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# The Evolution of Distribution Networks towards Decentralised (Renewable) Energy System

## Distribution System Operators and PV-Prosumers

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Andreas Jahn  
Senior Associate  
The Regulatory Assistance Project (RAP)®

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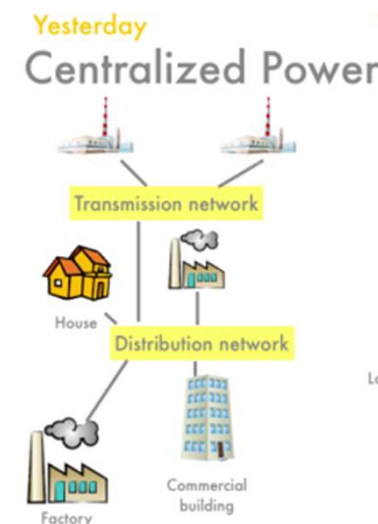
Anna-Louisa-Karsch-Straße 2  
D-10178 Berlin  
Germany

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+49 30 700 1435 421  
[ajahn@raponline.org](mailto:ajahn@raponline.org)  
[raponline.org](http://raponline.org)

# Distribution networks – where we come from

- Top down power flows
- Networks built along established methodology of coincidence (peak) demand
- Monitoring of utilisation and smart operation are rare, usually only at high voltage level
- Most system services e.g. ancillary, balancing provided at transmission level



# Distribution networks future perspective

- Increasing number / amount of feed-in on lower voltage level
- Bidirectional power flows
- Electrification of heat and transport
- Active and flexible consumers, incl. batteries
- Increasing data
- Decentralised trade / local markets



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# We expect from distribution network operators

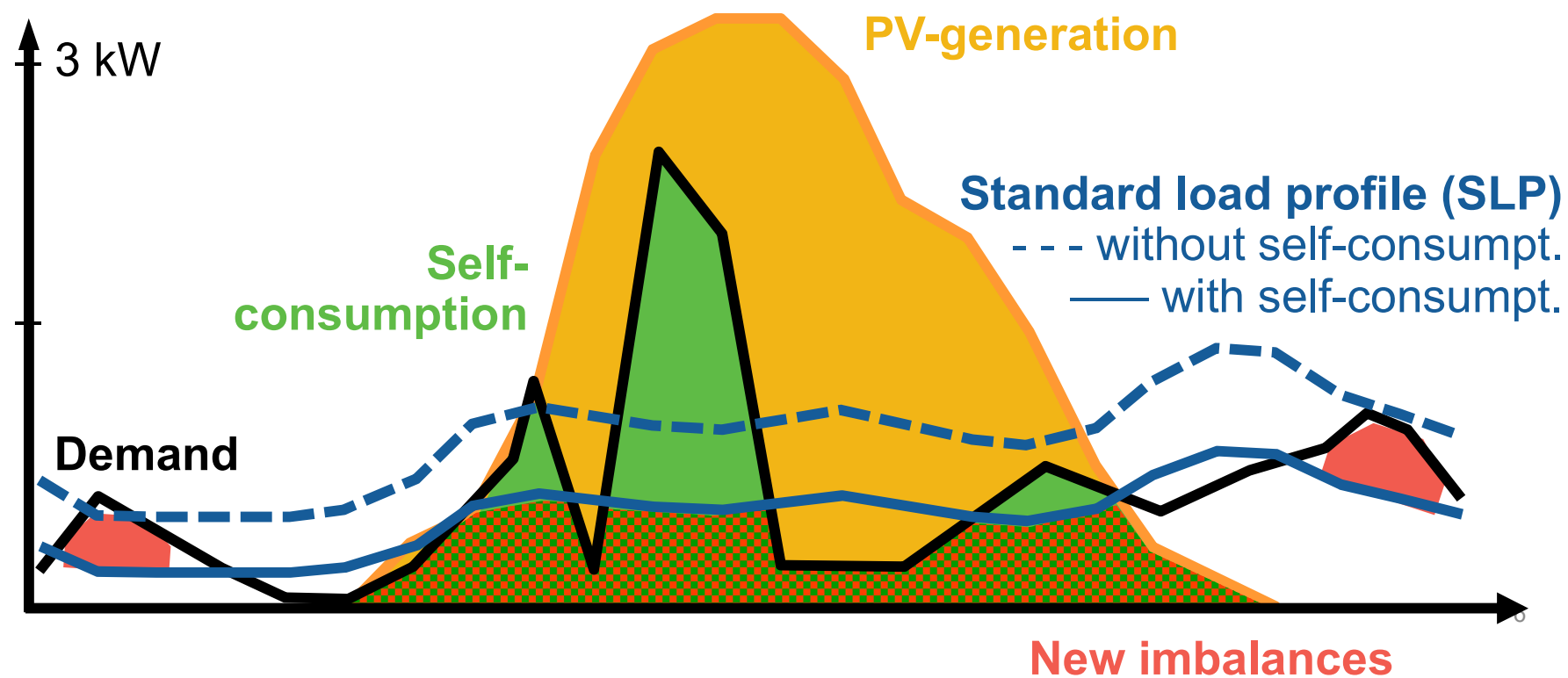
- Connecting resources asap
  - Fair connection conditions, punctual remuneration of feed-in
  - Priority dispatch of small-scale RES
  - Transparency on costs, cost allocation, network utilisation, congestions and investments,...
- ⇒ Most of all, we want a reliable and securely operated system at least-cost

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# Active consumers: From prosumers to energy communities

- Can't wait to do it themselves (better)
- Don't fit into current distribution networks
  - Standard contracts
  - Metering/measuring and billing approach
  - Balancing approach (standard load profiles)
  - Cost allocation and cost recovery
  - Thinking (?)

# Prosumer vs. standard load profile



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# Toolbox for distribution networks

- Load/peak forecasts
- Copper-investments within life-time cycles
- Considering regulated CAPEX bias
- Cost allocation among given consumer classes



⇒ An outdated toolbox isn't solving future needs

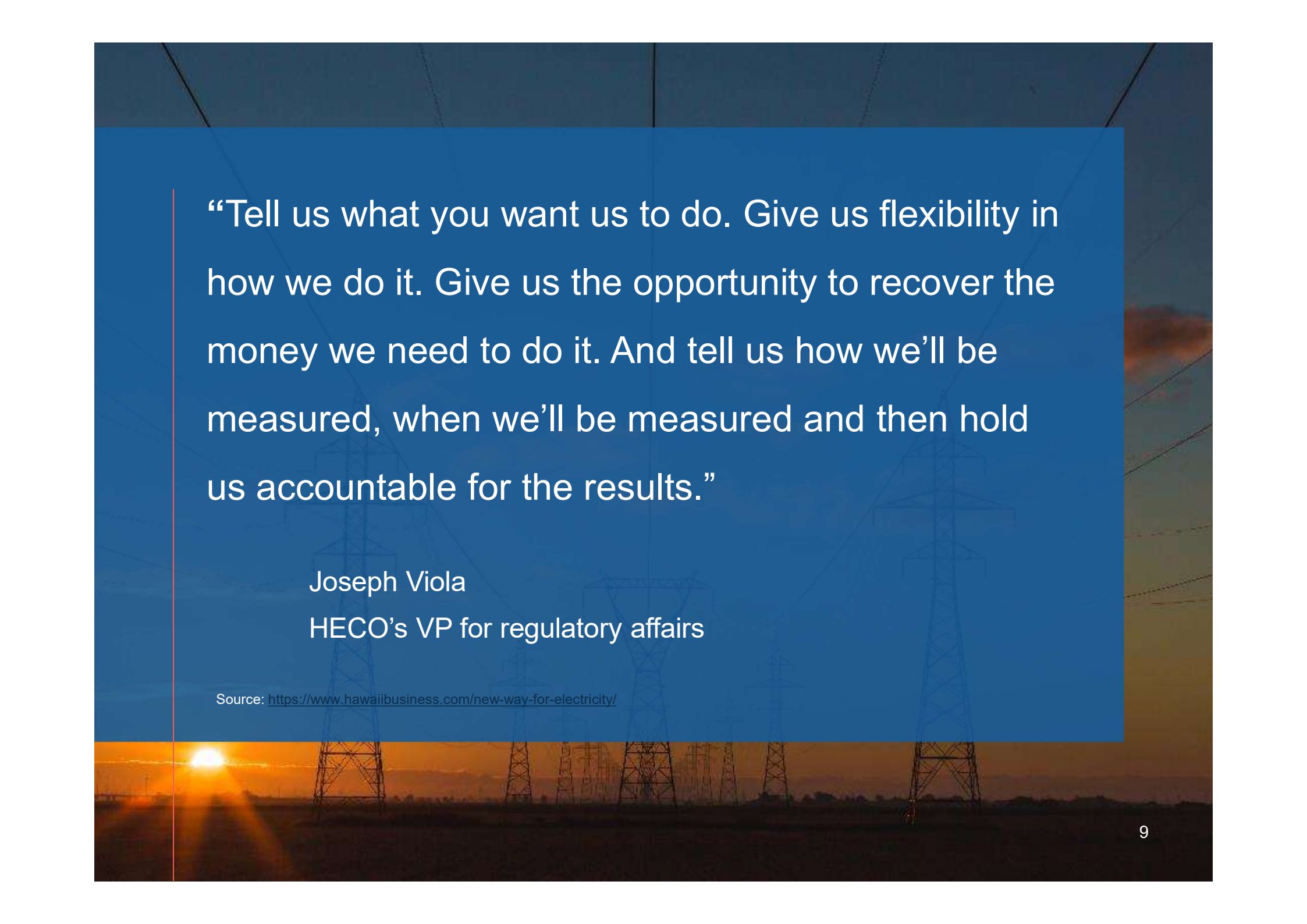


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# A road to nowhere?





The background of the slide is a photograph of several high-voltage power line towers and their associated cables. The scene is captured during sunset or sunrise, with a bright sun low on the horizon to the left, creating a strong orange and yellow glow. The sky transitions from a deep orange near the horizon to a darker blue at the top. The power lines and towers are silhouetted against this bright sky. A semi-transparent blue rectangular box is overlaid on the upper two-thirds of the image, containing the main text and the speaker's name. A thin red vertical line is positioned on the left side of the blue box.

“Tell us what you want us to do. Give us flexibility in how we do it. Give us the opportunity to recover the money we need to do it. And tell us how we’ll be measured, when we’ll be measured and then hold us accountable for the results.”

Joseph Viola  
HECO’s VP for regulatory affairs

Source: <https://www.hawaiibusiness.com/new-way-for-electricity/>

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# Stick and carrot for distribution networks

- Obligations for obvious things
- Penalties, if delay is self-inflicted
- Re-adjusted profit opportunities for networks via performance-based regulation (PBR)
  - ⇒ Standards required for cooperation (TSO-DSO) and system services
  - ⇒ Defining short and long-term performance goals, incl. non-wire alternatives

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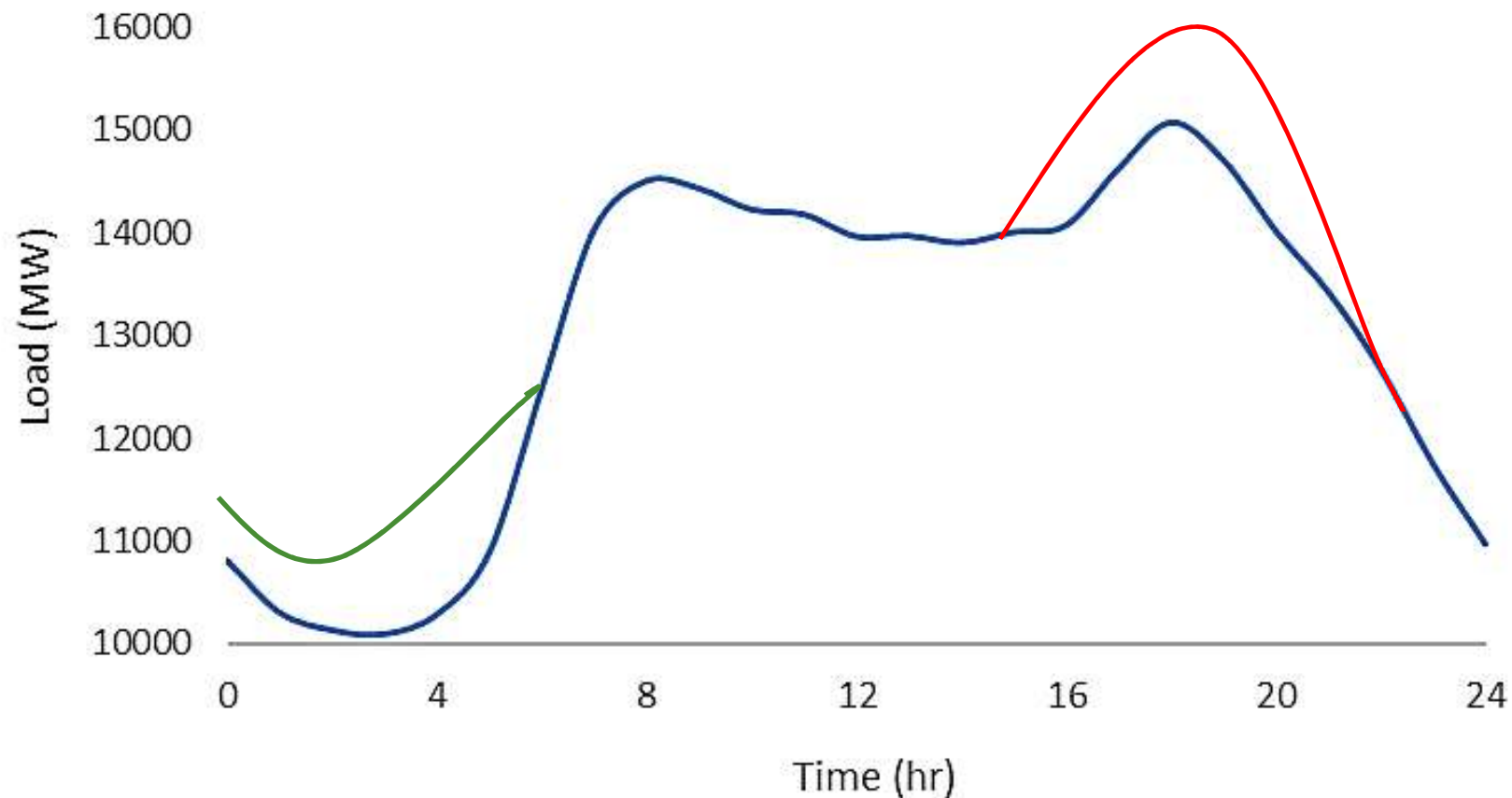
# Principles for electricity price incentives to activate customers

- Fair payment for provided local system services
- Fair share of investments and operational costs, as imbalances along (new) customer classes
- Network cost allocation based on utilization e.g. off-peak price reduction and peak pricing



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# 1. “Dumb” use increases peaks & costs

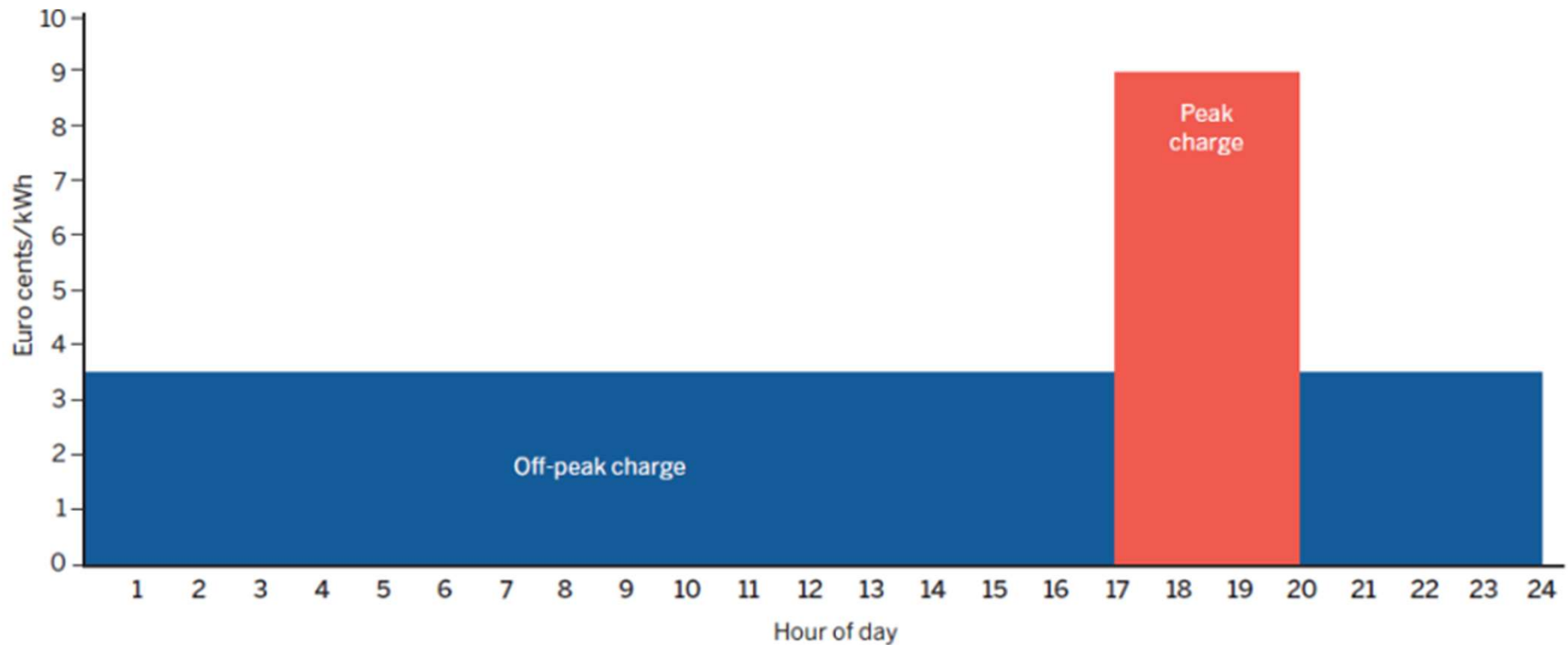


Source: own compilation based on [Westnetz](#), peak day 2017; red/green curves illustrative



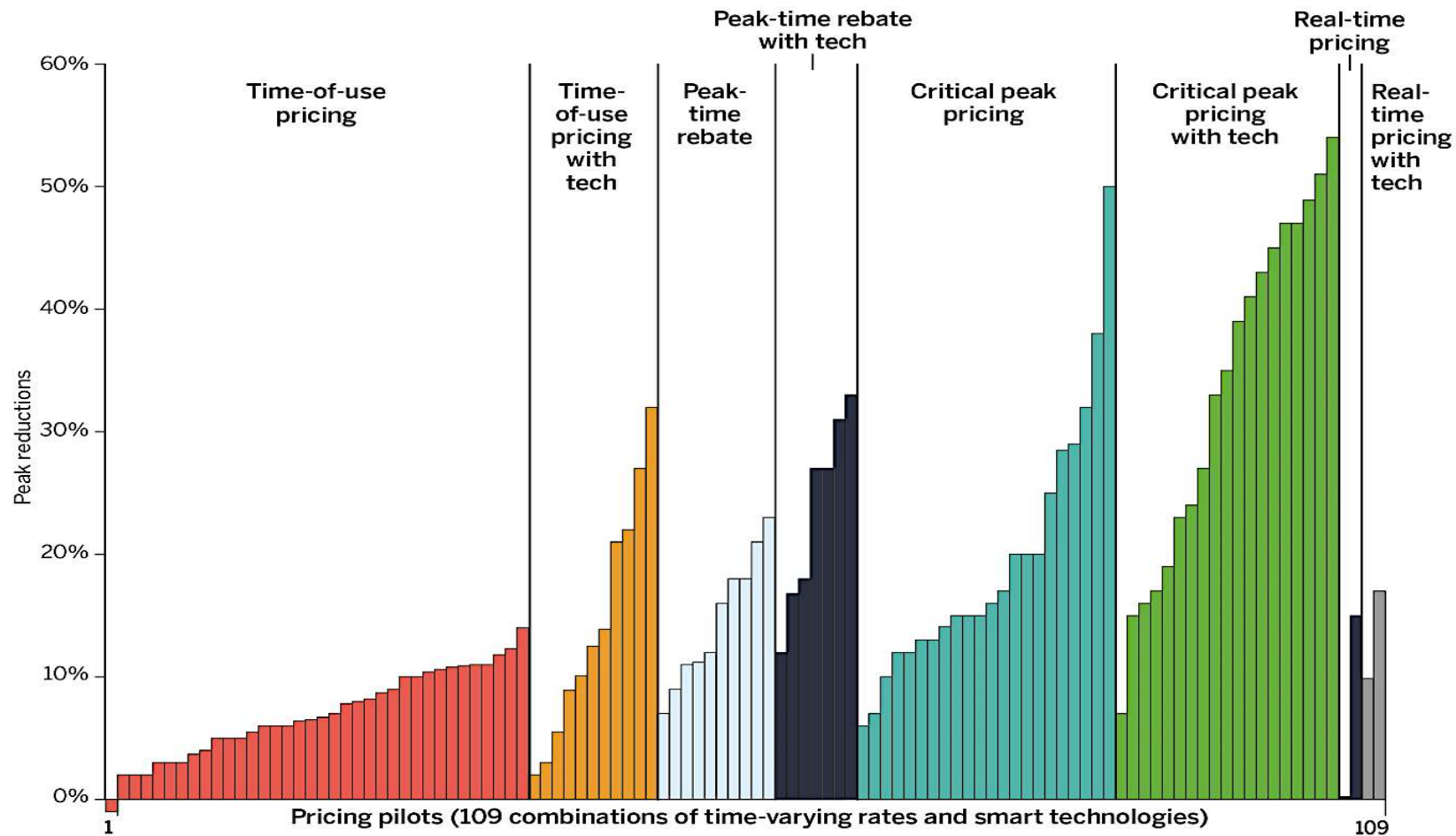
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# Network pricing based on congestion provides incentives to all customers



Source: Denmark ([Radius](#)), TOU network tariff for households (winter season)

# ... as it reduces peak demand



Source: Faruqui, A., Hledik, R., and Palmer, J. (2012). *Time-varying and dynamic rate design*.

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## 2. Balancing challenges of active consumers in the run-up

- Imbalances from standard load profile (SLP) are socialised
  - ⇒ All customers benefit from reduced costs
- When opportunities via self-consumption are privatised, this also applies to risks and costs
  - ⇒ Self-consumption imbalances should be allocated among these customers, e.g. via extra SLP, aggregators / balancing responsible parties

# German regulator suggests: Differentiation by use-case

- Full use of flexibility: forecast & balancing risks and chances for active customers, as for all non-SLP-customers
- Buy-all sell-all, for “keep-it-easy” customers
- Net billing & tracking for easy use of own supply

**Prosumer-Modell für neue/ausgeförderte Anlagen**

**Voraussetzung des Prosumer-Modells:** Für neue und ausgeförderte Anlagen kein Standard-Lastprofil bei bilanziellem Eigenverbrauch.

**Markt-Option: Viertelstunden-Vermarktung** mit Überschuss-Einspeisung

- Abrechnung von 1/4h -Messungen von Einspeisung und Bezug
- Privilegierter Eigenverbrauch + volle Marktintegration

**Netzbetreiber-Option: Kaufmännische Abnahme der Volleinspeisung**

- Bei neuen Anlagen: Einspeisevergütung
- Bei ausgeförderten Anlagen: „Förderfreie Auffangeinspeisung“ mit Wertsatz (anteiliger Marktwert)

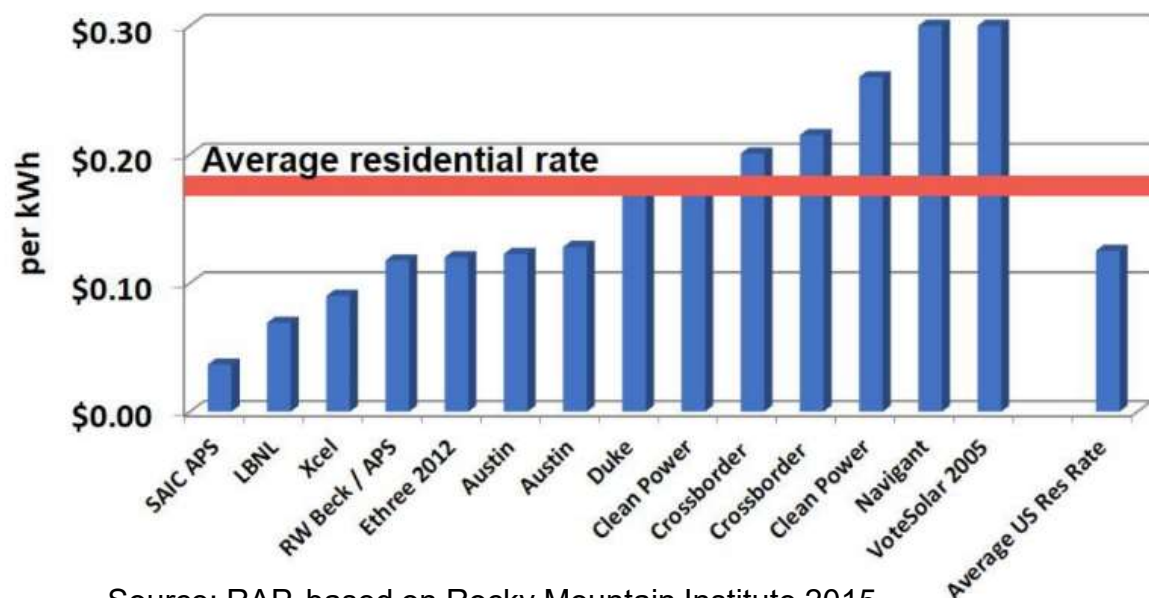
**Lieferanten-Option: Volleinspeisung mit Abwicklung aus einer Hand**

- Abrechnungsvariante der Netzbetreiber-Option
- Symmetrische Bepreisung von Überschusseinspeisung und Netzbezug
- Physikalischer Eigenverbrauch

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### 3. Renumeration of feed-in

- Market value differs by time and predictability
- Value can be defined along a broad range

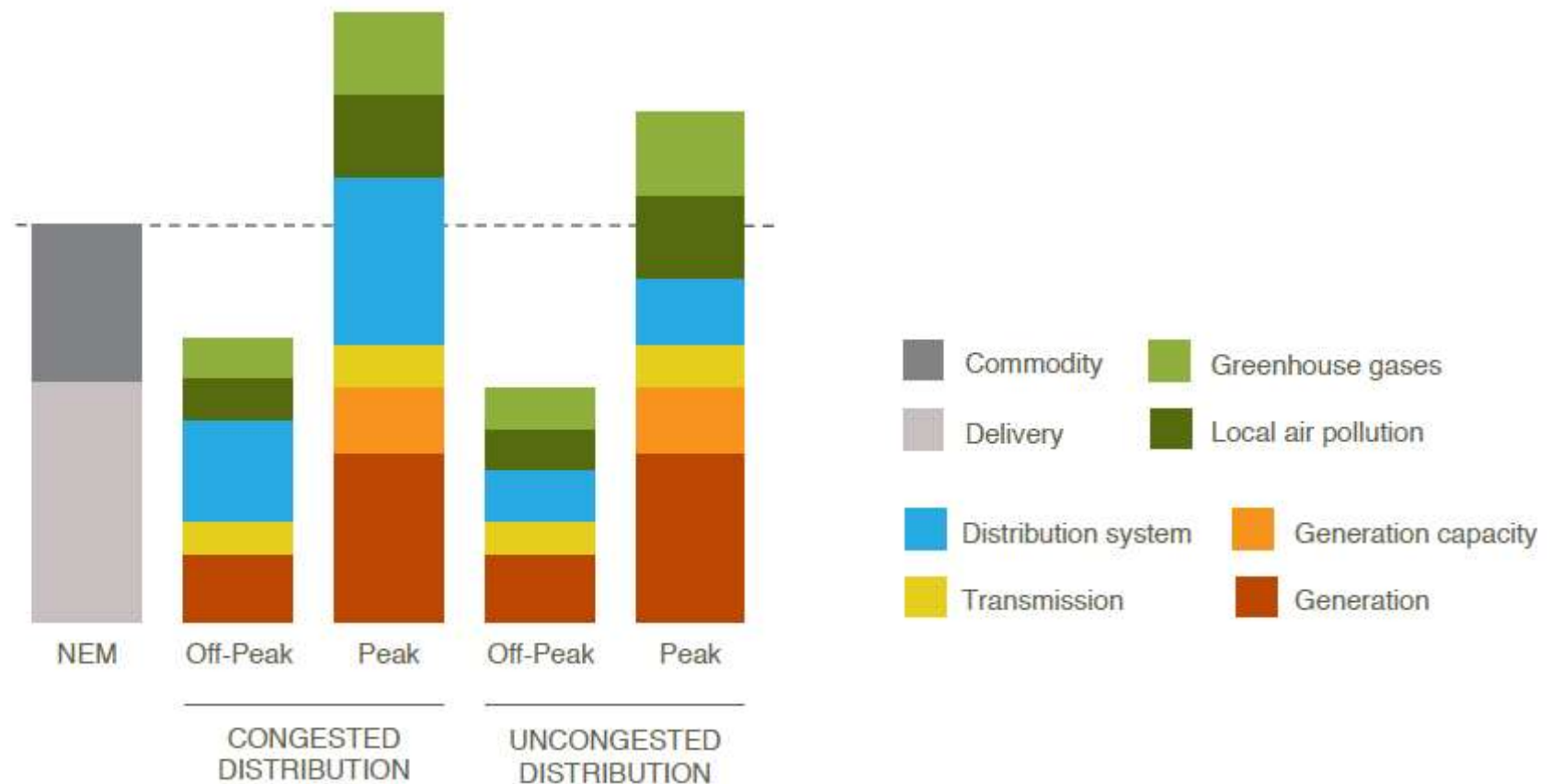


Source: RAP, based on Rocky Mountain Institute 2015

⇒ Renumeration should reflect all values, incl. provided services



# Value of DER compared to NEM



Source: Institute for Policy Integrity 2019

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# Prosumerism is a chance for all customers

- Use the momentum of customers engagement
  - a great value, difficult to value in monetary terms
- Push and pull for network operators to speed up
- System structure (incentives, cost allocation) must
  - Consider long-term system costs
  - Avoid cost-shift to other customers
  - Maximise benefit for all customers



# About RAP

The Regulatory Assistance Project (RAP)<sup>®</sup> is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at [raponline.org](https://raponline.org)



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Andreas Jahn  
Senior Associate  
The Regulatory Assistance Project (RAP)<sup>®</sup>

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Anna-Louisa-Karsch-Straße 2  
D-10178 Berlin  
Germany

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+49 30 700 1435 421  
[ajahn@raponline.org](mailto:ajahn@raponline.org)  
[raponline.org](https://raponline.org)