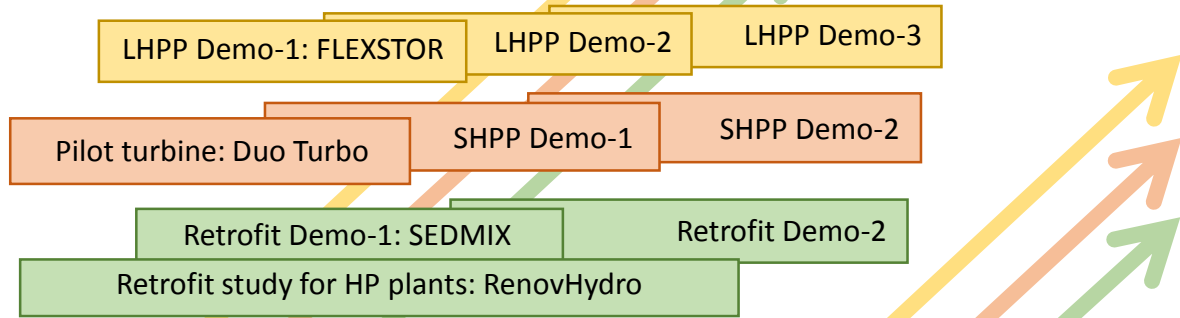


# Hydropower Activity Overview

## Key goals:

- Increase the HP electricity production under changing demand, climate and operating condition by 3160 GWh (after investment to respect the law for residual water: -1400 GWh)
- Ensure maintenance, improvement and operation of the infrastructure in the long term future

New Large HP Plants: +1'430 GWh until 2050
New Small HP plants: +1'600 GWh until 2050
Retrofit PP: +1'530 GWh until 2050



System  
Concept  
Validation  
Prototyping  
Roll-out

**Phase 1-2**

**Innovation technologies**

- Glacier ice thickness survey: new glacier lakes
- Sediment evacuation systems
- Impulse waves assessment and dam safety
- Cascade reservoir flushing concept
- Reduce water losses, friction in water ways
- Optimum environmental flow
- Enhanced operating range hydro units: variable speed, predictive maintenance.
- Energy harvesting micro turbines (*Duo-Turbo*)
- HP design under uncertainties

**Innovative integrated solutions**

- Robust and flexible HP projects
- Increase of operation flexibility at existing HP
- Services to the grid: transient & part load
- Mitigation of cavitation, sedimentation and abrasion
- Safety of steel lined pressure shafts for rough operation
- Intake design for control of air entrainment and floating debris; optimum location for sediment transfer
- Dam heightening : spillways/bottom outlets and structural safety
- Impact of hydro- and thermo-peaking; innovative measures
- Improved environmental flow criteria

**Phase 3**

**New innovation technologies and turbine developments**

Forecast modeling of water and sediments with climate change – HP system optimization

