Emerging Key Role of Data-enabled Reliable, Resilient and Efficient Electricity Services

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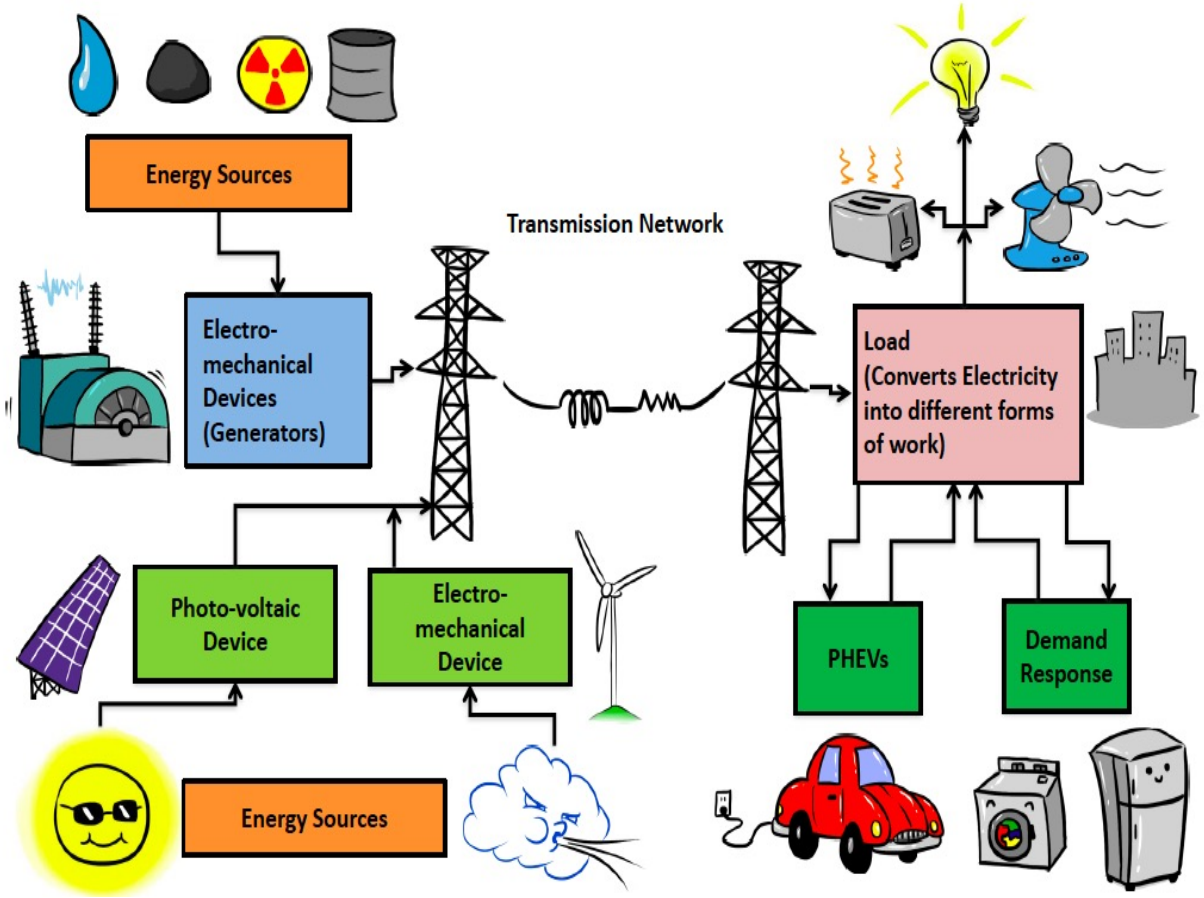
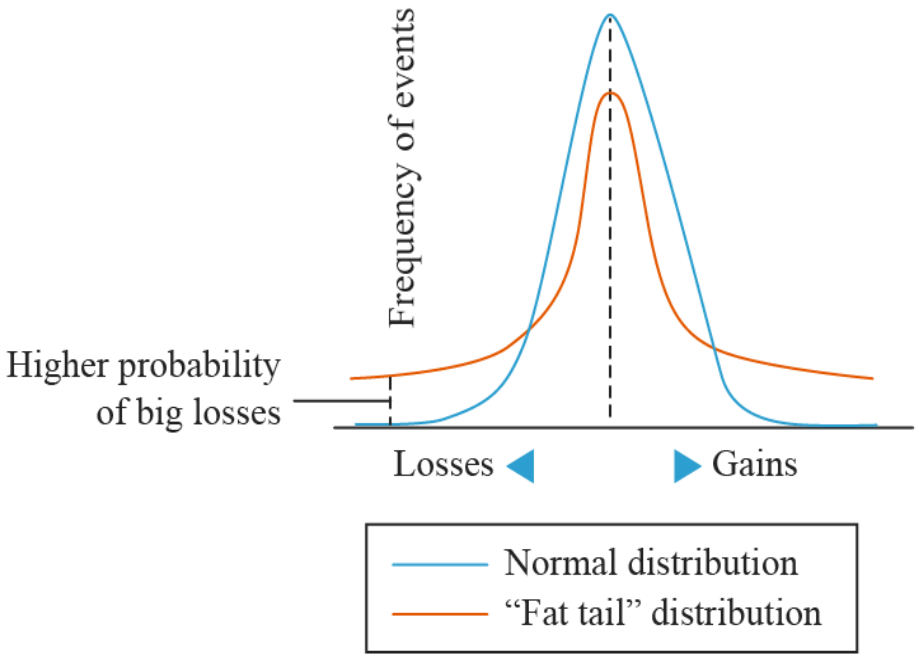
Difficult transition challenge: Making electricity service sustainable while still ensuring reliable/resilient and cost-effective energy service

Making the most out of the naturally available resources without depleting them (THE PROBLEM WE SHOULD SOLVE)

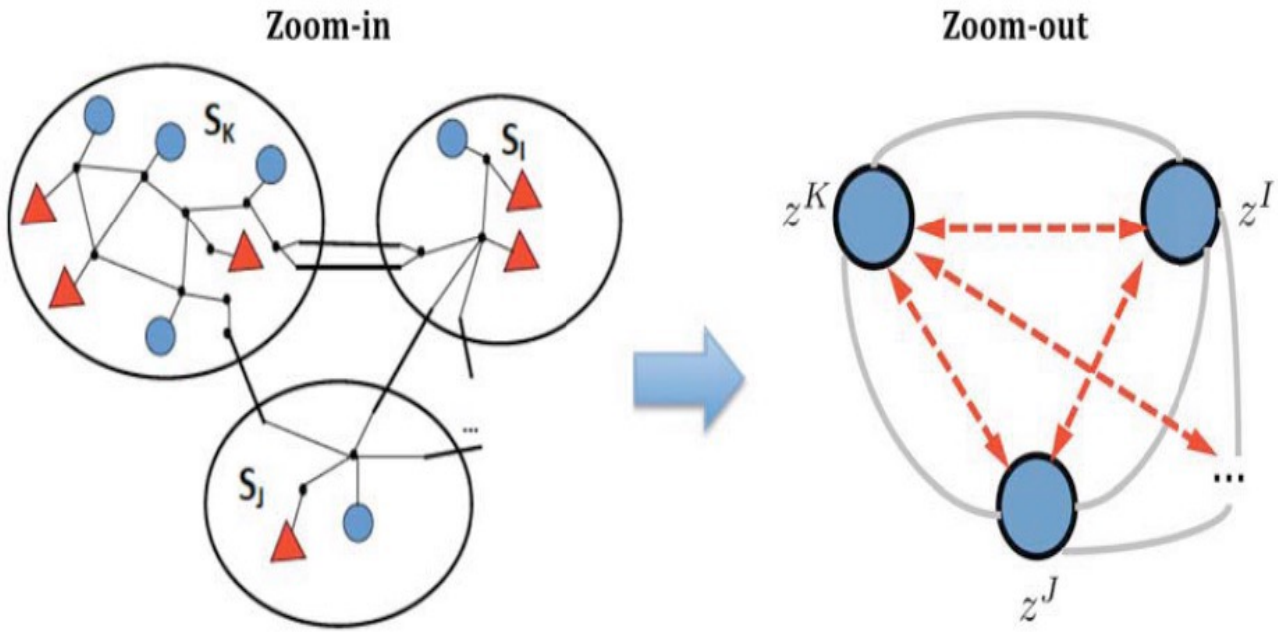




Prevent effect of low probability high impact events cost effectively using software (smart grid) vs. enhancing/adding hardware (storng grid)

Managing complexity in distributed interactive ways

- Qualitatively different ways of data-enabled electric energy services
- More complex design and operations objectives
- Trade-off--- communication/control complexity; market, technical outcomes; environmental effects
- Exciting complex systems problems; hidden value of high tech
- New modeling and control



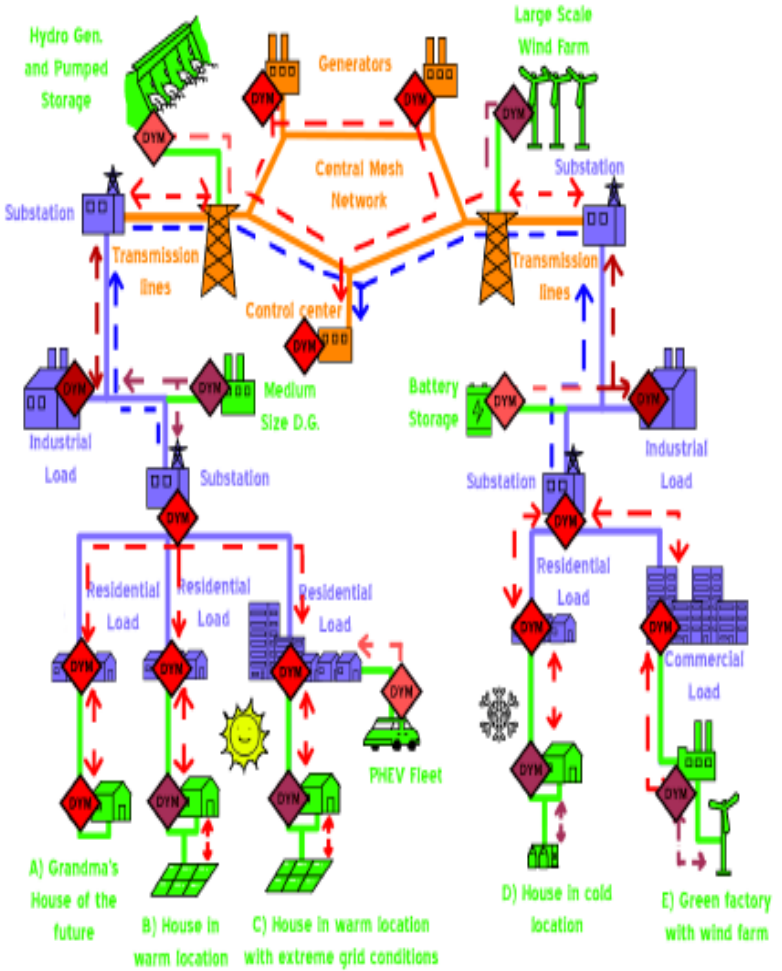
Marija Ilic, Interaction Variables-based Modelling and Control of Energy Dynamics, in Springer Nature, Women in Power:Research and Development Advances in Electric Power Systems, Editors: Jill S. Tietjen, Marija D. Ilic, Lina Bertling Tjernberg, Noel N. Schulz ,June 2023, https://link.springer.com/book/9783031297236
Marija Ilic, Interaction variables–based modeling and simulations of energy dynamics, MSCPES2023, Invited Keynote, May 2023, San Antonio, TX.

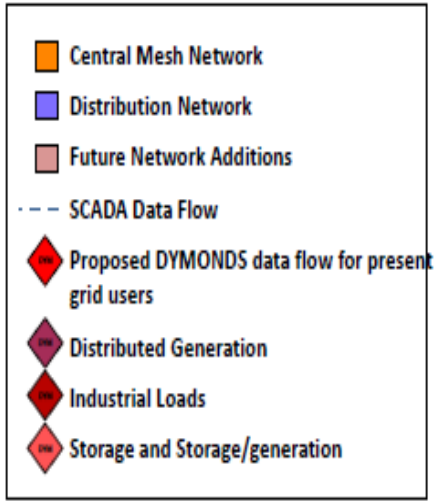
Protocol principles for evolving Dynamic Monitoring and Decision Systems (DyMonDS) architecture

Information exchange in terms of energy, power and rate of change of reactive power. intVars with physical interpretation as a generalized ACE.

BAs transform to iBAs In order to support interactive control and co-design today' s BAs are further organized as iBAs – groups of stakeholders, both utility and third parties, with their own sub-objectives. Each iBA is responsible for electricity services to its members and must communicate its commitments in terms of intVars to participate in electricity services with others

- Next generation SCADA to support information exchange among iBAs As the operating conditions vary, stakeholders process the shared information, and optimize their own sub-objectives, subject to own constraints and preferences; and communicate back their willingness to participate in system-wide integration





Standardized information exchange between neighboring layers enables efficient markets and secure operation

Ilic, M., & Jaddivada, R. (2022). Modeling and Control of Multi-Energy Dynamical Systems: Hidden Paths to Decarbonization. arXiv preprint arXiv:2207.08370.

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