

Optimization of Hybrid Generation Systems with Renewable Energy and Storage

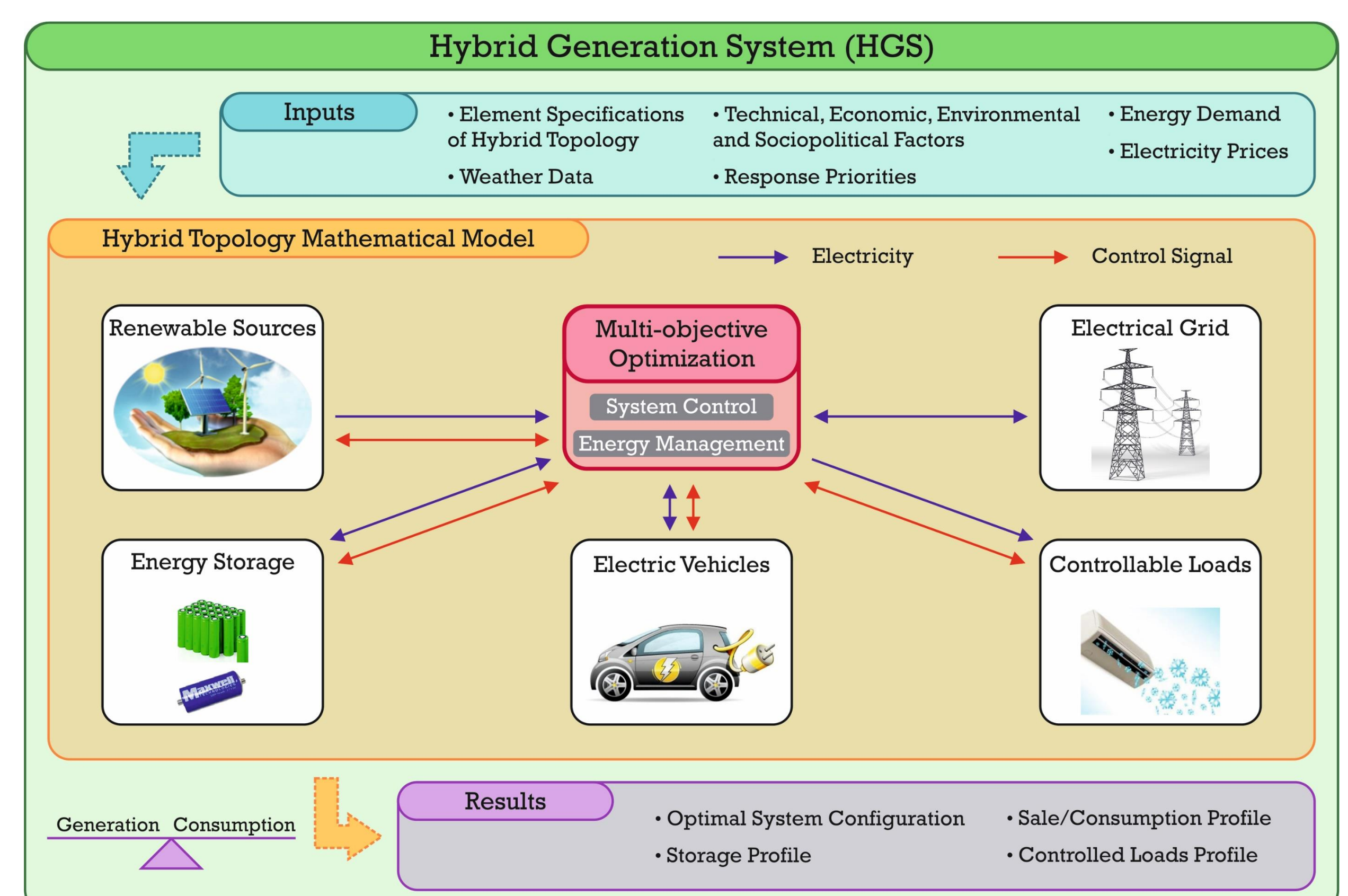
Power Systems

Background and challenges

- A **hybrid generation system** (HGS) enables the integration of several renewable energy sources into a single energy production and storage system.
- When **correctly controlled**, HGSs present, in addition to environmental benefits, lower energy costs and greater reliability in energy supply.
- However, control of this type of system is a **complex task**, particularly given the variability of renewable resources and energy demand.
- In this way, the **main challenge** is the control of a HGS, as well as the optimal energy management.

Description and main innovation

- The **main goals** are:
 - (1) modeling of different HGS topologies;
 - (2) simulation and validation of models;
 - (3) development of multi-objective optimization algorithms enabling to size, optimize, and control the HGS;
 - (4) development of control algorithms capable of controlling the HGS, guaranteeing technical, economic, environmental and sociopolitical factors;
 - (5) development of energy management algorithms allowing consumers to act as players according to their energy needs.

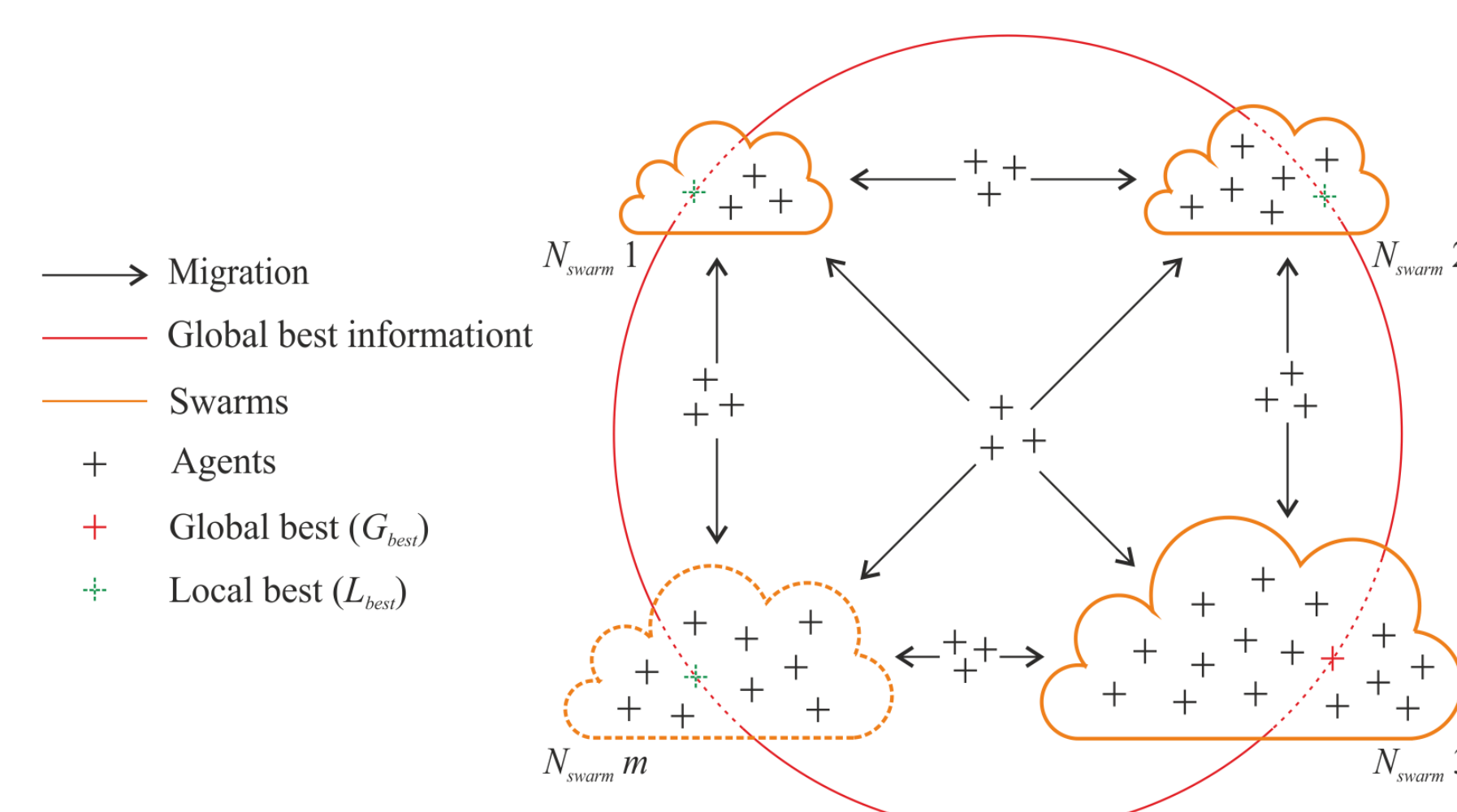
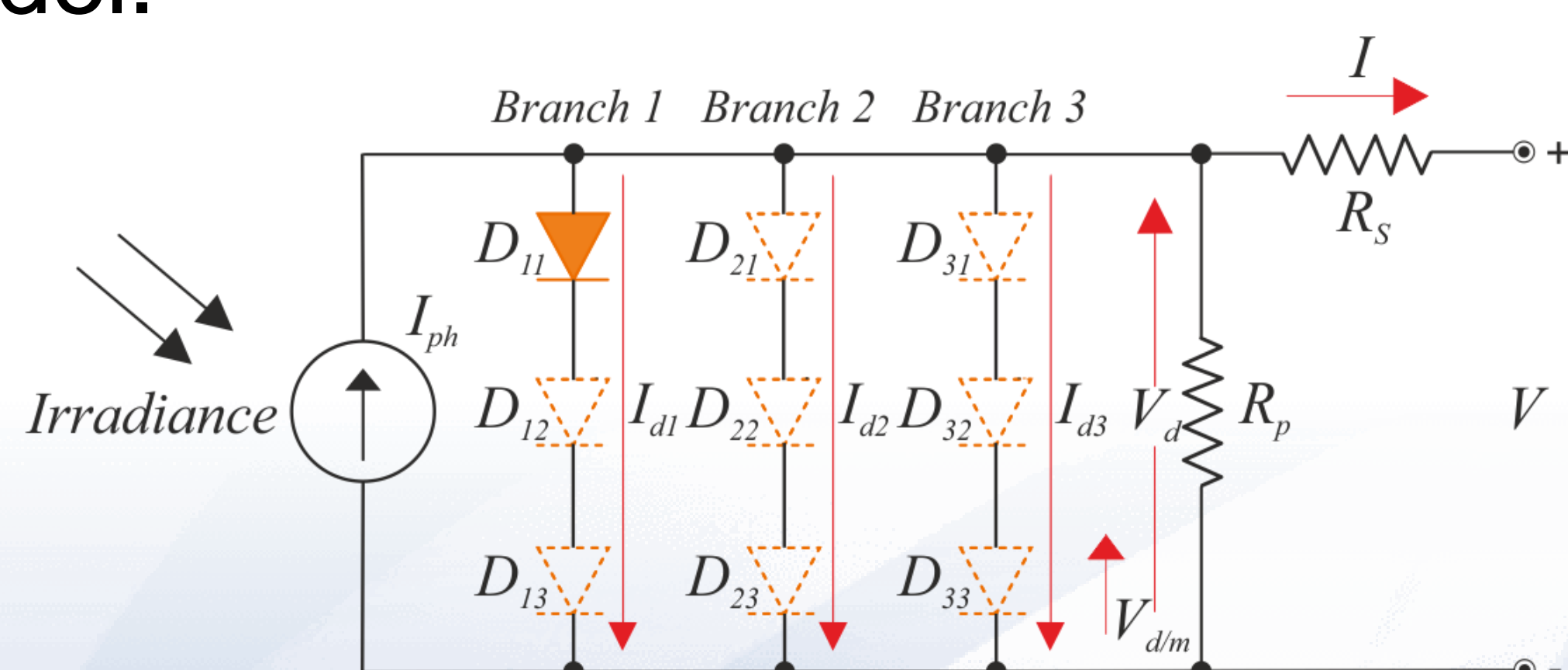


Hybrid generation system (HGS) architecture with renewable energy and storage.

- The **main contribution** will be a tool to optimize and control the HGS.

Achievements

- A new **mathematical model** to simulate the behavior of photovoltaic (PV) cells or modules, named modified multidimension diode model.



- A new **hybrid metaheuristic algorithm** to solve different optimization problems, named collaborative swarm intelligence.