provides consultancy and market analysis for the energy and transport sectors and combine a solid understanding of market dynamics with advanced modelling.
HOW NORWAY’S NEW FLEXIBLE POWER TARIFFS INCENTIVIZES SMART EV CHARGING

Mari Nyhaug, Consultant, THEMA Consulting Group
mari.nyhaug@thema.no
Agenda

1. The new power tariffs incentivizes the consumers to remove their peaks

2. An example with smart EV home charging

3. Backup: A little background about the change to power tariffs
The design aims to incentivize slow EV charging at night, and have the consumers demanding the most power pay the most.

**ENERGY**

**Incentive: Use less energy**

**POWER**

**Incentive: Use less energy at the same time**
The energy part incentivized lower energy consumption, and moving the usage to the night hours (time of use)

**ENERGY**

- Cost per kWh (energy)
- Must cover cost of marginal loss
- Can cover other fixed costs
- Can at most make up 50% of DSO’s income
- Can be differentiated by time of use

**Incentive: Use less energy**

The cost for energy has a «time of use» differentiation with lower costs at night and during weekends.

Source: NVE-RME, Eliva
... while the power part incentivized lower peaks through the "power staircase"

- Cost per month
- Must be differentiated based on power demand
- Must cover customer specific costs (Billing, measuring..)
- Can cover other fixed costs

Incentive: Use less energy at the same time

The power cost per month is decided through placement in the «power staircase»

The three highest peaks per month decides your step

Source: NVE-RME, Eliva
EXAMPLE: In September of 2022 I consumed 232 kWh in my apartment, resulting in a 293.16 NOK bill for my grid access.

**ENERGY**

- Consumption: 122 kWh
  - Price: 0.43 nok/kWh
  - Cost: 52.46 NOK

- Consumption: 110 kWh
  - Price: 0.37 nok/kWh
  - Cost: 40.70 NOK

**I total: 232 kWh  →  Cost: 93.16 NOK**

**POWER**

Consumption in the peak hour per day (kWh/h):

- Days:
  - 2.39
  - 2.78
  - 3.28

**Price for step from 2kW to 5 kW: 200 NOK**

Source: Elhub.no for Mari’s apartment
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In this analysis we will look at three cases to see how the power tariff affects them: a baseline with no EV-charging, a fast EV-charging and a slow EV-charging.

**Baseline (no car)**
- Consumption: 27 000 kWh

**Fast charging**
- Charging: 2400 kWh = 12 000 km

**Slow charging**
- Charging: 2400 kWh = 12 000 km

**Milage: 0.2 kWh/km**
BASELINE: Our house is heavily affected by the outdoor temperature, with high power peaks in the winter

Energy consumption (kWh/year)
Baseline (No car)
27 000 kWh

How much capacity is paid for? (kW)
(Average of three highest peaks per month)

Yearly tariff (NOK/year)

<table>
<thead>
<tr>
<th>Energy</th>
<th>Power</th>
</tr>
</thead>
</table>
| 10 046 | 5 508 
| 4 538  |       |

Baseline (no car)

We’re only looking at the grid-part of the bill, the electricity bill will come in addition.
CASE 1: We buy an EV and charge it for 1 hour every afternoon. Every month our power consumption jumps up to the next step in the «power staircase» compared to the baseline.

**Energy consumption (kWh/year)**

- Baseline (No car): 27 000 kWh
- Baseline + fast charging: 29 400 kWh

**Yearly tariff (NOK/year)**

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (no car)</td>
<td>5 508</td>
<td>6 072</td>
</tr>
<tr>
<td>Fast charging</td>
<td>4 538</td>
<td>6 051</td>
</tr>
</tbody>
</table>

- Baseline (no car): 10 046 NOK/year
- Fast charging: 12 124 NOK/year

**How much capacity is paid for? (kW)**
(Average of three highest peaks per month)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
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CASE 2: We move our EV-charging to the night hours and slow it down. Compared to the baseline, we only have to pay grid rent for more energy, not more power to charge our EV.

Energy consumption (kWh/year)

<table>
<thead>
<tr>
<th>Baseline (No car)</th>
<th>Baseline + fast charging</th>
<th>Baseline + slow charging</th>
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<tbody>
<tr>
<td>27 000 kWh</td>
<td>29 400 kWh</td>
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</table>

Yearly tariff (NOK/year)

<table>
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<tr>
<th>Baseline (no car)</th>
<th>Fast charging</th>
<th>Slow night charging</th>
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<tr>
<td>10 046</td>
<td>5 508</td>
<td>12 124</td>
</tr>
<tr>
<td>5 508</td>
<td>6 072</td>
<td>10 328</td>
</tr>
</tbody>
</table>

How much capacity is paid for? (kW)

(Average of three highest peaks per month)

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1. The new power tariffs incentivizes the consumers to remove their peaks

2. An example with smart EV home charging

3. Backup: A little background about the change to power tariffs
The process of implementing new tariffs for the low voltage grid customers in Norway has been a long one.

<table>
<thead>
<tr>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suggestion on public hearing</strong></td>
<td><strong>A new hearing is announced, but not released</strong></td>
<td><strong>The feedback asks for simpler models</strong></td>
<td><strong>Decision made! New tariffs from 01.01.2022</strong></td>
<td><strong>01.07.2022</strong></td>
<td><strong>Revised tariffs are implemented</strong></td>
</tr>
</tbody>
</table>

- **01.01.2019**: All consumers in Norway must have smart meters.
- **01.07.2019**: Suggestion on public hearing.
- **01.01.2020**: 3 new models are presented and sent on a public hearing.
- **01.07.2020**: The regulatory authority releases their final suggestion.
- **17.12.2021**: New tariffs are postponed 2 weeks before implementation.
The motivation behind the change was for the tariff to reflect the DSO’s actual cost structure...

A DSO’s costs and income with the old tariff scheme

- Costs:
  - 90% Fixed
  - 10% Variable

- Income:
  - 70% Variable
  - 30% Fixed
... and to meet the future strain on the grid due to the rise of electric vehicles and charging at home.

Registered vehicles in Norway

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>2013</td>
<td>99%</td>
<td>1%</td>
</tr>
<tr>
<td>2014</td>
<td>98%</td>
<td>2%</td>
</tr>
<tr>
<td>2015</td>
<td>97%</td>
<td>3%</td>
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<tr>
<td>2016</td>
<td>96%</td>
<td>4%</td>
</tr>
<tr>
<td>2017</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>2018</td>
<td>93%</td>
<td>7%</td>
</tr>
<tr>
<td>2019</td>
<td>91%</td>
<td>9%</td>
</tr>
<tr>
<td>2020</td>
<td>88%</td>
<td>12%</td>
</tr>
<tr>
<td>2021</td>
<td>84%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Source: SSB
It is important to remember that a change in the tariff design does not make the DSOs earn more money, its just a redistribution of the costs.
When designing the tariff, the regulator considered three tariff elements to distribute the costs in a fair manner, each element incentivizing the user in a different way.

**FIXED**
Incentive: None

**POWER**
Incentive: Use less energy at the same time

**ENERGY**
Incentive: Use less energy

The old tariff design had a **fixed** part and an **energy** part. There were large differences in weighting of the two parts between DSOs.
Navigate the energy transition with confidence