

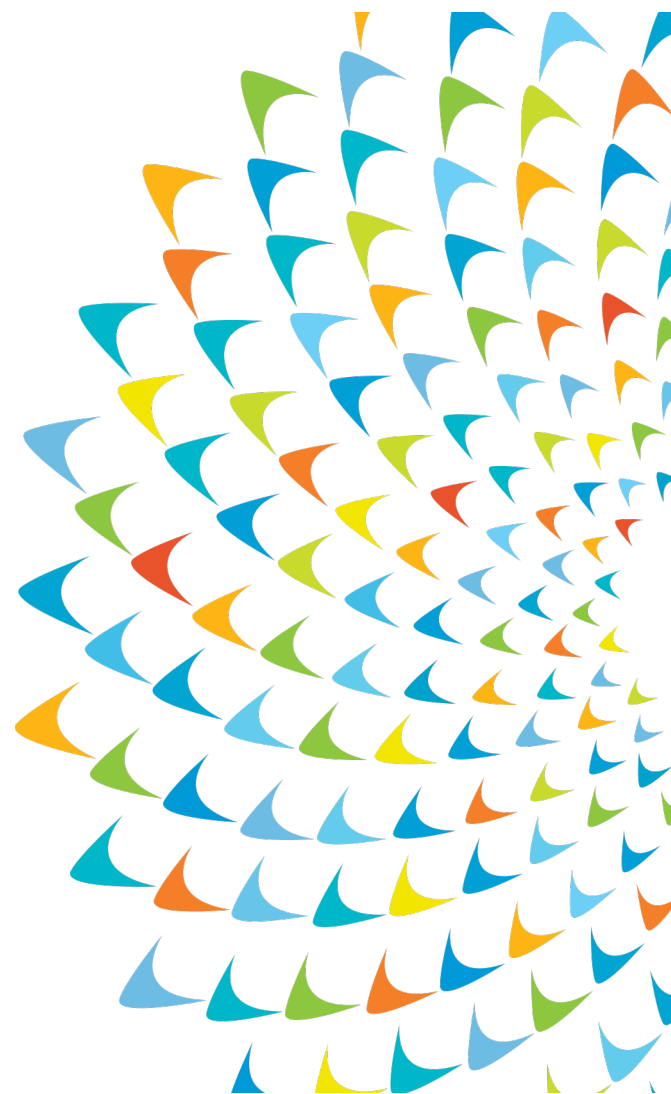
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ADB

# Building Resilience of the Power System in the Low-Carbon Transition

Virtual Dialogues on Resilient Infrastructure  
28 April 2021

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Chair, Energy Committee  
Asian Development Bank



# ADB Strategy 2030

## 7 Operational Priorities:



Addressing remaining poverty and reducing inequalities



Accelerating progress in gender equality



Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability



Making cities more livable



Promoting rural development and food security



Strengthening governance and institutional capacity



Fostering regional cooperation and integration

# ENERGY SECTOR PRIORITIES and TARGETS

## Overall framework

Deployment of new and advanced technologies will help to achieve energy access and climate mitigation finance targets

Sustainable Development Goal 7  
(Affordable and Clean Energy)



Country's NDC\* under  
the Paris Agreement



ADB's climate finance targets

ADB's value addition  
Technical innovation  
Financing innovation

\*Nationally Determined Contributions.  
CO2 reduction target

# Building power system resilience

- Vulnerability assessments => development of resilience plans
- Multiple scenarios for extreme climate and geophysical events (e.g., tsunami):
  - 100-year storm vs. maximum credible event
- Adoption of emergency preparedness, response and recovery strategies – not just for utilities...
  - lessons learned from Fukushima 2011 and Texas/ERCOT 2021
- Smart grids: advanced metering infrastructure, digitization and automation, drone and remote sensing for wide area monitoring applications
- Power infrastructure hardening for climate-proofing, geophysical events, and maintenance (don't forget cybersecurity)
- Diversified / distributed energy mix with flexible operations and storage throughout the system

## CENTRALIZED GRID MORPHOLOGY

19<sup>th</sup> century “natural monopoly” design basis (by Thomas Edison *et al*)

### Controllable / dispatchable generation

- Biomass (wood)
- Hydropower
- Fossil fuel generation – coal begins to replace wood

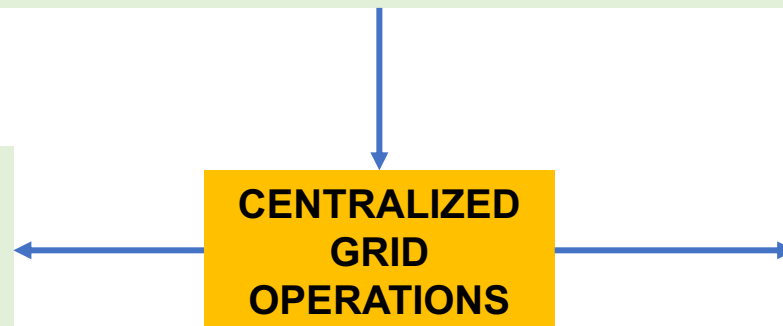
### Critical / non-interruptible loads

- Hospitals / life support
- Public security and military

### CENTRALIZED GRID OPERATIONS

### Controllable / interruptible loads

- Lighting
- Water heating



# CENTRALIZED GRID MORPHOLOGY

Mid-20<sup>th</sup> century configuration

## Controllable / dispatchable generation – baseload + peaking power

- Biomass / waste to energy
- Hydropower
- Fossil fuel generation -- gas for peaking power
- Geothermal

## Controllable / interruptible loads

- Cooking
- Lighting
- Refrigeration
- Water heating

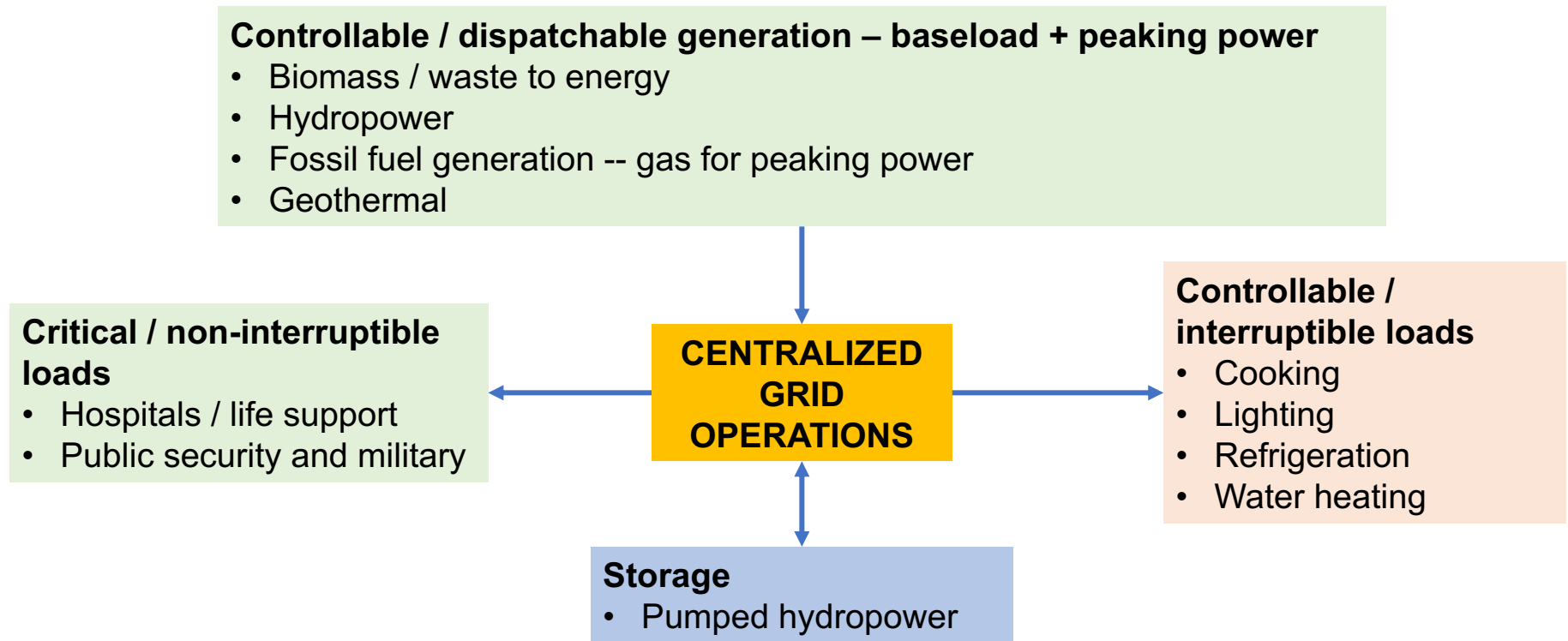
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## CENTRALIZED GRID OPERATIONS

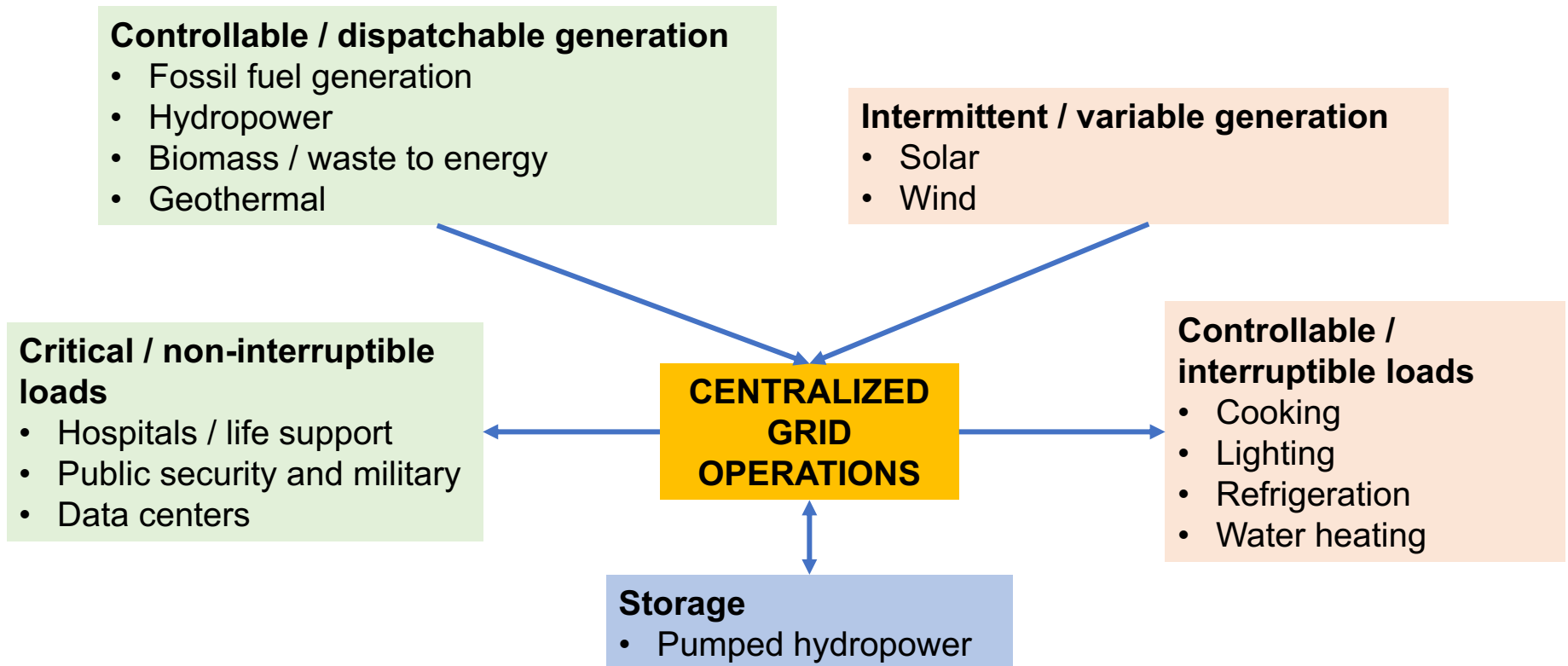
## Storage

- Pumped hydropower



# CENTRALIZED GRID MORPHOLOGY

late 20<sup>th</sup> century / early 21<sup>st</sup> century configuration



# URBAN MICRO-GRID MORPHOLOGY 21<sup>st</sup> century design basis

## Controllable / dispatchable generation

- Biomass / waste to energy
- Geothermal: deep well, ground source heat pumps
- Hydro: rivers, water supply system & WWTP outfalls
- Hydrothermal: seawater, lake water cooling
- Fossil fuel generation / co- and tri-generation

## Critical / non-interruptible loads

- Hospitals / life support
- Public security and military
- Data centers

## Storage

- Batteries: grid stability and time shifting
- Electric vehicles / mobile storage
- Hydrogen: bulk storage, long-term time shifting, blend with biogas and natural gas
- Thermal storage: coupled to Organic Rankine Cycle generators and HVAC systems

Main Grid

Point of Common Coupling

Controller and Energy Management System

## Intermittent / variable generation

- Solar: rooftop and “community”
- Wind: vertical axis turbines, bladeless, etc.

## Controllable / interruptible loads

- Cooking
- Lighting
- Refrigeration
- Water heating

