

# RELIABLE POWER SUPPLY THROUGH DYNAMIC DISTRIBUTION OF LOCAL ENERGY RESOURCES DURING OUTAGES

Selma Čaušević\*, Martijn Warnier, Frances M.T. Brazier

Faculty of Technology, Policy and Management, Delft University of Technology

\*s.causevic@tudelft.nl



## POWER SYSTEM CHALLENGES IN DEVELOPING COUNTRIES

Power systems face many challenges in dealing with increased integration of distributed energy resources (DER), while ensuring reliable power supply. Ensuring supply reliability is even more crucial in areas frequently affected by outages.

This is particularly relevant in the context of developing countries due to:

- Aging infrastructure and maintenance of old power plants
- High penetration of DER in local communities



## ENSURING RELIABLE POWER SUPPLY USING LOCAL RESOURCES

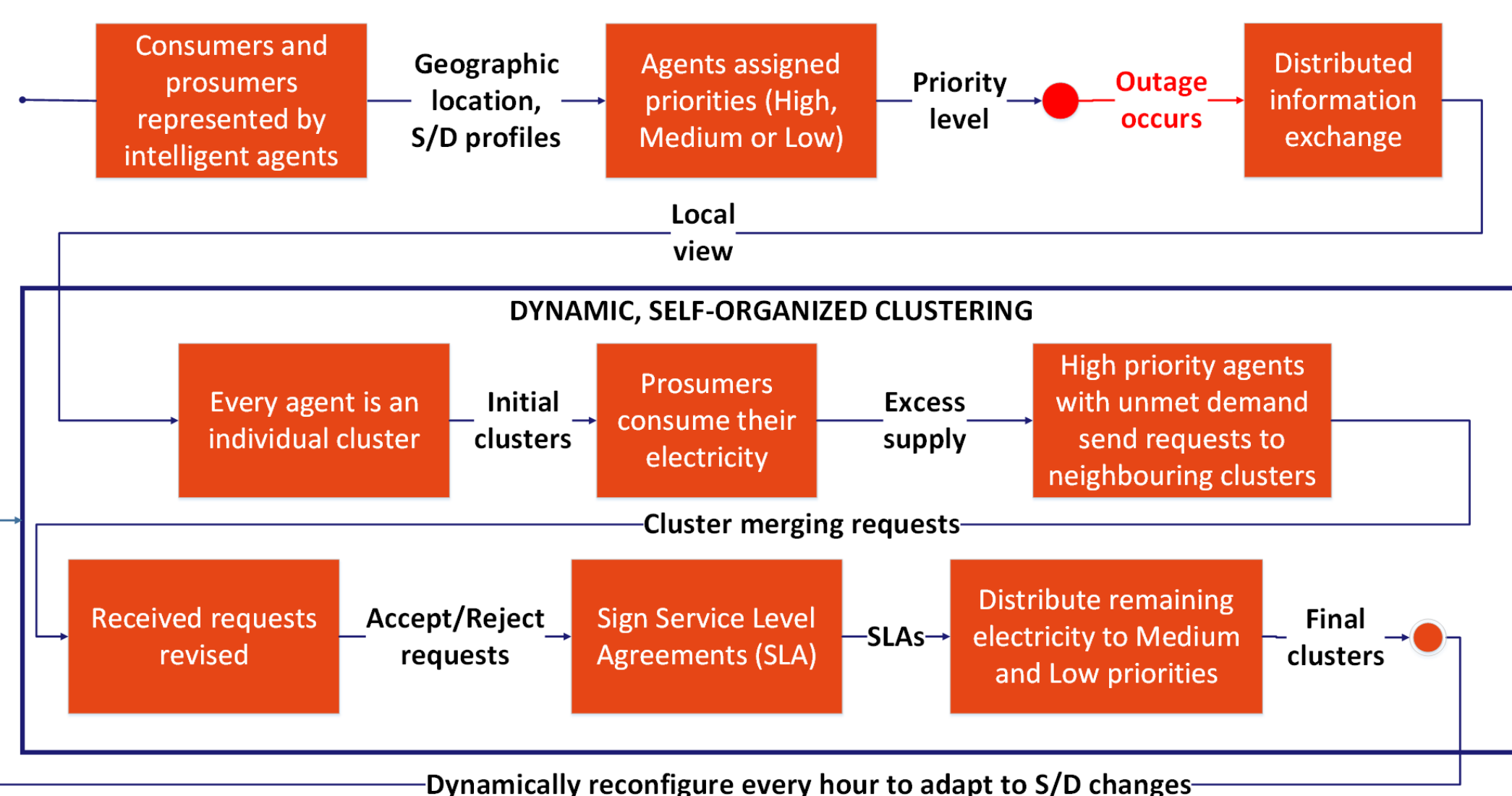
In areas that are frequently affected by **scheduled** and **unscheduled outages**, and have high penetration of renewables, the idea is to achieve reliable power supply during outages using **locally generated renewable supply**. Consumers and prosumers are assigned a **level of supply priority**. These **priorities can change** depending on the situation, and can be agreed upon by the local community. Prosumers first meet their own demand, and the excess electricity is distributed to **the highest priorities first** using mechanisms that enable energy sharing in local communities. Using these mechanisms, consumers and prosumers form virtual groups (**clusters**) that dynamically adapt to changes in their environment.

## DYNAMIC, SELF-ORGANIZED CLUSTERS

- Consumers and prosumers represented by **intelligent agents**
- Agents have **local knowledge** of their supply/demand
- Agents have **perfect forecasts** of their hourly S/D
- **Priorities (HIGH, MEDIUM, LOW)** assigned to agents
- When there is overproduction, agents **organize themselves** into **clusters** that **locally balance S/D mismatch**

1. HP agents send cluster forming requests to agents that meet their demand
2. If there is supply left, MP agents repeat the same process, followed by LP agents

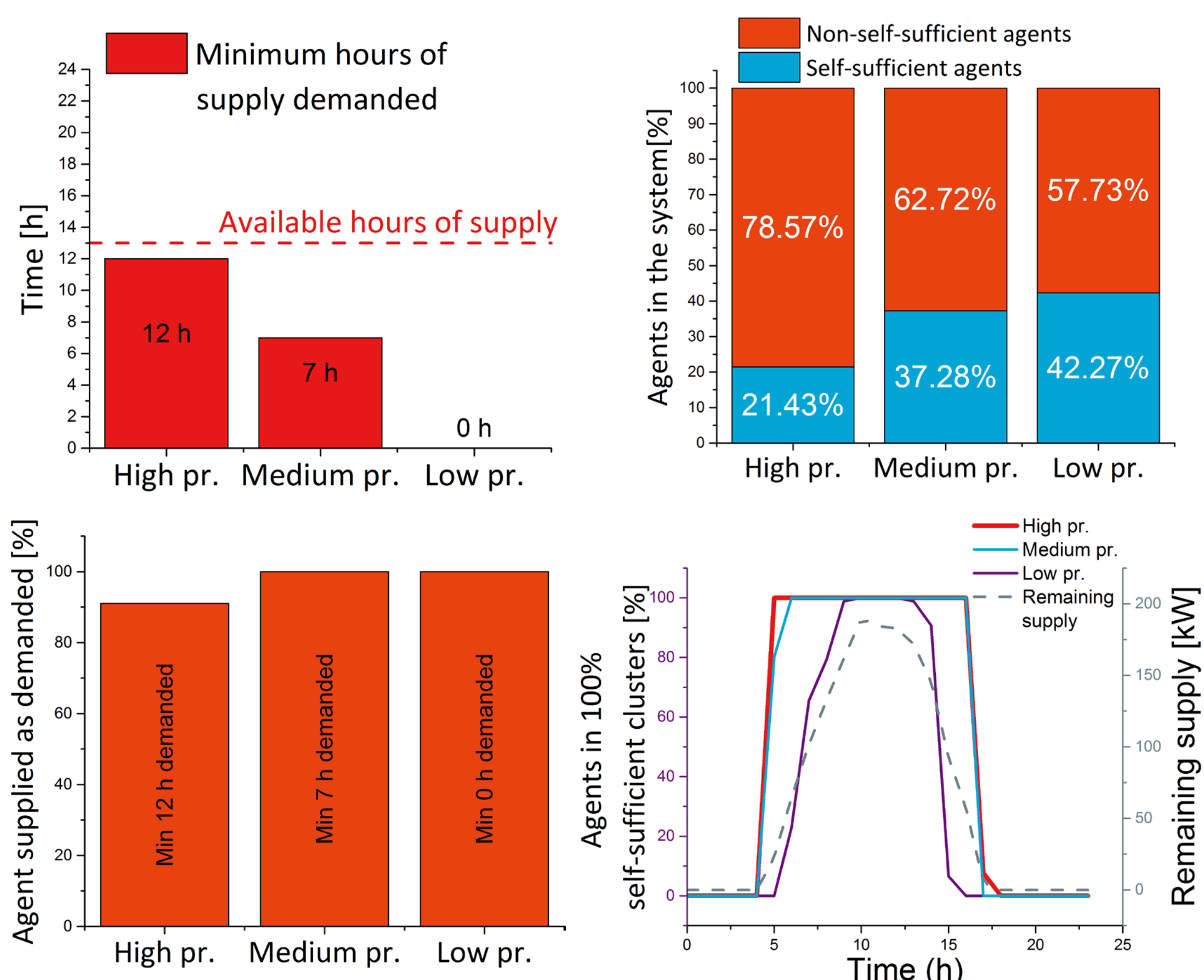
- Clusters **dynamically reconfigure** to adapt to changes



## PRELIMINARY RESULTS

The model considers 500 agents. Prosumers have **solar panels** only. Each priority demands a minimum number of hours of supply (based on the available supply in the system). The results are assessed in terms of:

- Percentage of agents supplied as demanded
- Percentage of agents in 100% self-sufficient clusters



## CONCLUSIONS

Local energy sharing of renewable production during outages can ensure reliable power supply to certain prosumers and consumers, provided priorities are assigned. The developed mechanisms can be used in cases of both scheduled and unscheduled outages, where dynamic reconfiguration of clusters can help better adapt to changes in the environment.