AI for grid decarbonization: Opportunities and challenges

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Support Carbon-neutral Electricity and Mobility

"Data sets and algorithms for AI/machine learning-based approaches to accelerate the carbon-neutral transition"

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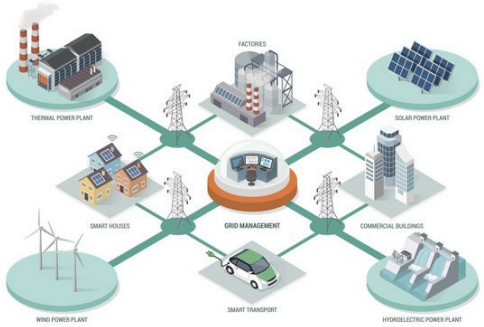
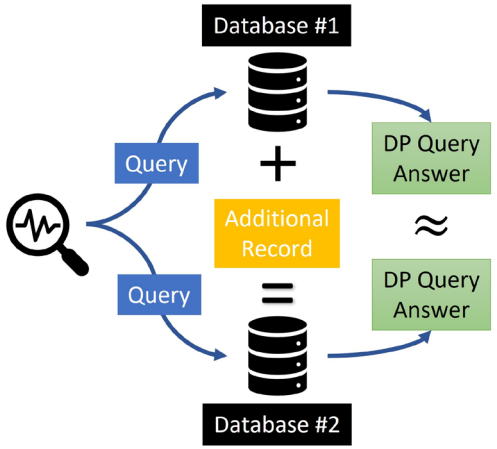
Graph Neural Networks and physics constrained learning are powerful innovations to investigate





Privacy preserving digital twin

- **Beyond physical modeling**: inadequate to handle
  - Uncertainty of renewable energy resources (DER)
  - Demand response (DR) – residential and mobile
    - Consumers, Appliances and Energy Markets interface
  - Complex dynamics of power electronics
- **AI Benefits** for decarbonization
  - Inference → Grid monitoring and reliability
  - Predictions → **Predictive control**
  - Foresighted Decisions → **Reinforcement Learning (RL)**
- **Challenges:** safety for RL, training for rare events, interpretability, access to infrastructure data for training (a ”digital twin is needed”)

Grid AI algorithms → Physics awareness, feasibility and robustness for RL policies.
Grid Data → Accelerate use of Differential Privacy, understand risks