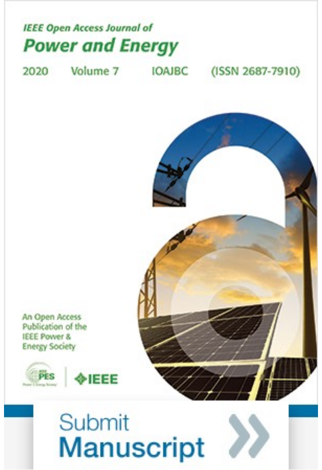
Elektrikte
Gelecek Senaryoları
Nasıl Yapılır?

Barış Sanlı
30 Nisan 2020
Bilkent EPRC

Kısa okuma listesi



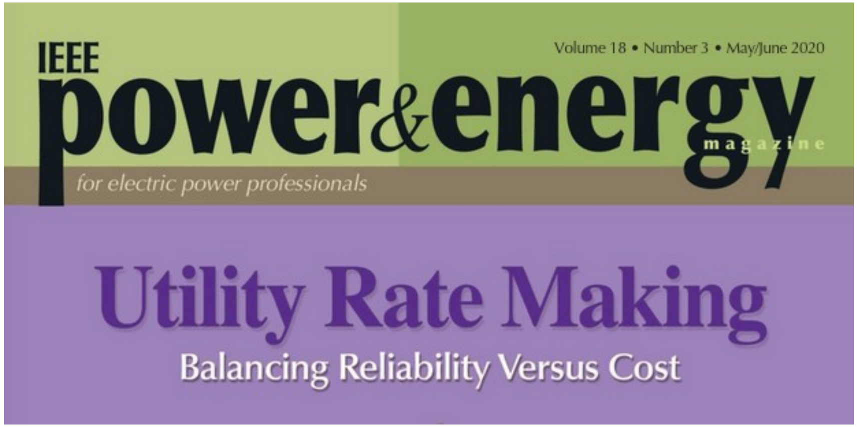
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8784343

http://energy.mit.edu/

MITei

Electric Power Systems Center MIT Energy Initiative

AN MIT ENERGY INITIATIVE LOW-CARBON ENERGY CENTER



https://www.nxtbook.com/nxtbooks/pes/powerenergy_050620/

Elektrik sektörünün yönü?

- Çok görüş var
- İki görüş
  - Güvenlikçiler : Sistem çalışsın, denenmiş yenilikler
  - Geliştiriciler : Sistemin uzun vadeli güvenliği

- İyi vs kötü değil.

Avustralya’da güneş tartışmaları

WA News

Rooftop solar poses blackout threat to WA’s main power grid

Daniel Mercer | PerthNow
May 20, 2018 9:00PM

TOPICS Politics

EXTRAORDINARY powers designed for emergencies such major power plant failures or bushfires are being triggered to protect WA’s main grid from soaring output generated by rooftop solar panels.

“A critical issue arising from uncoordinated DER growth (particularly rooftop solar PV systems), is that at some point, the total output from rooftop solar PV systems will be greater than the demand on the system (ie. on low demand sunny days),” AEMO wrote.
“This excess generation can result in an inability to dispatch sufficient frequency control ancillary services to manage system frequency effectively. In a situation of high rooftop solar PV output, should invertors ‘trip’ en masse in an uncontrolled manner, with insufficient frequency control ancillary services online and available this can result in subsequent under frequency load shedding.
“The worst case outcome of such a scenario is a total system blackout (our emphasis).
“This point may not be far away, considering the projected increases in embedded generation. It is possible that alternative ancillary service arrangements may be required to deal with this problem. With more utility-scale synchronous generators expected to exit the market, this work needs to proceed with some urgency.”

This was published 1 year ago

Too much of a good thing: Solar power surge is flooding the grid

By Cole Latimer
June 6, 2018 — 4.42pm

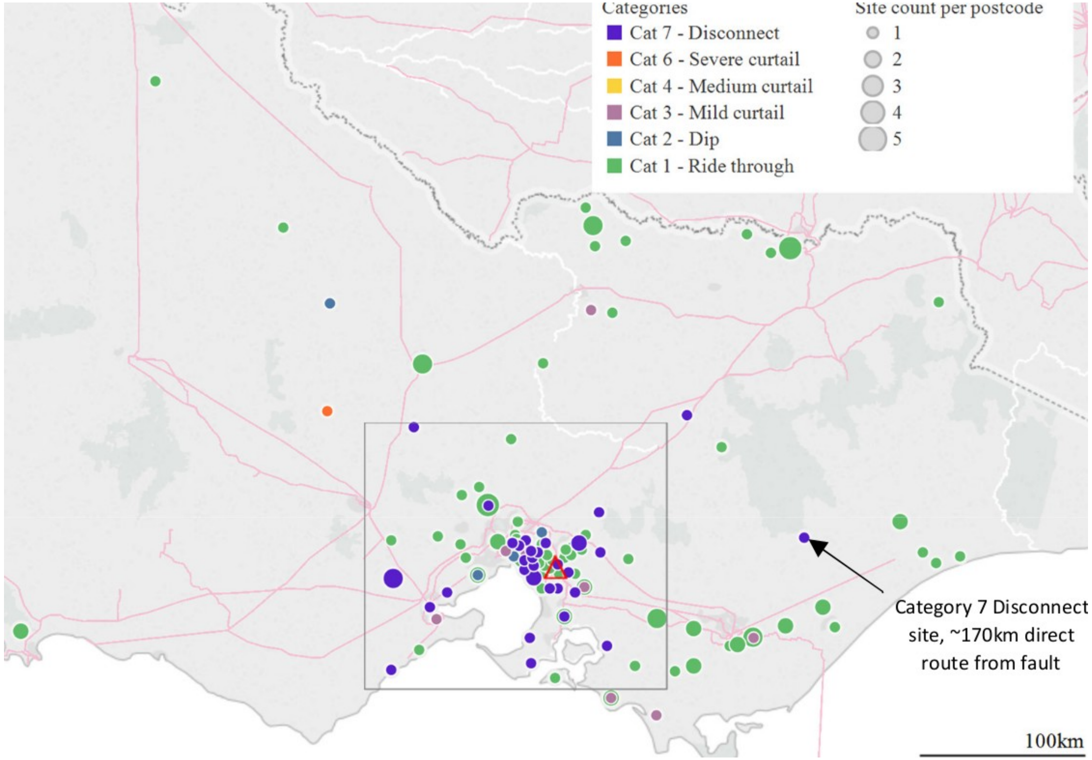
A A A

The rising number of solar rooftop installations is creating concerns that too much energy is flooding into the electricity grid, and could cause blackouts as the system struggles to control the excess power.

"Solar spill", when high levels of energy are generated by rooftop installations in the middle of the day when demand is low, is becoming a problem for Australia’s electricity networks, according to Andrew Dillon, the head of the grid representative body Energy Networks Australia.

https://reneweconomy.com.au/whats-behind-scare-campaign-on-rooftop-solar-blackout-threat-78729/

Avustralyada bir olay



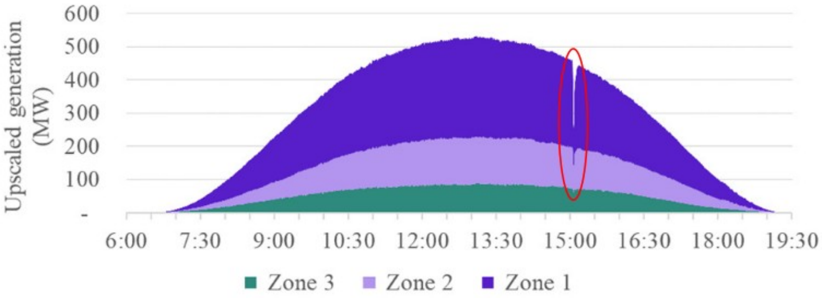


Fig. 19. South Australia upscaled PV generation estimate

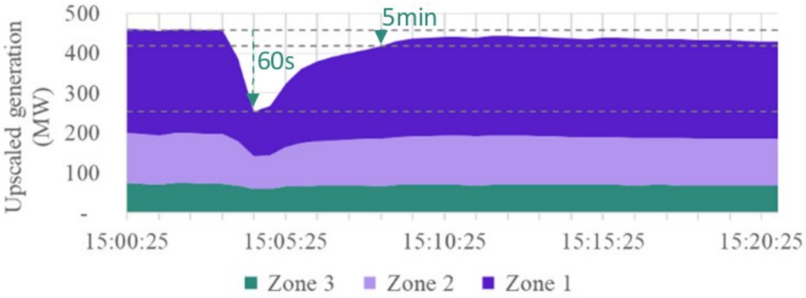


Fig. 20. South Australia upscaled PV generation estimate, time of event

https://www.researchgate.net/publication/338789909_Observed_behavior_of_distributed_photovoltaic_systems_during_major_voltage_disturbances_and_implications_for_power_system_security

Tarifelerin yarını

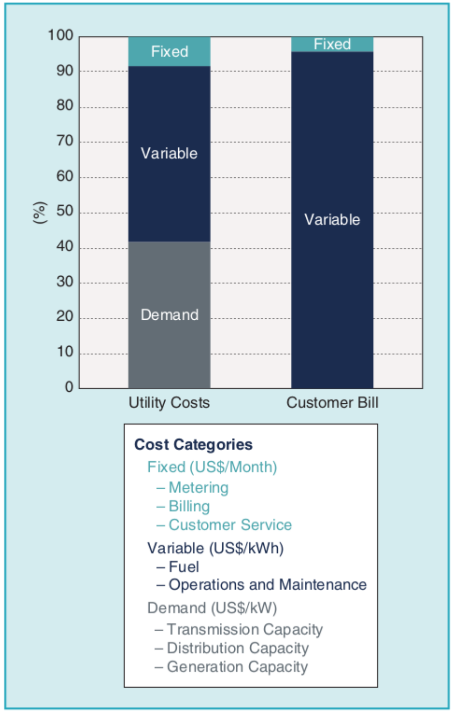


figure 1. An illustrative misalignment between residential rates and costs.

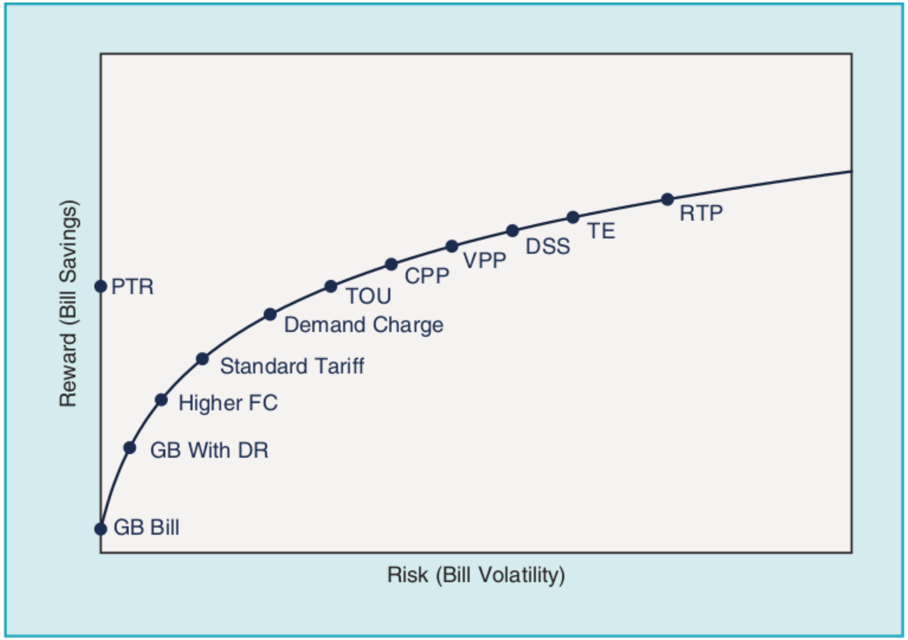


figure 2. Efficient pricing frontier. FC: fixed charge.

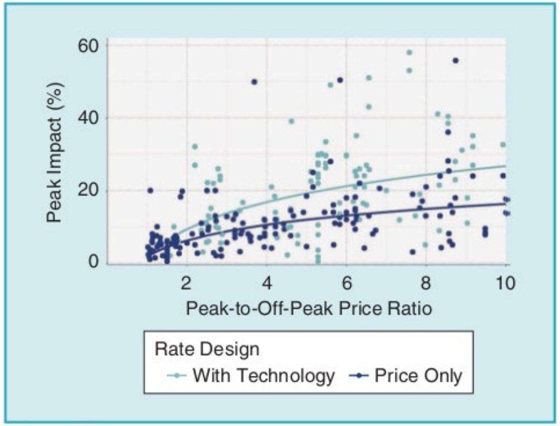
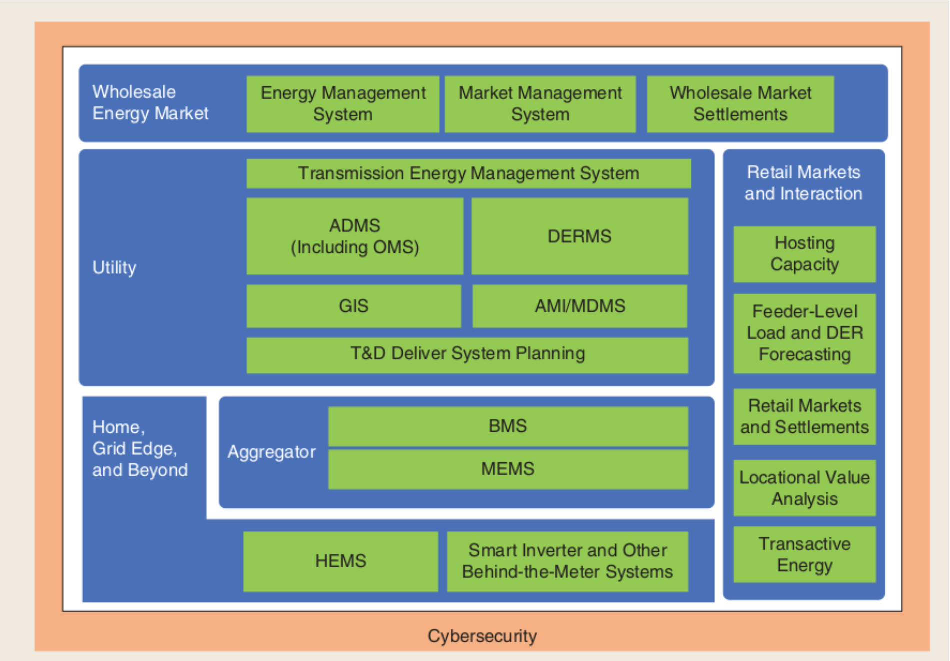


figure 3. Price responsiveness under dynamic pricing experiments.

DOI:10.1109/
MPE.2020.2972136

Elektrik sistemleri



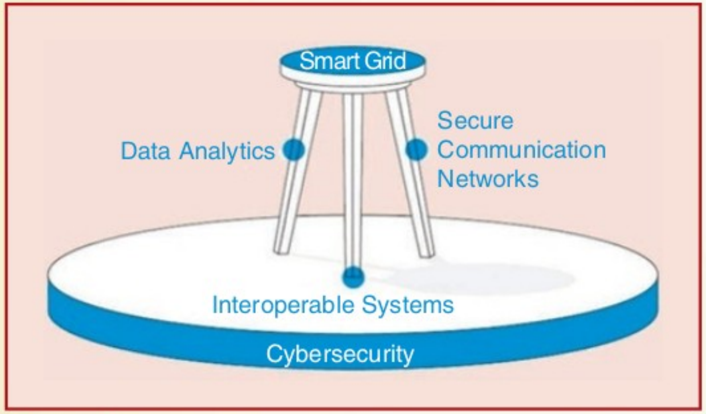


figure 1. The fundamental attributes necessary for the modern electric distribution network.

IEEE power & energy magazine

Dağıtım sistemleri - MultiSpeak

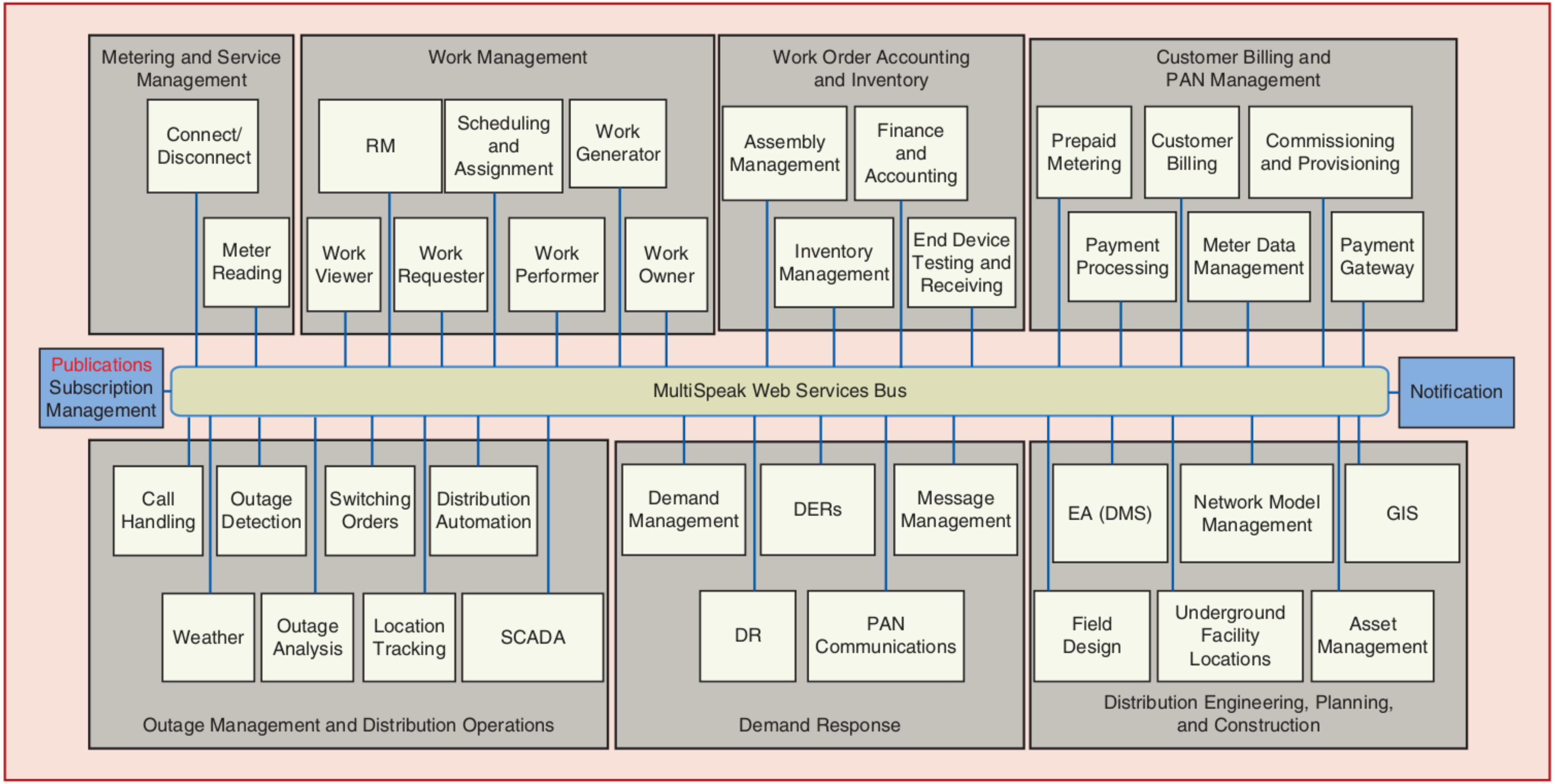


figure 4. The overview of the MultiSpeak endpoints. PAN: personal area network.

Gelişmiş Dağıtım Sistemleri

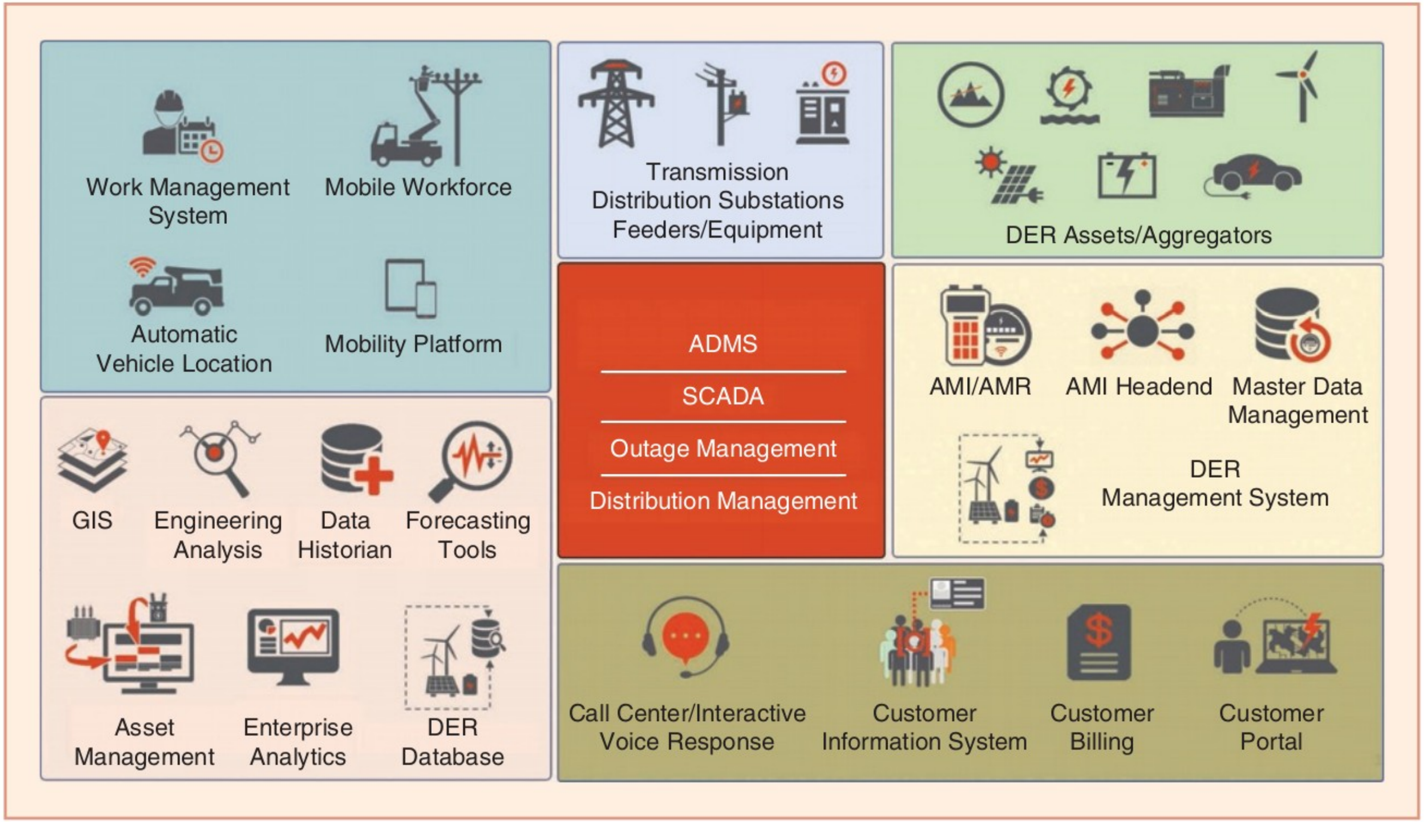


figure 1. ADMS applications exchange data with a multitude of devices and systems. GIS: geographic information system; AMI: advanced metering infrastructure; AMR: automatic meter reading.

Yüksek seviye fonksiyonlar

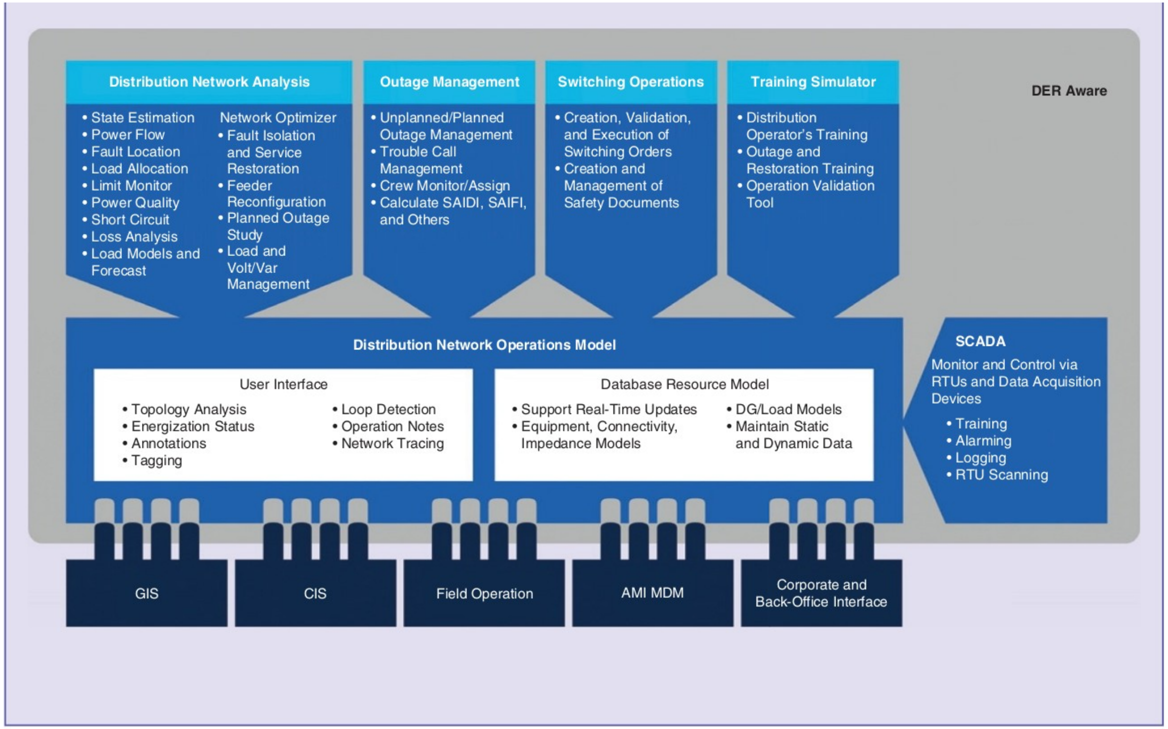


figure 1. The high-level functional architecture of an ADMS. DG: distributed generation; RTU: remote terminal unit; AMI: advanced metering infrastructure; MDM: meter data management; CIS: customer information system; SAIDI: System Average Interruption Duration Index; SAIFI: System Average Interruption Frequency Index.

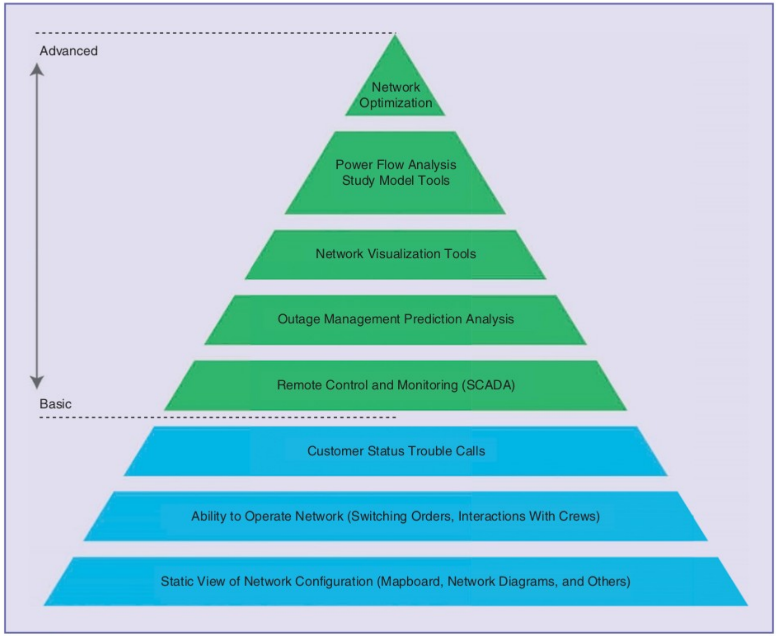


figure 2. The distribution operations functionality pyramid.

Daha fazla veri ile nereye

1. Bilişimsel zekanın ne kadarı tüketici tarafında?
2. Eskiden günlük→ saatlik→ dakikalık→saniyelik
3. Doğanın intikamı: Hava durumu, ağaçlar ve hayvanlar
4. Daha hızlı, çevik ve otonom

Uzun vadede ihtiyaçlar

Application	Network Model	Communication Direction	Location of Intelligence	Advanced Analytics	Other Comments
	grey: No yellow: Simple green: Full	grey: No yellow: Unidirectional blue: Bidirectional green: Peer to peer	yellow: Centralized blue: Distributed green: Local	yellow: Type 1 blue: Type 2 green: Type 3	I: input (measurements)* O: output (decisions and controls)
Stage 1: Applications currently being adopted by industry					
Voltage control	grey	grey / yellow / blue	green / yellow	yellow	I: nodal V and Sflow O: regulator taps and cap bank status
Traditional demand response (using DLC)	grey	yellow	yellow	yellow	I: substation Sflow O: load-curtailment signal
DER control and coordination	grey	yellow / blue	yellow	yellow	I: substation Sflow and V at the DER PoC O: DER P/Q dispatch
FLISR	yellow	blue	yellow	yellow	I: outage data O: switch operations
Stage 2: Near-term applications					
Short-term demand and generation forecasting	grey / yellow	yellow	yellow	yellow / green	I: historical and real-time Sload and SDER and weather data O: load/generation forecasts
Utility/customer microgrid control and coordination	yellow	blue	yellow	yellow / blue	I: Sflow and V at the microgrid PoC O: Sflow dispatch signal at the PoC
Network topology and state estimation	green	yellow	yellow	blue	I: switch status, Sflow, and Sload O: nodal V and Sflow
Optimal voltage control (e.g., volt-var control and conservation voltage reduction (CVR) optimization)	green	blue	yellow	blue	I: Sload, SDER, and ZIP model O: regulator taps, cap status, and DER P/Q dispatch
Optimal DER control and coordination	green	blue	yellow	blue	I: Sload, SDER, and ZIP model O: DER P and Q dispatch
Proactive demand response	green	blue	yellow	blue	I: cleared market bids O: real-time corrective signals
Resilient restoration with intentional islanding	green	blue	yellow / blue	blue	I: postdisaster SA and DER status O: switch action and island control
Stage 3: Long-term applications and enablers					
Adaptive protection	green	blue	yellow	blue	I: SDER, Sload, and nodal V O: adaptive protection settings
Proactive crew and mobile restoration resources for resilience	green	blue	yellow / blue	blue	I: weather data, fragility curves, and transportation network O: path and resource dispatch plan
Hybrid centralized and distributed intelligence (enabler)	green	green	blue	blue	I: local/and/or downstream data O: control P, Q, and V signals
Data-driven postdisaster situational awareness	yellow	yellow / green	yellow / blue	green	I: weather data, fragility curves, and real-time equipment status O: postdisaster network model
Data quality and data consistency (enabler)	grey / yellow	yellow / green	yellow / blue	green	I: dataflow (AMI, and DERMS) O: data inconsistencies
Autonomous decision making (enabler)	grey / yellow	grey / yellow	blue / green	green	I: local P, Q, and V measurements O: control P, Q, and V signals

* In addition to knowing the status of the controlled devices.
/: indicates that the corresponding application may employ any of the options that are separated by a /; AMI: advanced metering infrastructure; DERMS: distributed energy resource management system; DLC: direct load control; P: active power; PoC: point of connection; Q: reactive power; SA: situational awareness; SDER: complex DER power; Sflow: complex power flow; Sload: complex load demand; V: voltage.

Nasıl bir gelecek senaryosu?

- Daha dağıtık → dağıtım+++, iletim----
- Daha merkezi → dağıtım---, iletim+++
- iEDAŞ → dağıtım +++++, tekno firma ++++
- Geleneksel yapı → dağıtım +, iletim +, firma +

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