

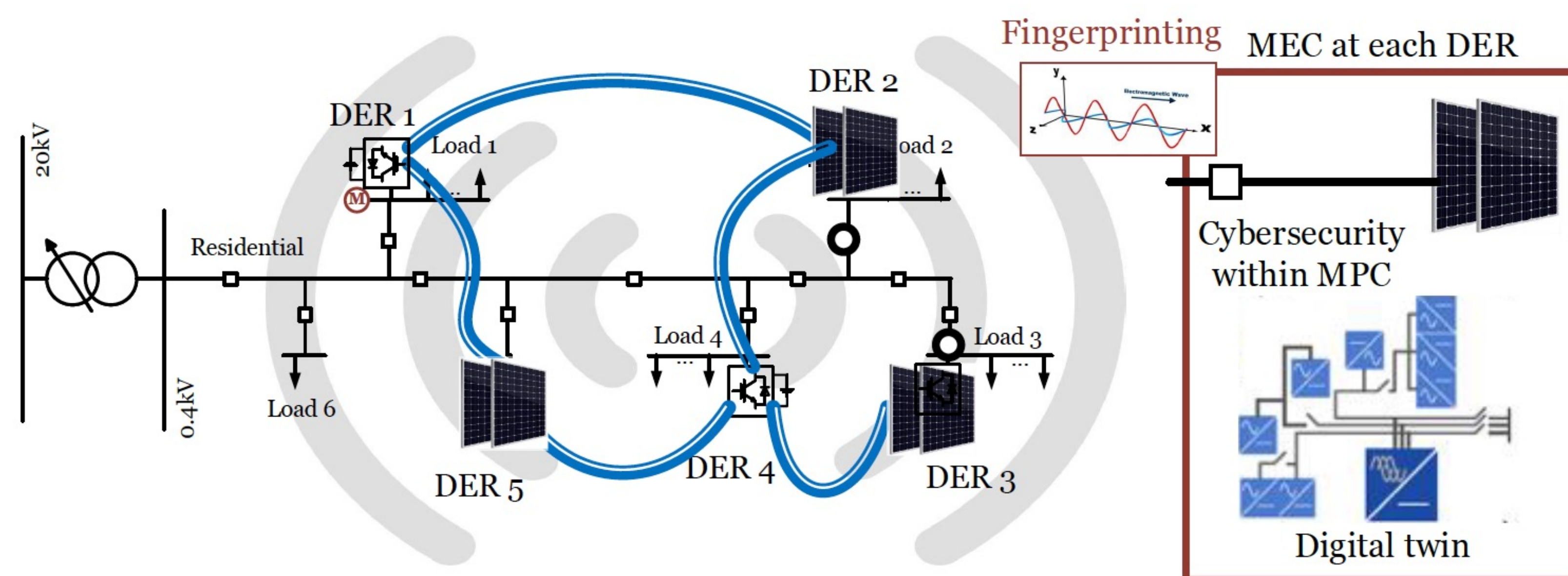
# CPS: Small: Collaborative Research: **CYDER**: CYbersecure Distribution systems with power Electronically interfaced Renewables

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Our ultimate goal is to create and demonstrate the **cyber (communication, cybersecurity, and control)** technology required for the **electric power system** to be more secure, more situationally aware, more efficient, and more green-tech.

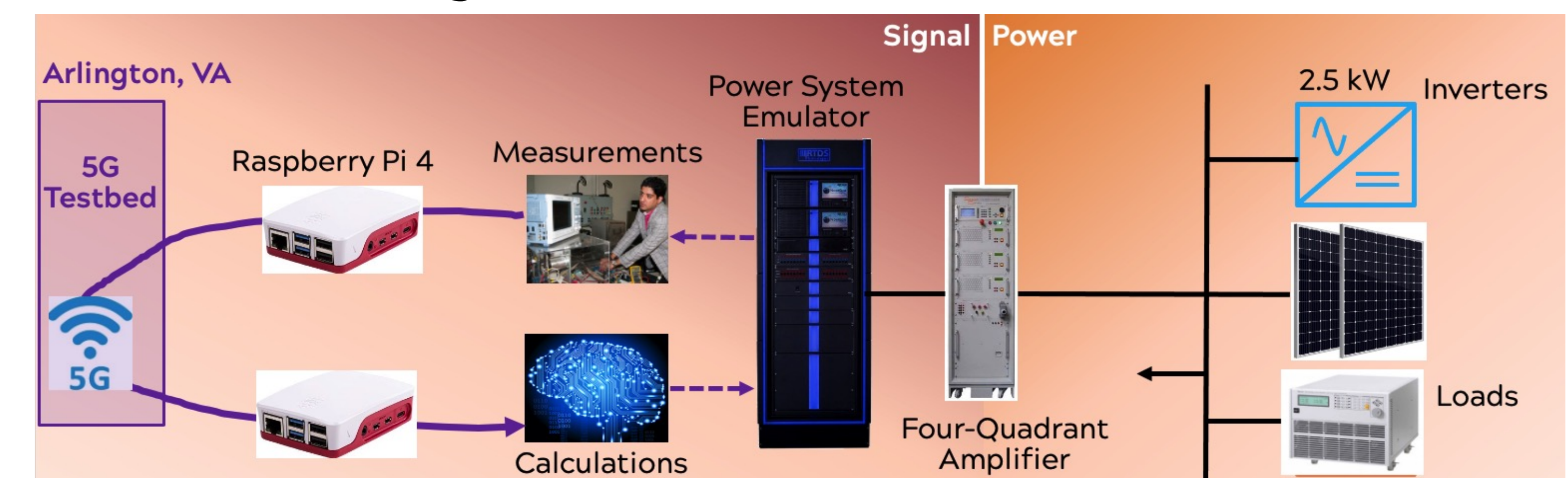
## Challenge: Key Problems and Significance

Today's **electric distribution system** is a complex cyber-physical system of **connected controllable** assets, e.g., inverter-interfaced distributed energy resources (DER), metering infrastructure, and distribution automation that support multiple applications with **cybersecurity** requirements. And we have a new player: We have a new player: 5G (and future generations) communications with MEC capabilities which we need to evaluate/design for the power system. Here, we look at **control** challenges.



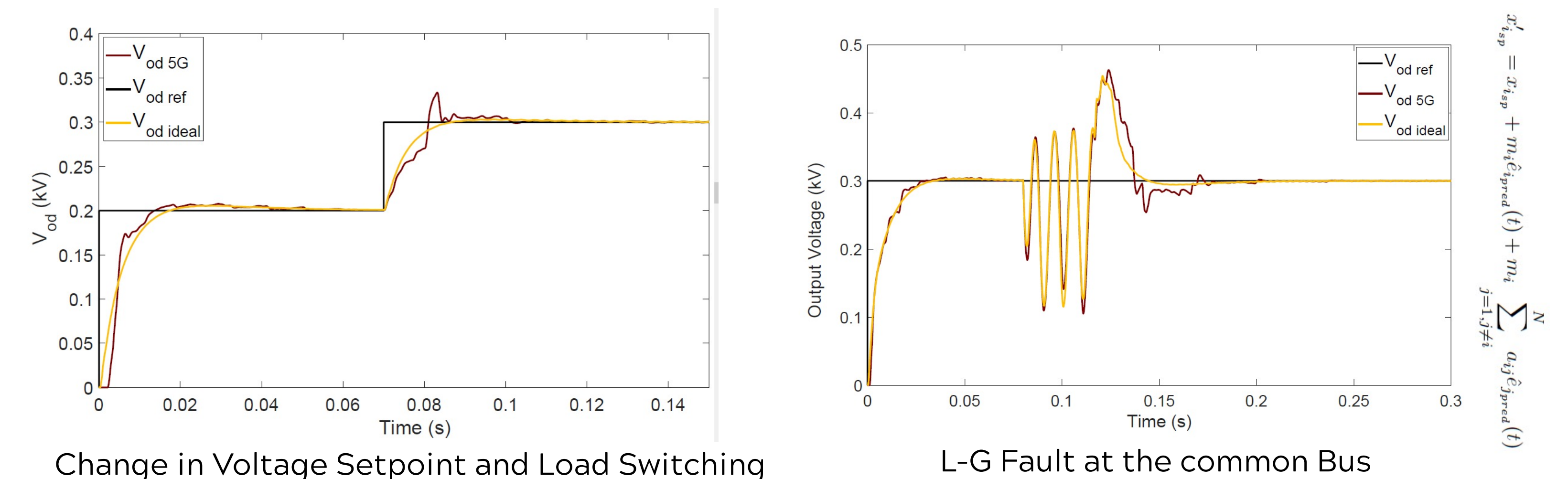
## Scientific Impact

We have created a testbed as part of this project with support from state of Virginia's Commonwealth Cyber Initiative (CCI).



## Distributed Control for Microgrids

We design a coordinated controller taking into account the intricacies of 5G communication; some results are below:



## Broader Impact: Society

Enhancing resiliency of the distribution system with renewables helps alleviate environmental concerns. Power outages highly disrupt the society and economy, costing as much as \$33B annually.

## Broader Impact: Education

We have created an undergraduate course on Microgrids that discusses our work in this project. We have also created a new program called Virginia Integrative Virginia Integrative Experiential Workforce for power system communication and cybersecurity.

## Broader Impact: Other CPS Areas

Our testbed can be employed for several power system + communication + control + cybersecurity applications; it can be used for testing of algorithms (distributed and centralized) for defense against any factor resulting in controller deterioration.