



# Advanced Metering System (AMS)

Status and plans for installation per Q2 2016

Unofficial Translation of Norwegian Report 79-2016

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## Summary

This report shows the status and plans for implementation of AMS per Q2 2016.

111 grid companies have reported their status and plans for the AMS rollout, representing 2.9 million meters. These figures include the 34 companies, amounting to 200.000 meters, that have been given dispensation from certain functional requirements until 2020.

Nearly all companies had signed agreements with suppliers and installers before the reporting deadline, unlike last time reporting was made.

Compared to the last report in 2015, there are few changes with regard to planned installations. Investment costs per meter differ hugely between companies.

The number of planned installations of AMS meters EOY 2016 is notably lower in this report, compared to the 2015 report.

## Main figures Q2 2016

### Rollout plan

- 18 % installation before 31.12.2016, 70 % before 31.12.2017 and «the rest» (30 %) in the course of 2018.

### Investment costs

- Total investment costs for the AMS project is approximately NOK 10 bill.

## 1 No. of meters per customer segment

| <i>Segment</i>           | <i>No. of meters</i> |
|--------------------------|----------------------|
| Households               | 2 284 127            |
| Cabins and cottages      | 322 913              |
| Businesses > 100 000 kWh | 302 878              |
| Streetlights             | 20 025               |
| Other                    | 18 451               |
| <b>Total</b>             | <b>2 948 394</b>     |

### Comment:

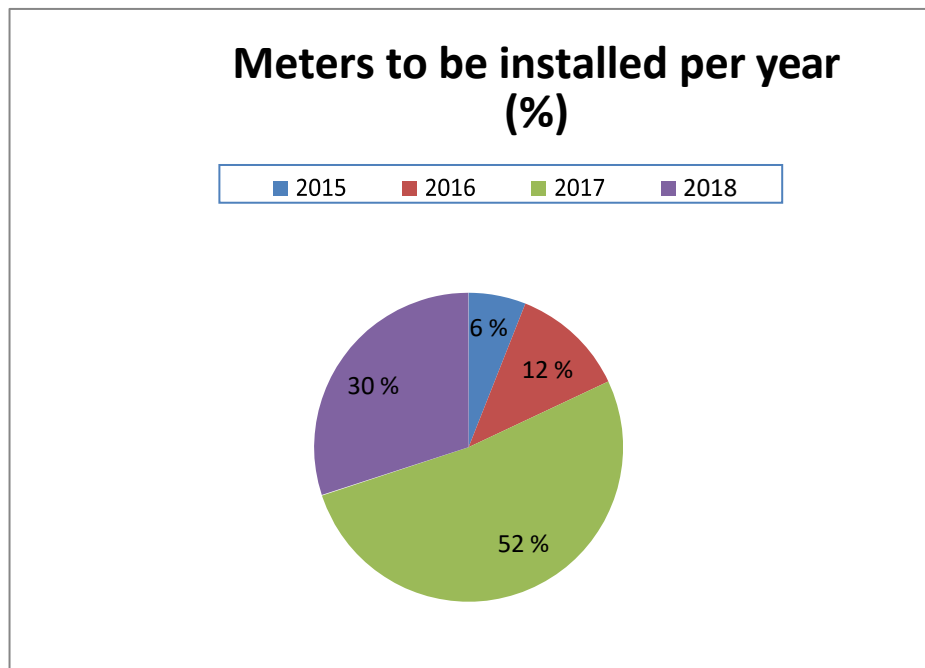
- The number of meters includes the 33 grid companies that have been given partial dispensation from the regulation to install AMS. All these companies had installed two-way communication timestamp metering prior to the regulation coming into force. These companies represent approximately 200.000 meters.

## 2 Annual installation plan

|   | 2015   | 2016   | 2017    | 2018   | 2019  | 2020  |
|---|--------|--------|---------|--------|-------|-------|
| No. of meters installed per year        | 179383 | 347286 | 1539247 | 873890 | 14310 | 14489 |
| Percentage of meters installed per year | 6      | 12     | 52      | 30     | 0,5   | 0,5   |

### Comments:

- The figure for 2015 is for historically installed meters up to and including 2015.
- The figures for 2019 and 2020 have been provided by grid companies with dispensation from specific rules in the AMS regulation.

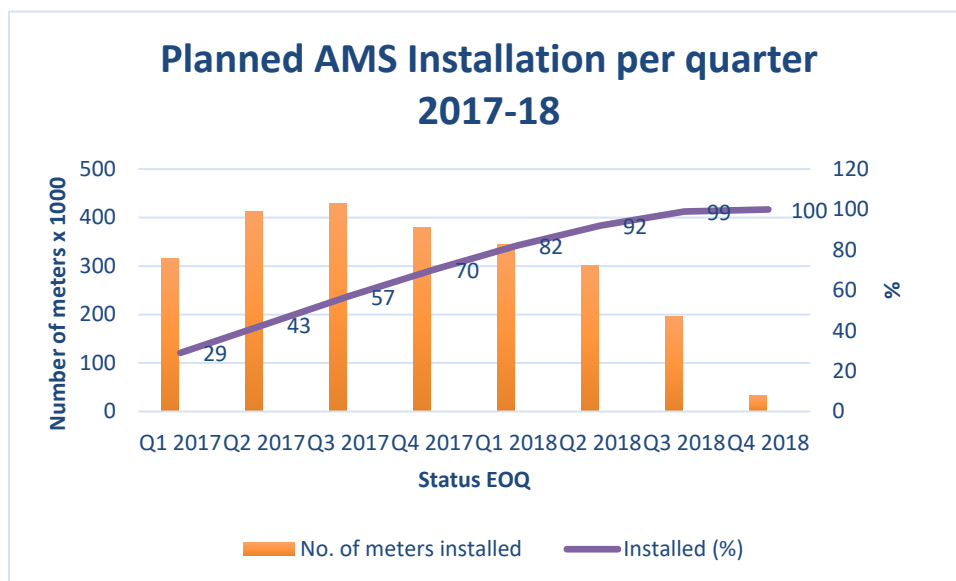


### 3 Quarterly installation plan

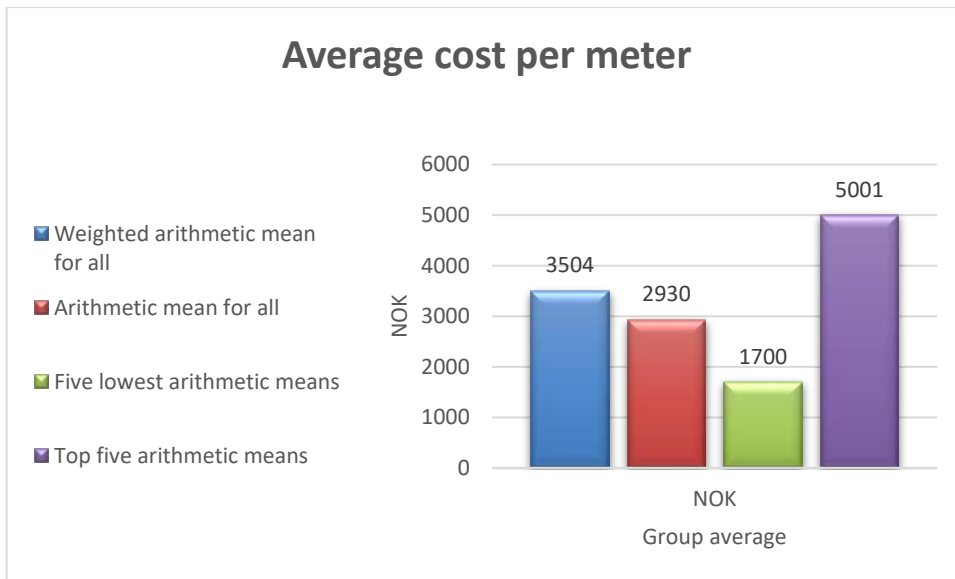
|  | 2016 | Q1 2017 | Q2 2017 | Q3 2017 | Q4 2017 | Q1 2018 | Q2 2018 | Q3 2018 | Q4 2018 |
|--|------|---------|---------|---------|---------|---------|---------|---------|---------|
| No. of meters (x 1000) installed per quarter | 527  | 315     | 412     | 429     | 380     | 345     | 301     | 195     | 33      |
| Accumulated percentage completed             | 18   | 29      | 43      | 57      | 70      | 82      | 92      | 99      | 100     |

**Comments:**

- No. of planned meters are in thousands.
- The figure for 2016 is the sum of historically installed meters up to and including 2016.
- Plan installed meters EOY 2016 is clearly lower in this report compared to the 2015 report.



## 4 Costs per meter

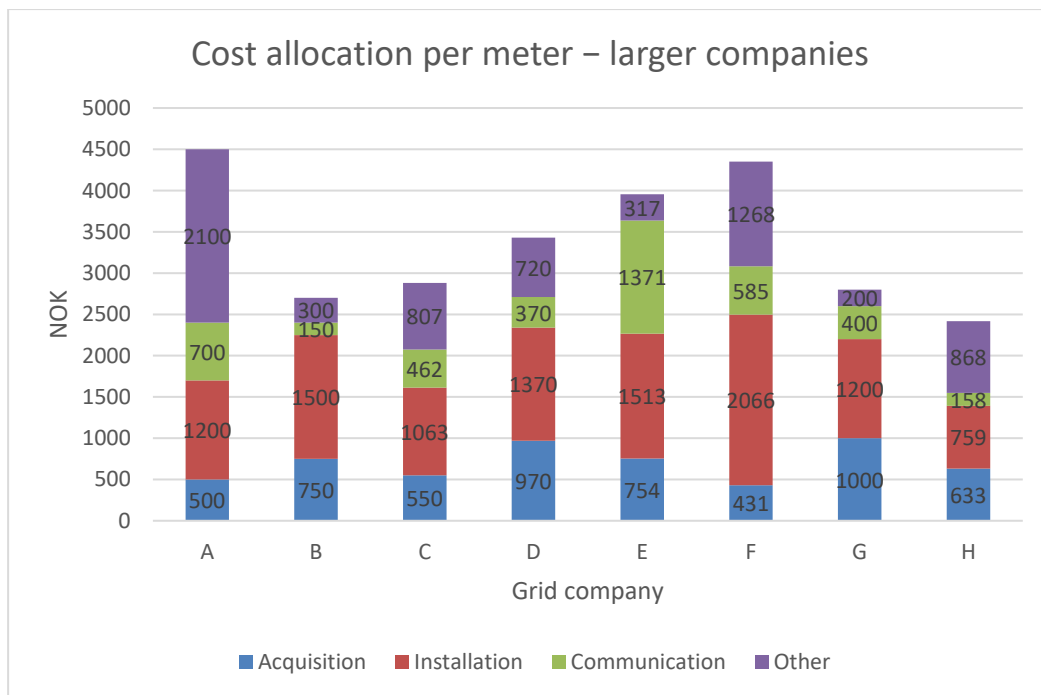


### Comments:

- 'Weighted arithmetic mean for all' refers to the grid companies' total number of meters.
- 'Five lowest' refers to the five grid companies that have provided the lowest AMS costs per meter, as opposed to the 'top 5'.
- 87 grid companies comprising 2.2 million meters have costs less than the weighted arithmetic mean cost.
- 24 grid companies comprising approximately 0.7 million meters have costs above the weighted arithmetic mean



## 5 Costs per meter for a selection of larger grid companies



### Comment:

- The bar chart show the cost allocation per meter for some of Norway's largest grid companies. The figures show the budget for procurement, installation, communication and 'Other'. 'Other' generally refers to costs for the headend system. The varied total costs per meter and the cost allocation between the different categories are characteristics typical for grid companies as a whole.

## 6 AMS procurement alliances

| <i>Category</i>  | <i>No. of grid companies</i> | <i>Approx. no. of meters</i> |
|--|------------------------------|------------------------------|
| Yes, the grid company has signed a cooperation agreement with other grid companies | 76                           | 1.2 mill.                    |
| No, the grid company has no formal cooperation agreement (*)                       | 35                           | 1.7 mill.                    |

**Comment:**

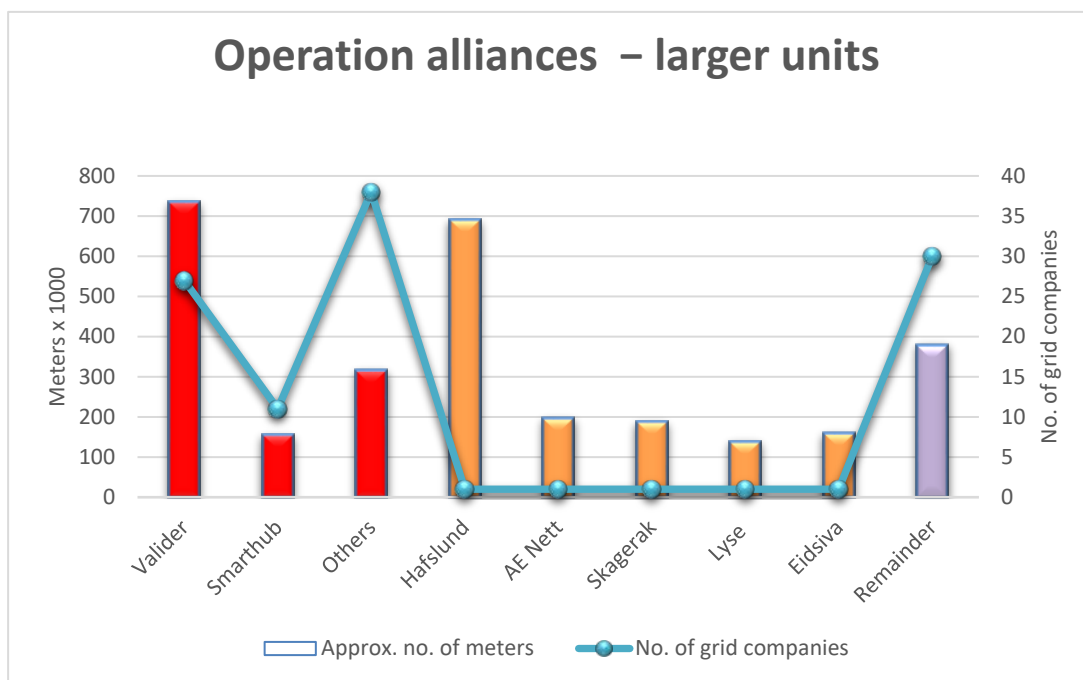
- (\*)Five of the seven largest grid companies are not part of formal AMS procurement alliances. These five represent approximately 1.4 million meters.

## 7 Operation alliances after AMS rollout completion

| <i>Category</i>                  | <i>No. of grid companies</i> | <i>Approx. No. of meters</i> |
|----------------------------------|------------------------------|------------------------------|
| <b>Valider AS</b>                | 27                           | 734 000                      |
| <b>Smarthub AS</b>               | 11                           | 154 000                      |
| <b>Other operation alliances</b> | 38                           | 315 000                      |
| <b>No operation alliance</b>     | 35                           | 1 746 000                    |

### Comment:

- The category 'No operation alliance' comprises five grid companies that, as a whole, total just under 1.4 million meters. Separately, these companies have between 137.000 and 689.000 meters. Including the various alliances, they represent a total of 2.6 million meters, i.e. 87% of all meters.

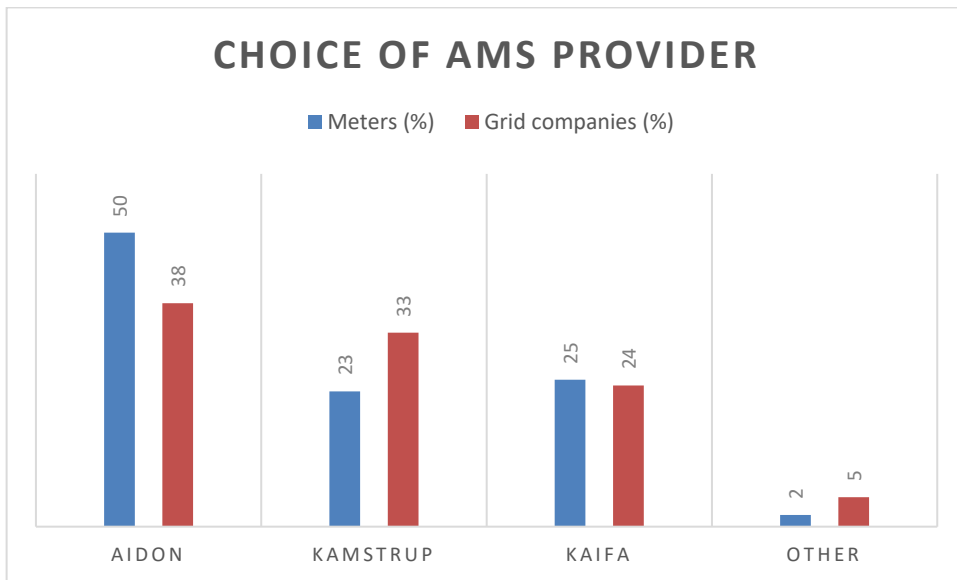


## 8 Choice of AMS provider

| <i>Category</i> | <i>No. of grid companies</i> | <i>Meters (%)</i> |
|-----------------|------------------------------|-------------------|
| <b>Aidon</b>    | 42                           | 50                |
| <b>Kamstrup</b> | 37                           | 23                |
| <b>Kaifa</b>    | 26                           | 25                |
| <b>Other</b>    | 6                            | 2                 |

### Comment:

- The category 'Other' applies to grid companies with dispensation from regulations.

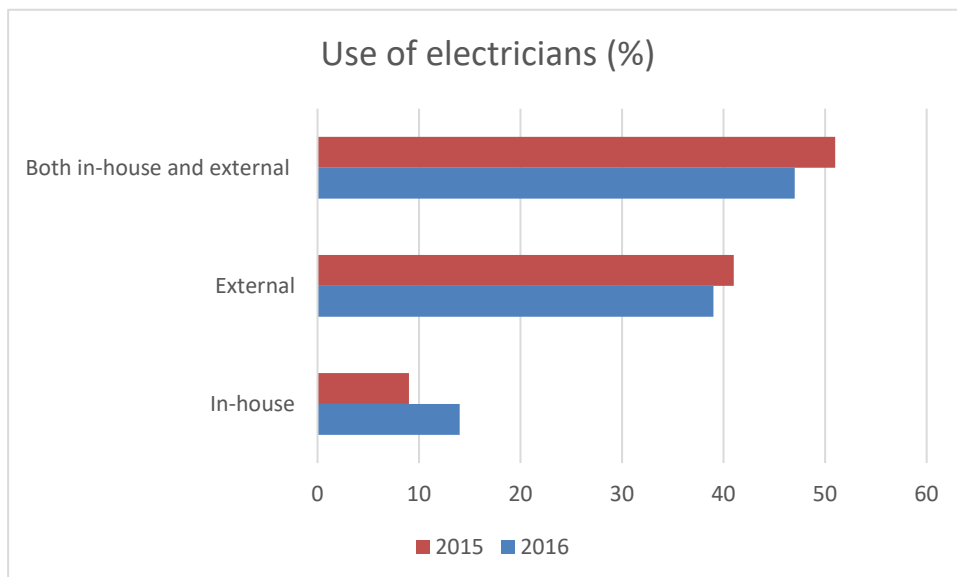


## 9 Installation of meters

| <i>Category</i>                                | <i>No. of companies<br/>2016 report (%)</i> | <i>No. of companies<br/>2015 report (%)</i> |
|--|---|---|
| <b>In-house electricians</b>                   | 16 (14%)                                    | 7 (9%)                                      |
| <b>External electricians</b>                   | 43 (39%)                                    | 33 (41%)                                    |
| <b>Both in-house and external electricians</b> | 52 (47%)                                    | 41 (51%)                                    |

### Comments:

- ‘In-house’ electricians refers to electricians legally connected to the company or enterprise through ownership. ‘External electricians’ are not legally connected to the grid company.
- Only the smaller grid companies use in-house electricians.



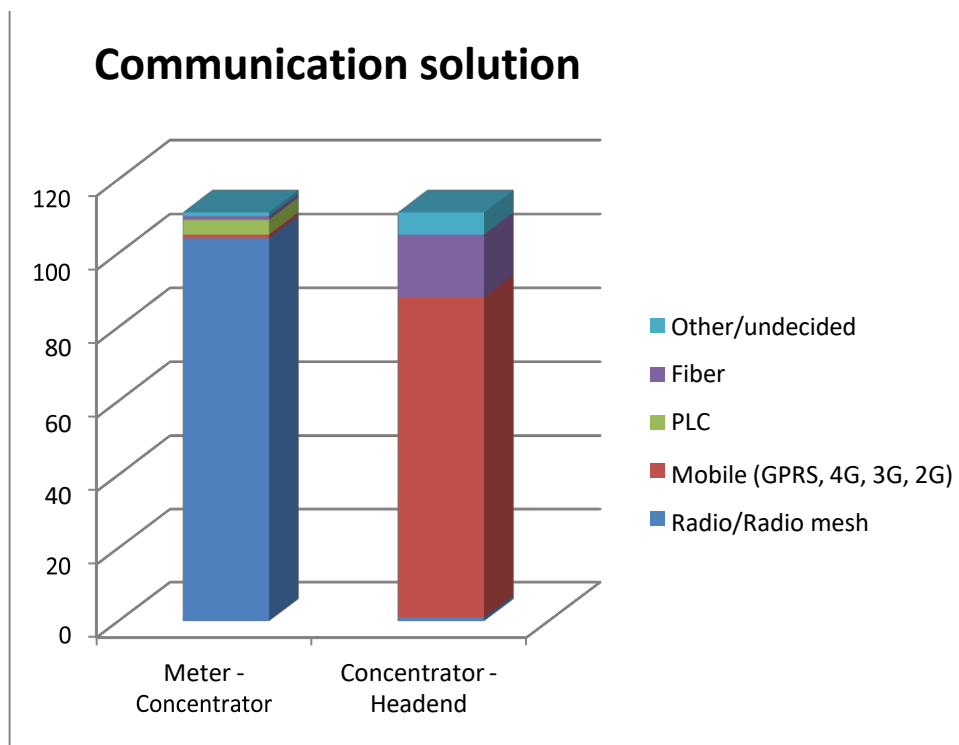
## 10 Communication solutions

| <i>Category</i>           | <i>Meter - Concentrator</i> | <i>Concentrator - Headend</i> |
|---------------------------|-----------------------------|-------------------------------|
| Radio/Radio mesh          | 104                         | 1                             |
| Mobile (GPRS, 4G, 3G, 2G) | 1                           | 87                            |
| PLC*                      | 4                           | 0                             |
| Fiber                     | 1                           | 17                            |
| Other/Undecided           | 1                           | 6                             |

\*Programmable Logic Controller

### Comment:

- NB! If grid companies use several means of communication, only the most used solution is reported.

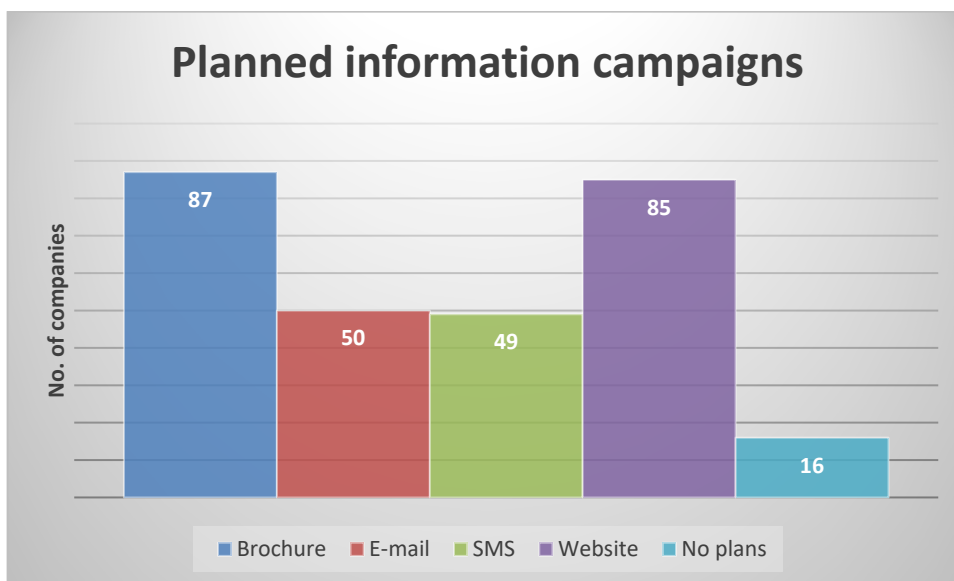


## 11 Information campaigns

| <i>Category</i>             | <i>No.</i> |
|-----------------------------|------------|
| <b>Planned campaigns</b>    | 95         |
| - Brochure                  | 87         |
| - E-mail                    | 50         |
| - SMS                       | 49         |
| - Website                   | 85         |
| - Other                     | 18         |
| <b>No campaigns planned</b> | 16         |

### Comment

- Most companies have several campaigns planned.

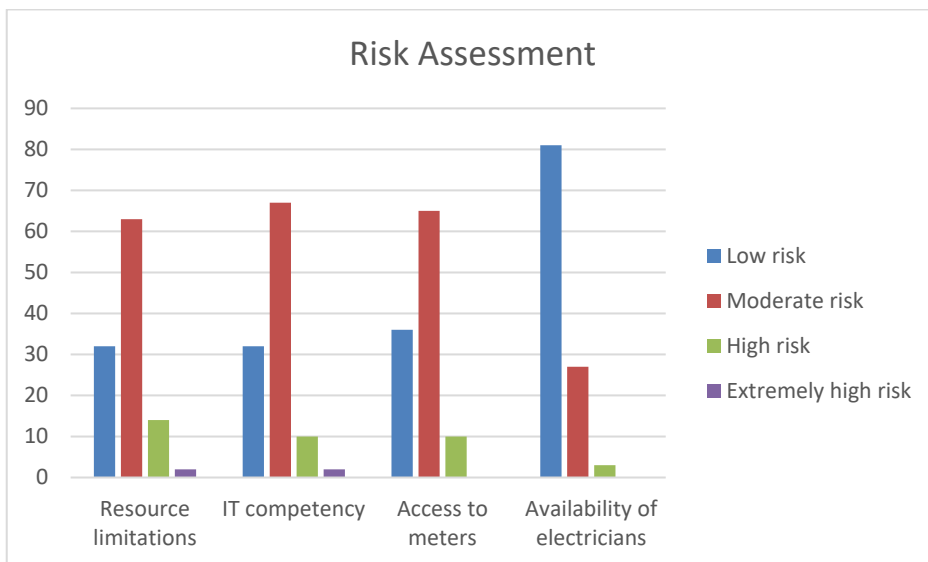


## 12 Risk assessment

| <i>Category/No. of companies</i>    | <i>Low risk</i> | <i>Moderate risk</i> | <i>High risk</i> | <i>Extremely high risk</i> |
|-------------------------------------|-----------------|----------------------|------------------|----------------------------|
| <b>Limited competency/resources</b> | 32              | 63                   | 14               | 2                          |
| <b>IT/Information security</b>      | 32              | 67                   | 10               | 2                          |
| <b>Meter accessibility</b>          | 36              | 65                   | 10               | 0                          |
| <b>Availability of electricians</b> | 81              | 27                   | 3                | 0                          |

### Comments:

- Limited competency/resources (esp. IT-related)  
The extent to which the grid company assesses that access to internal staff and expertise will limit or affect the AMS rollout.
- IT/Information security  
The risk connected to whether the system will be secure enough both in relation to misuse of data and unwanted access to control functions, hacking, etc.
- Meter accessibility  
Most meters are installed indoors and require house owners to be physically available or have other means of giving access to the meter. How the grid companies assess the risk due to lack of access to meters, making it difficult to meet the deadline for rollout within 2016.
- Availability of electricians  
Risk due to unavailability of authorised electricians when installing meters.



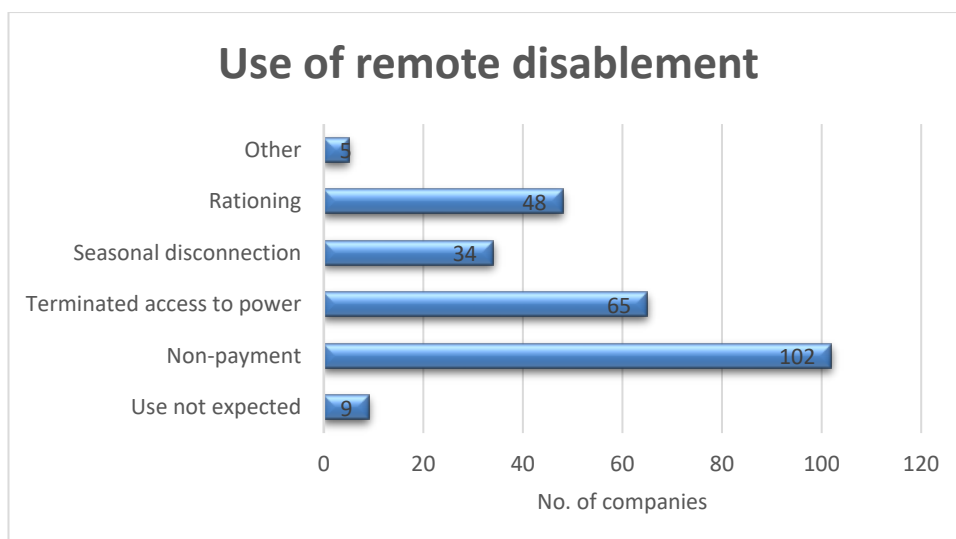


### 13 Use of remote disablement

| <i>Category</i>            | <i>No. of companies</i> |
|----------------------------|-------------------------|
| Use not expected           | 9                       |
| Non-payment                | 102                     |
| Terminated access to power | 65                      |
| Seasonal disconnection     | 34                      |
| Rationing                  | 48                      |
| Other                      | 5                       |

**Comment:**

- There are no statutory provisions for operational use of remote disablement.

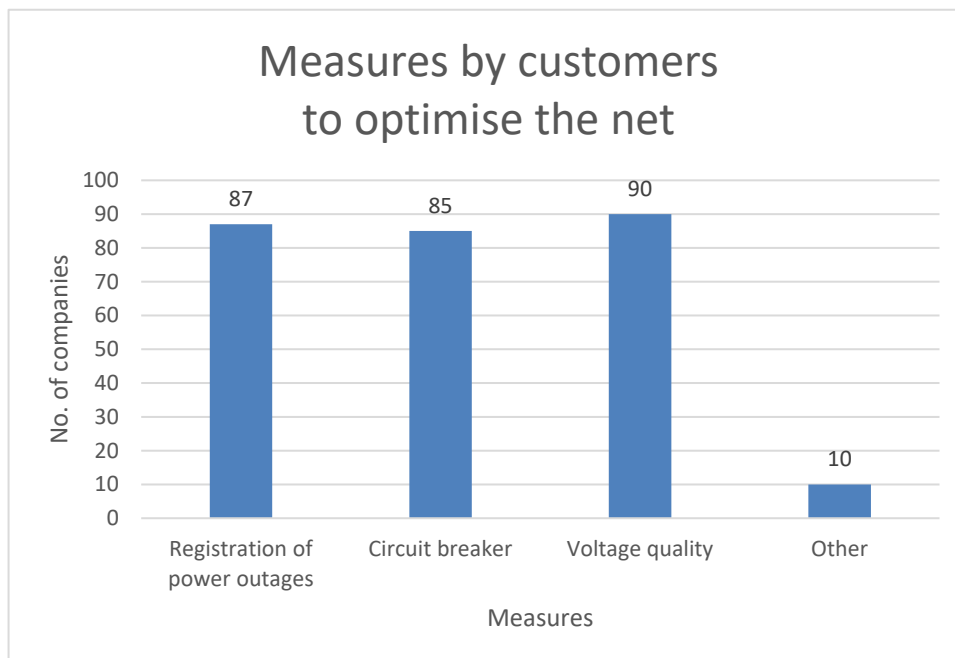


## 14 Measures by customers to optimise the network

| <i>Category</i>               | <i>No. of companies</i> |
|-------------------------------|-------------------------|
| Registration of power outages | 87                      |
| Circuit breaker               | 85                      |
| Voltage quality               | 90                      |
| Other                         | 10                      |

### Comment:

- There are no AMS regulations for these measures.



## 15 HAN interface – PKI encryption

| <i>Category</i>                 | <i>No.</i> |
|---------------------------------|------------|
| Post-fitting of HAN port        | 27         |
| HAN port fitted at installation | 84         |
| PKI Encryption                  | 53         |

### Comments:

- The HAN port (Home Area Network) is the AMS meter's connection/coupling point that communicates with the customer.
- PKI (Public Key Infrastructure) is an authentication tool. This is not explicitly a statutory provision, but is one of the measures that grid companies should evaluate in order to fulfill Section 4-2 g) in the Norwegian regulation no. 301 of 11 March 1999: Regulations governing metering, settlement and coordinated action in connection with electricity trading and invoicing of network services.



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