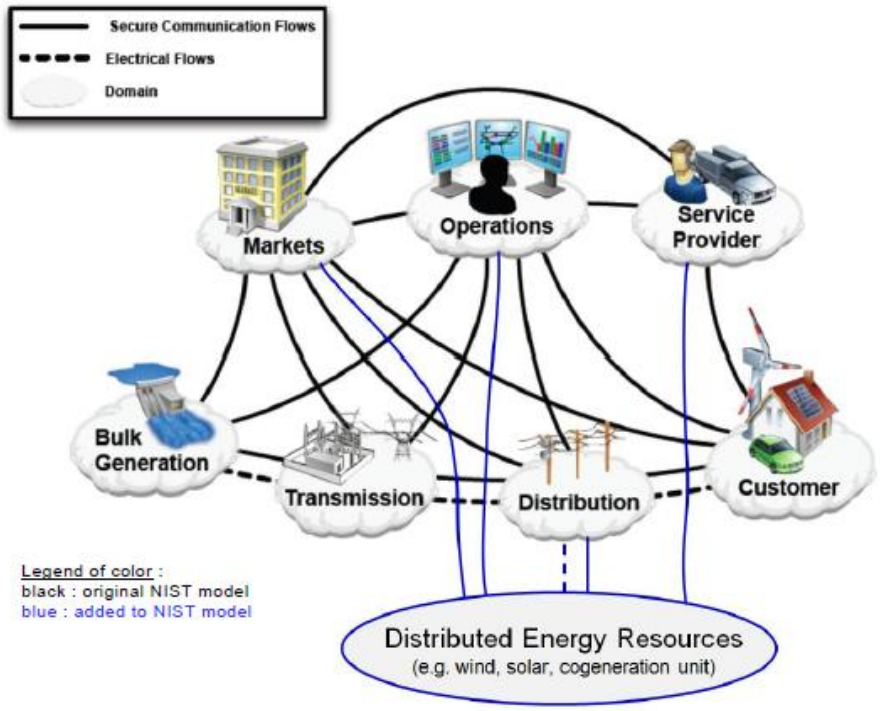
IEC role in the deployment and operation of the Smart Grid

General data

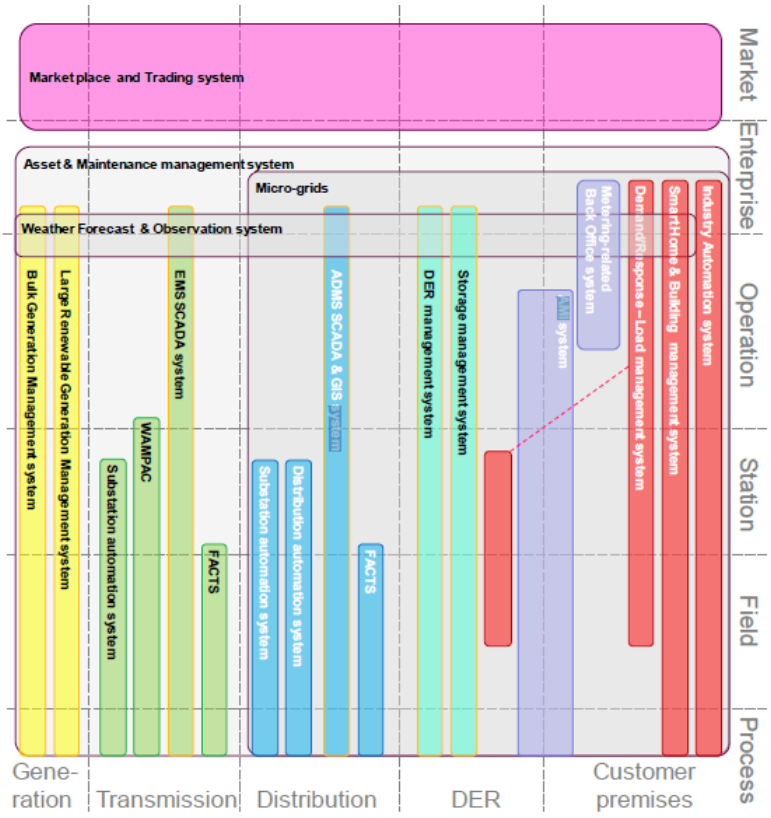
A smart grid is an upgraded electricity network to which two-way digital communication between supplier and consumer, intelligent metering and monitoring systems have been added[1].

Smart metering is an inherent part of a smart grid. It consists of an electricity meter that records consumption of electric energy and communicates that information to the grid operator and energy supplier for monitoring and billing purposes. Thanks to this information consumers are able to directly control and manage their individual consumption. Moreover, the grid operator can better plan the use of infrastructure and balance the system, for instance in terms of integration of renewable[2].

Figure. 1: Smart Grid – conceptual model



[1] MEMO/11/ Brussels, 12 April 2011 Q&A on the deployment of smart electricity grids and smart meters
[2] Ibid



The many smart grid technology areas – each consisting of sets of individual technologies – span the entire grid, from generation through transmission and distribution to various types of electricity consumers. Some of the technologies are actively being deployed and are considered mature in both their development and application, while others require further development and demonstration. A fully optimised electricity system will deploy all the technology areas in Figure 2. However, not all technology areas need to be installed to increase the “smartness” of the grid.

Wide-area monitoring and control

Real-time monitoring and display of power system components and performance, across interconnections and over large geographic areas, help system operators to understand and optimize power system components.

Information and communications technology integration

Underlying communications infrastructure, whether using private utility communication networks (radio networks, meter mesh networks) or public carriers and networks (Internet, cellular, cable or telephone), support data transmission for deferred and real-time operation, and during outages.

Renewable and distributed generation integration

Integration of renewable and distributed energy resources – encompassing large scale at the transmission level, medium scale at the distribution level and small scale on commercial or residential building – can present challenges for the dispatchability and controllability of these resources and for operation of the electricity system.

Transmission enhancement applications

There are a number of technologies and applications for the transmission system.

Distribution grid management

Distribution and substation sensing and automation can reduce outage and repair time, maintain voltage level and improve asset management.

Advanced metering infrastructure

Advanced metering infrastructure (AMI) involves the deployment of a number of technologies – in addition to advanced or smart meters that enable two-way flow of information, providing customers and utilities with data on electricity price and consumption, including the time and amount of electricity consumed. AMI will provide a wide range of functionalities:

- Remote consumer price signals, which can provide time-of-use pricing information.
- Ability to collect, store and report customer energy consumption data for any required time intervals or near real time.
- Improved energy diagnostics from more detailed load profiles.
- Ability to identify location and extent of outages remotely via a metering function that sends a signal when the meter goes out and when power is restored.
- Remote connection and disconnection.
- Losses and theft detection.
- Ability for a retail energy service provider to manage its revenues through more effective cash collection and debt management.

Electric vehicle charging infrastructure

Electric vehicle charging infrastructure handles billing, scheduling and other intelligent features for smart charging (grid-to-vehicle) during low energy demand.

Customer-side systems

Customer-side systems, which are used to help manage electricity consumption at the industrial, service and residential levels, include energy management systems, energy storage devices, smart appliances and distributed generation.

Business models

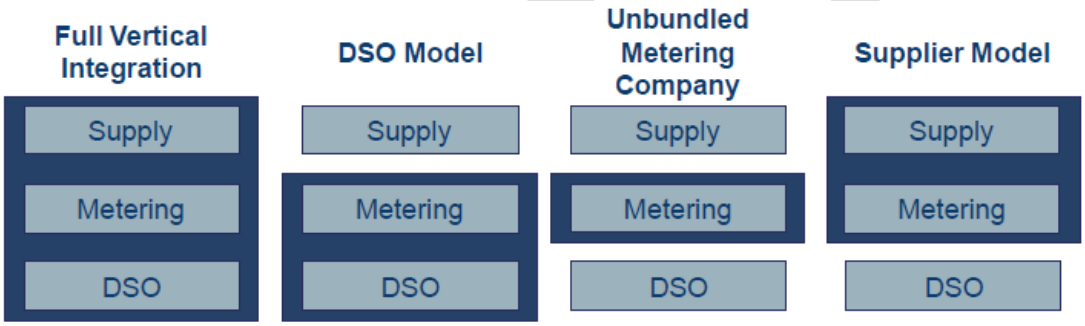
When deciding on a smart metering roll-out, the market model for the metering services has to be taken into account.

Basic Metering Market Models

Traditionally metering has been carried out as part of the distribution and supply activities of a vertically integrated utility. In such regimes the customer has (had) a single point of contact for network connection, supply, meter (installing, maintaining and reading) and invoicing (full vertical integration model).

Some other models could either be carried out by the distribution system operator as part of its regulated activities (DSO-model), by a separate metering company independent of the distribution and supply companies (unbundled metering company) or as an additional competitive service area of the supplier (supplier model).

Figure 3: Possible Options for the Structuring of the Metering Sector



Source: KEMA

In addition to this general structure of the metering market, the provision and operation of meters could be further broken down into several tasks that can be carried out by different market.

The traditional and still most common model of a monopolized metering sector, where the metering activities belong to the regulated activities of the DSO or to a separate dedicated regulated national/regional metering asset and service provider.

In almost all Energy Community Contracting Parties metering services remain part of the regulated DSO functions. The costs of meters are recovered via the regulated network charges, and investments in metering equipment are subject to regulatory approval.[3]

Fully integrated model or DSO Model

In this model, the Israel Electric Corporation Ltd. (IEC) takes up all roles concerning the smart meter, metering, communication and data base treatment. The IEC will take up the role of communication as he can use power line communication (PLC, if this technology is used) to send the meter data. A roll-out of smart metering by the IEC could therefore be easily implemented into the existing industry structures. Moreover, as smart

[3] Regulatory Aspects of Smart Metering. Commissioned by: National Association of Regulatory Utility Commissioners (NARUC), Energy Regulators Regional Association (ERRA). Submitted by: D. Balmert, Dr. K. Petrov, KEMA International B.V, Bonn, 20 December 2010

metering might be seen as the natural precursor of the smart grid, it makes great sense for the IEC to take up responsibility for smart metering.

Technical: As the meter comprises all functionality, installation of this system is relatively easy. It is required that the installation of the meter is taking place by a IEC's electrician. In terms of operational processes, the existing meter needs to be decoupled and replaced by a smart meter (including communication module), thus the meter data needs to be re-updated in the back office of the IEC, as well as some other administrative issues need to be changed and updated. When problems occur with the meter such as replacement of communication module for a new technology, the IEC's electrician will need to come down to each house, shutting down the full smart meter including electricity component, making the replacement and resetting the system.
This will require as mentioned below a lot of additional administration in the back office. In terms of communication, the IEC makes use of its own electricity network to connect the smart meters to its own telecommunication infrastructure via PLC or other communication channels. Additional investments are required in the access network installing amplifiers and connections points in order to cope with all the data (two-way) traffic taking into account a low delay and latency.

Business: As the IEC is taking care of all activities, everything can be arranged in a more organized and efficient way. They (IEC) also act as SPOC (single point of contact) for the end customer. When faults would occur in the network, either in the electricity, telecom and other component, the IEC is the only responsible party. This states that all required competences for all these components are available within the IEC organization.
The proposed model promotes the open and competitive market for suppliers and home automation. It is particularly in favour of emerging new service providers, e.g. aggregators. The service providers who are in conformity with the data security rules/certificates can participate with their products and services in the process and propose to the end users different energy efficiency and other value-added services. Centralized implementation of the smart meter deployment makes able use of economies of scale in the procurement of components for smart metering systems (meters, gareways, communication modules and facilities). If the amount of orders doubles, the investment costs decrease by between 10 and 15% with increasing order quantities[4].

Customer: For the end customer a single solution with one SPOC would be best. Centralized database treated under stringent security standards will guarantee the consumers data safety and will safeguard their privacy.

[4] **"Kosten-Nutzen-Analyse für einen flächendeckenden Einsatz intelligenter Zähler",** Im Auftrag des Bundesministeriums für Wirtschaft und Technologie. Ernst & Young, August 2013

Deployment sequence

The industry has now learned smart meter system deployments are not the routine "technology upgrade" that utilities have performed for the past 100 years. The phrase known to every utility field technician, "we have the legal right to repair, replace, and maintain OUR equipment," while true, does not establish a foundation for a new type of customer relationship[5].

"Stealth" smart meter deployments would be very risky in today's environment[6]. IEC's adopted approach is a "neutral-to-positive customer experience" that would set the foundation to achieve future demand response goals. The goal depends upon a successful smart meter deployment..

As experience gathered so far shows, the deployment of smart metering will face many barriers. Despite the benefits of smart metering, market parties will not in all cases adopt smart metering voluntarily or willingly. Developments which may endanger successful smart metering deployment will be taken seriously throughout the process[7].

Consumer Resistance

Consumer resistance may present a serious barrier to smart metering deployment. Consumer resistance is probably the most difficult barrier to mitigate.

In most cases consumer resistance can be observed to be driven primarily by three reasons:

- Consumers might fear that security and privacy of data gathered by smart metering cannot be guaranteed and hence unauthorized parties might have access to private data; they may also be against the authorized usage of the data.
- Consumers might also fear that they would have to bear the costs for deploying a smart metering infrastructure or that new (time-of-use) tariffs would lead to higher energy costs, whereas consumers' benefits might prove to be overestimated.
- Consumers might fear of unknown: radiation, allegedly accompanying new communication devices (no real base under this conclusion) etc.

The case of consumers opposing smart metering deployment due to the amount and level of detail of personal data gathered is highly relevant. As concerns regarding data security and consumer privacy can be easily understood, given the nature and amount of data gathered, they should be taken seriously. Moreover, the timely acknowledgement of concerns may be crucial in preventing issues endangering the success of smart metering deployment and in creating the necessary public acceptance.

Personal data should in general be protected by privacy law. Special attention will be given to smart metering as the amount of personal data collected is much greater than ever before. Privacy standards and access rights should be in place before a smart

[5] THE SMART METER DEPLOYMENT HANDBOOK. NV Energy and U.S. Department of Energy, 2013
[6] Ibid

[7] Development of Best Practice Recommendations for Smart Meters Rollout in the Energy Community. By order of: Energy Community Secretariat. Submitted by: KEMA International B.V. Authors: D. Balmert, D. Grote, K. Petrov. Bonn, 2012

metering roll-out is started. For example, The European Commission prepared[8] a recommendation for the roll-out of smart metering, which draws special attention also to the data protection issues.

The second major concern consumers may have is the fear that smart metering may lead to higher energy costs. It is the regulator's task to ensure that only the justified efficient costs are passed through to consumers and that these costs are shared with other parties gaining from smart metering deployment.

If consumer benefits resulting from smart metering deployment are higher than the associated costs, then passing efficient costs through to consumers is justified. To prevent consumer resistance and to mitigate consumer concerns requires an effort to increase consumer awareness of energy savings potentials and to strengthen their confidence in the proposed reforms in metering infrastructure.

Strengthening consumer awareness, trust and knowledge is essential to mitigate consumer resistance. Smart metering deployment should be accompanied by an information campaign[9].

Legal/Regulatory Barriers

Successful smart metering deployment is thus dependent on regulatory authorities (PUA), governmental and legislative bodies. These institutions have to play a significant part in assessing costs and benefits of smart metering deployment, setting up the roll-out scheme and monitoring the actual implementation.

Revenue / Tariff Setting and Incorporation of Costs of Smart Metering

The lack of a consistent legal and regulatory framework sufficiently adjusted to foster a smart metering roll-out and to promote energy savings will pose a major barrier to successful smart metering deployment. The legal and regulatory framework should show commitment to the smart metering roll-out by governmental and regulatory authorities. Moreover it should explain clearly how the investment and operating costs will be accommodated in tariff regulation.

Deployment Strategies[10]

Besides the metering market model, one of the key questions when devising the smart metering deployment strategy is the decision on the speed of smart metering roll-out. The timeframe for a smart metering roll-out – if full-scale national roll-out is the objective – seriously affects costs and benefits, due for instance to the

- necessity to operate two systems in parallel as long as old meters are in existence,
- peaking demand for a qualified labor force,
- metering and communications hardware and installation equipment and

[8] COMMISSION RECOMMENDATION on preparations for the roll-out of smart metering system. 9 March 2012 , EU/2012/148

[9] Development of Best Practice Recommendations for Smart Meters Rollout in the Energy Community. By order of: Energy Community Secretariat. Submitted by: KEMA International B.V. Authors: D. Balmert, D. Grote, K. Petrov. Bonn, 2012

[10] Regulatory Aspects of Smart Metering. Commissioned by: National Association of Regulatory Utility Commissioners (NARUC), Energy Regulators Regional Association (ERRA). Submitted by: D. Balmert, Dr. K. Petrov. KEMA International B.V, Bonn, 2010

- stranded investments if old meters are replaced before reaching the end of their economic lifetime.

The Team

The overall accountability for smart metering projects will be assigned to a Smart Meter Steering Committee that is chaired by a senior vice president of IEC. The Steering committee will coordinate the various project workflows and functional areas. The Steering committee delegates responsibility for customer experience and consumer confidence to the customer experience/confidence lead. This person coordinates with the functional areas that manage customer and stakeholder touchpoints to establish plans, execute plans, and monitor results[11].

The Plans

There should be multiple plans that govern the activities of the project. Each of the functional areas will then have one or more plans that align with the customer experience plan[12]. Corporate communications will have a plan for messages, media and communications calendars, and so on. It is best that plans are developed around customer segments. The reasons for this are the varying needs of the different segments and the meter technology used by the different segments.

The Coordination

The deployment of smart meters is dynamic and fluid. There will be adjustments to even the best plans due to weather, outages, inventory shortages, consumer complaints, media attention, regulatory orders, and so on. Thus, it is imperative that the consumer confidence team meet regularly to monitor the development and execution of plans, and ensure the various functional areas are coordinated[13]. Regular meetings are the norm, with daily stand-up meetings suggested during key events (such as first week of meter deployment, launch of web portal, and so on).

Detailed plan[14][15]

IEC will therefore have a key role to play before, during and after the installation of smart meters. The rollout and related education and communication effort towards customers will encompass three different phases:

- Phase 1 – Preparation of the rollout
- Phase 2 – Installation of the smart meters
- Phase 3 – Post-installation: smart meter customer support, complaint handling and fault resolution

In this preparatory phase, IEC should aim to:

[11] After THE SMART METER DEPLOYMENT HANDBOOK. NV Energy and U.S. Department of Energy, 2013
[11] Regulatory Aspects of Smart Metering.
[12] THE SMART METER DEPLOYMENT HANDBOOK. NV Energy and U.S. Department of Energy, 2013
[13] Ibid
[14] Based on "According to Communicating smart meters to customers– which role for DSOs?" A EURELECTRIC paper, June 2013
[15] According to "THE SMART METER DEPLOYMENT HANDBOOK." NV Energy and U.S. Department of Energy, 2013

- Inform customers about the deployment of the new metering system and the advantages smart meters bring with respect to overall energy efficiency;
- Inform public officials, the media, and other energy market players (ESCOs, suppliers, aggregators, etc.) who are likely to interact with customers during the deployment process;
- Provide a timeline of smart meter installations;
- Explain the process associated with the installation of smart meter;
- Clarify at a general level why the IEC is installing smart meters.

IEC will consider the following three aspects:

1.Customer awareness and understanding of smart meter deployment

The communication materials should be clear, concise and drafted in a way that customers can reasonably be expected to understand them. The materials might include:

- A welcome letter
- Website
- Frequently Asked Questions

2.Training and accreditation of the installers

- Rules for safety in low voltage to observe during installation work
- The installation instructions and process information should be well documented and taught to the installers
- The training material should recognize local specificities (e.g. metering solutions, wiring, tariff based load controls).

3.Scheduling visits

When scheduling the smart meter installation time:

- The IEC agrees with the chosen contractor (if applicable) to carry out the installations at the installation time of a certain area.
- Some weeks before the planned installation the DSO sends a letter to those customers who will receive a new meter.
- The letter gives general information about the meter exchange and the changes it implies.
- A few weeks before the planned installation the contractor sends letters to those customers who need to be at home (onsite) during installation.
- Several days before the planned installation the contractor sends an information letter to those customers who do not need to be home (onsite) during meter exchange.
- It is recommended that soon after the installation process, customers are asked to respond to a customer satisfaction inquiry (via email, app, SMS, web-tool, etc.), and that this information is used to improve the advance information and the installation process.

IEC will install the meter and carry out appropriate tests:

Installation

- A site inspection could be undertaken before commencing any work at the installation visit and the customer is advised that the inspection will take place.
- Where appropriate, the installer gives the customer verbal guidance on safety and makes them aware of the risks of storing objects too close to or obstructing the meter.
- The customer is made aware of whom to contact after the installation visit for further information in relation to the smart meter installation for support, query resolution, or to provide feedback (verbally or in writing). Non-premium rate helpline numbers are provided.
- The customer is made aware of any additional sources of help and information, including helplines, websites and other appropriate organizations able to offer assistance.
- The IEC is responsible for defining the standards against which meter installers working for contractors are certified as competent for the task.

Installing the smart meter – what will happen when the smart meter is installed?

1. The IEC or the contractor (if applicable) will contact customers and let them know about a fixed period during which a qualified meter installer will come to remove the old meter and fit the new smart meter.

2. The installers will present and identify themselves. They will let the customer know when the work is about to begin and when it is finished. The customer will not be required to pay anything to the installer.

3. The power will be switched off for a certain time (usually 20 to 60 minutes) while the smart meter is installed.

4. Meter reading of the old and new meter.

5. The installer will leave the customer with instructions on how to read the new smart meter (including a safety manual) and details about whom to contact if case of problems.

6. In cases where the power control functionality of the smart meter is being implemented, instructions must be left so that the customer understands the new operation of power control and how to react when the demanded power exceeds the contracted one.

7. Suppliers will get in touch with consumers to offer innovative customer services (e.g. introduction of new type of contracts or products).

Testing and demonstration

To ensure the accuracy of its smart meters, the IEC has multiple test phases in place prior to, during and after installation.

- It is the IEC's responsibility to take appropriate steps to ensure the full smart metering system is operating correctly.
- The use of the smart metering system is demonstrated to the customer, including what information is available from the smart metering system and how this can be accessed.

- Instructions, in a written or other suitable format, on how to use the smart metering system are left with or sent to the customer.
- The demonstration of the smart metering system is responsive to the needs of vulnerable customers or others with specific needs.
- Essential information should be provided in a format suitable for vulnerable customers and those with specific needs.
- When the meter installers have changed the meter they can give the customer a hand-out (or leave a note in the customer's mailbox) with additional information. It is important to notify customers where they can get additional information if needed.

Customers do not necessarily need to receive all of the information mentioned in the previous section automatically (e.g. all benefits of smart metering, all new qualities of the meter, the distribution of installation costs). Instead, some information can be made available on the IEC web page. Alternatively, customers could contact a IEC customer service center if they would like to receive more specific information.

Customer feedback

It is the IEC's responsibility to ensure that:

- The customer has a means of providing feedback on their experience of the installation visit. This could be in the form of feedback card, via a website, email or verbally.
- A follow-up call or visit can be made to a demonstrably valid sample of customers from a variety of customer groups to learn from their experience of the installation visit. This information provides input for future installation visits and, where appropriate, for member policies and processes.
- The customer should possibly also receive written information about the reading of the replaced meter and the fact that a smart meter has been installed. It is also recommended that additional information on the meter itself is provided (information available on the display, etc.).

Resolving complaints

Customers should have clarity on whom to contact if they have queries or problems and where they can get redress. IEC should ensure that:

- Different communication channels (customer care center, web, offices, etc.) are put in place and trained to give an adequate level of support.
- Dedicated complaint handling and redress systems with appropriately trained staff are put in place ahead of rollout.
- The IEC makes every reasonable endeavor to take responsibility for the fault and the resolution.
- Suitable operational arrangements are in place with service providers and network operators so that complaints are addressed in a timely manner.
- If IEC use a contractor for installations, the processing and responsibilities concerning customer complaints must be clearly agreed between IEC and contractors.

Fault resolution

IEC should ensure that:

- Information is provided as to whom customers can contact if they identify a fault with the smart metering system.
- The customer is provided with contact details for additional information related to the smart metering system fault, for example should they wish to check progress.
- If a fault is identified with the smart metering system after the installation visit, the customer is made aware what the resolution is likely to be, who will be resolving the fault, and the approximate timescales of the resolution.

Conclusions. Smart metering by IEC is in the interest of customers.

- Metering is a crucial behind-the-scenes process, which is necessary for the smooth operation of all other market processes. Giving the IEC the sole responsibility for all metering sub-processes, including meter reading and validation, significantly reduces complexity and guarantees a smooth and efficient operation.
- Smart meter data collection and management by IEC enables effective privacy and security of customer data in a regulated environment.
- Smart meters enable IEC to measure power quality and interruptions. This is useful to solve problems in the network and to improve the quality of supply for customers.

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