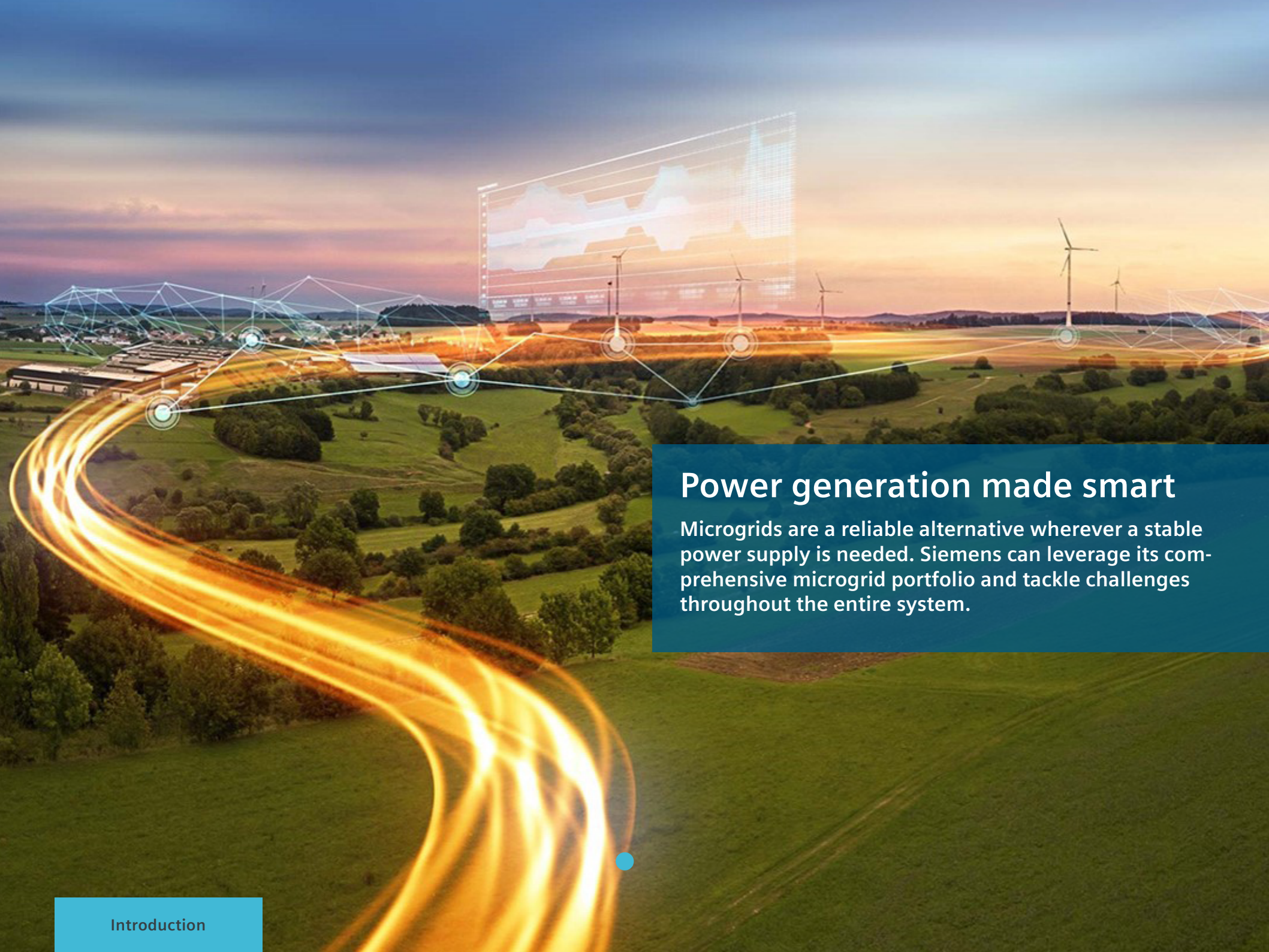




# Microgrids – the future of energy management





## Power generation made smart

Microgrids are a reliable alternative wherever a stable power supply is needed. Siemens can leverage its comprehensive microgrid portfolio and tackle challenges throughout the entire system.

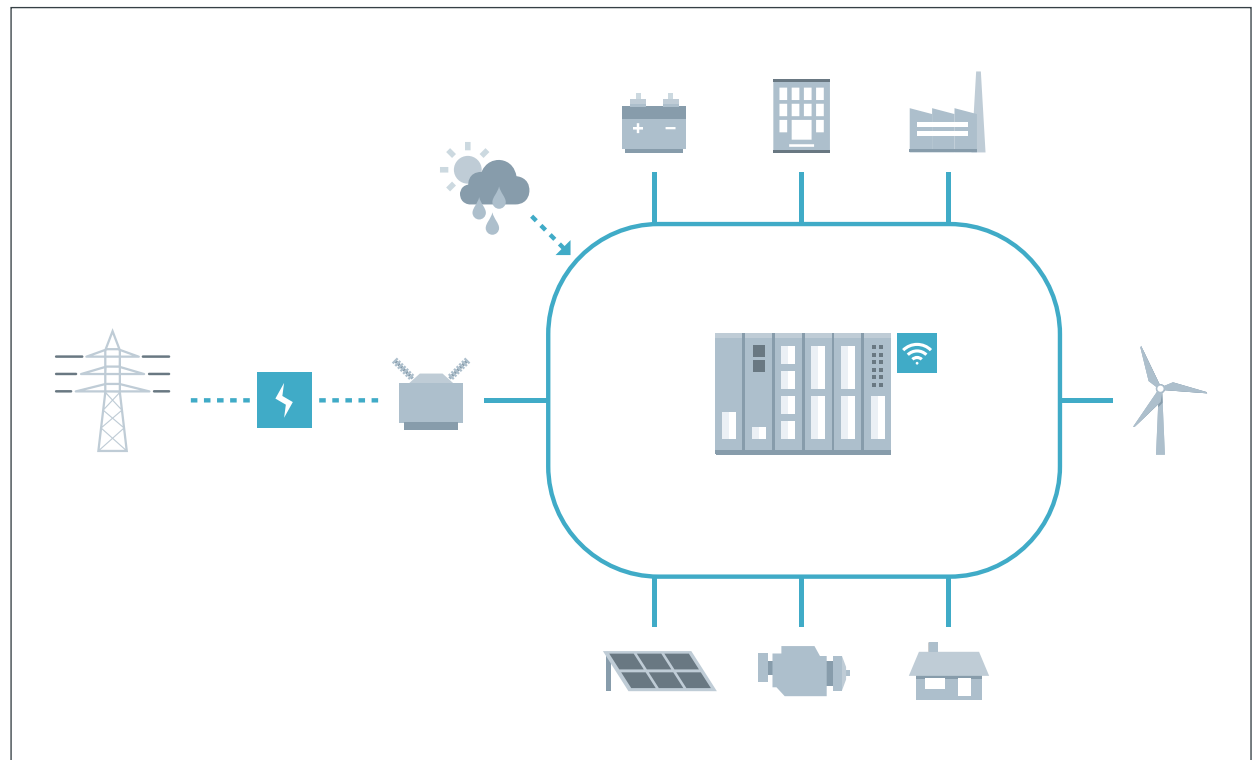
# Microgrids are efficient, resilient, and sustainable distributed energy systems

Two major trends are driving the transformation of the energy world: digitalization and the shift from centralized unidirectional to distributed energy systems. These trends as well as prosumers' needs are driving the development of microgrids.

Microgrids contain all the elements of complex energy systems, they maintain the balance between generation and consumption, and they can operate on and/or off grid. They are ideal for supplying power to remote regions or locations with no connection to a public network. In addition, more and more industrial operators are using microgrids to produce the electricity they need cost-effectively, sustainably, and reliably.

Microgrids use a variety of energy sources, including photovoltaic and wind-power plants as well as small hydro-power and biomass-power plants. Biodiesel generators and emergency power units, storage modules, and intelligent control systems ensure the security of supply.

Siemens provides a comprehensive portfolio of products, solutions, and services to help build and operate microgrids of any size. They provide generation and distribution of electrical energy as well as monitoring and controlling of microgrids.

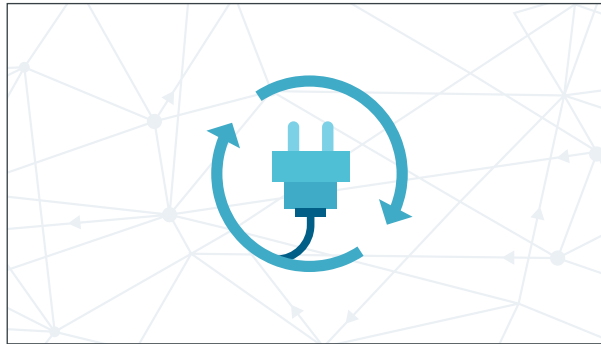


# Benefits at a glance



## Economics and energy efficiency

Using sophisticated software, operators can optimize power usage based on demand, utility prices, and other factors. Application areas most impacted are campuses as well as commercial and industrial areas.



## Reliability and resilience

Microgrids are designed to provide uninterrupted 24/7 power and to balance load demands for an organization with changing power needs. Relevant applications are critical infrastructures, military institutions, commercial and industrial areas, remote locations and islands.



## Sustainability

By using primarily renewable energies, microgrids reduce carbon-dioxide emissions, which is often required by government regulations. That makes them especially attractive for campuses, utilities, and islands.

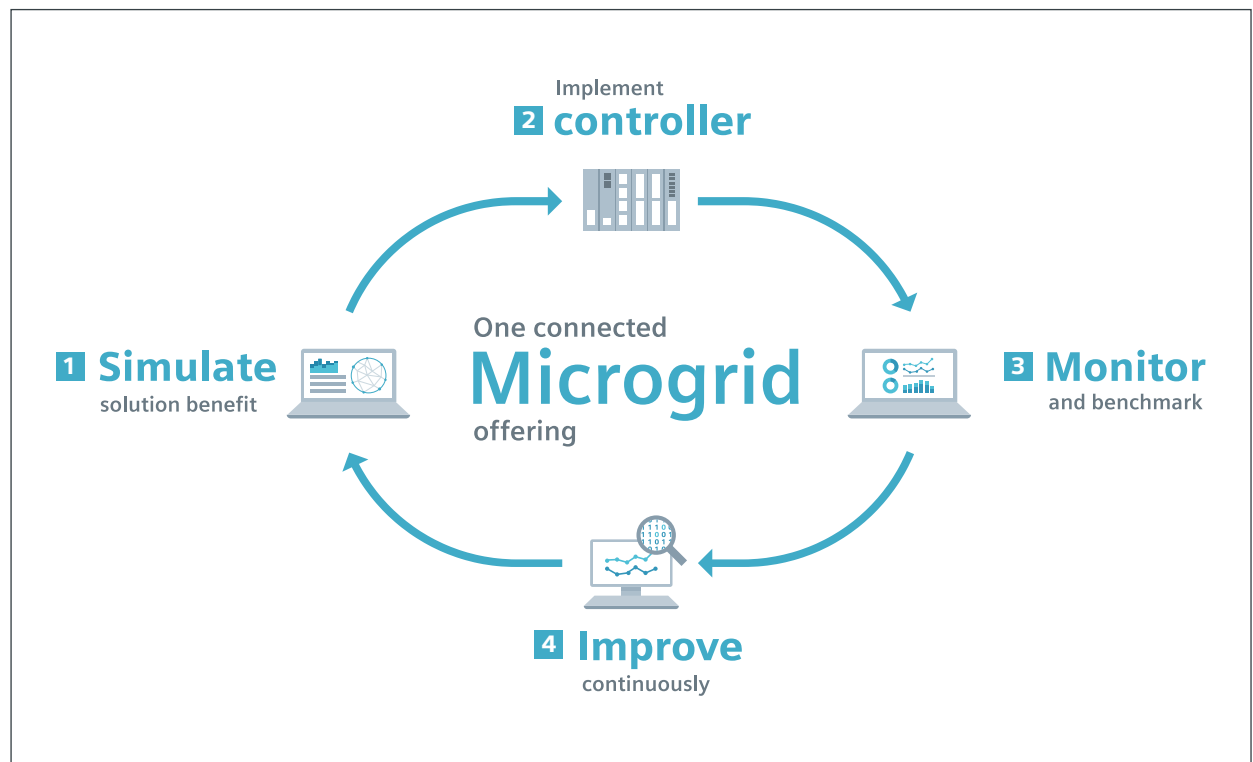


# Mastering all challenges with Siemens

## One offering for distributed energy systems

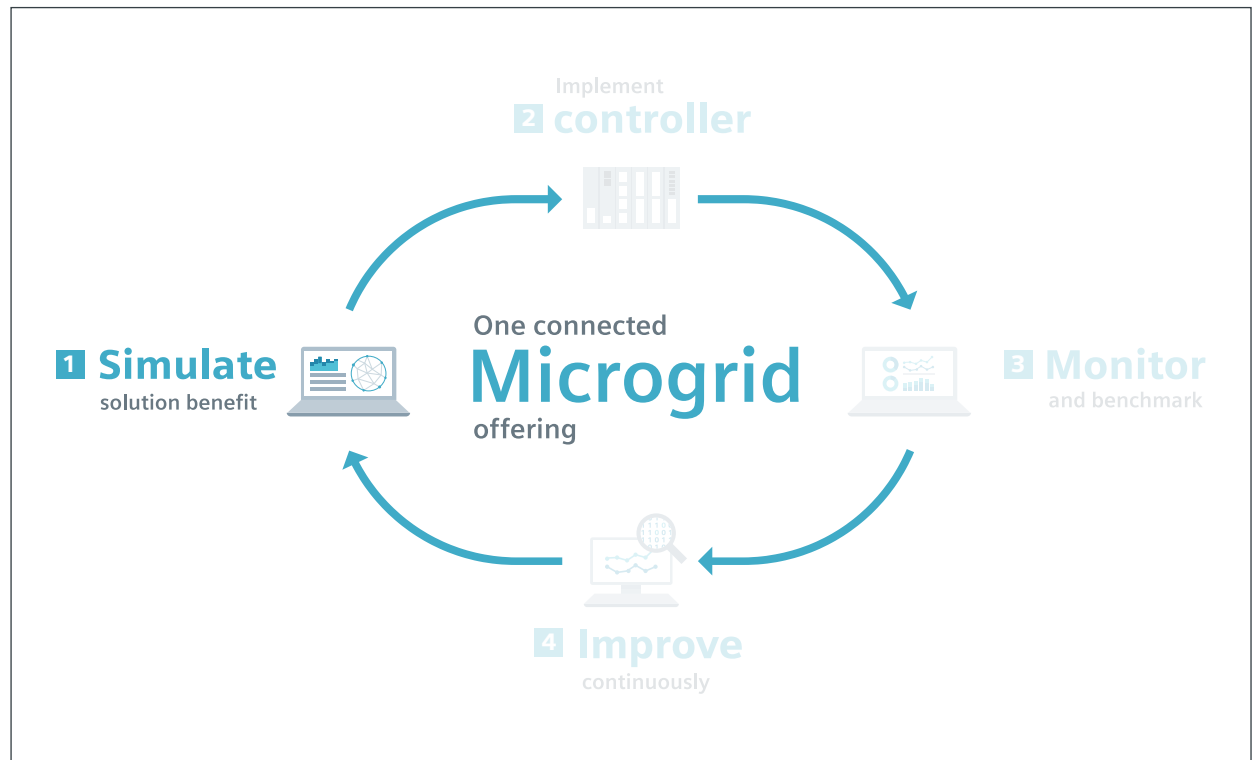
To integrate distributed energy systems (DES), we support you in several steps to reach the most efficient system. Define and simulate, integrate the right controller, monitor and improve the system. Several portfolio elements help you create a microgrid solution that meets your requirements perfectly.

We will work with you to design and deliver a comprehensive, and integrated microgrid solution for your energy infrastructure project. Our proven expertise with complex decentralized energy sources, leading control systems, and transmission and distribution systems, along with our suite of services, make us an ideal partner for stakeholders.



# 1 From simulation with an energy twin to solution benefits

The first process step is the energy twin: We simulate the entire microgrid project using virtually integrated control modules. What's more, we evaluate the DES baseline and solution benefits.



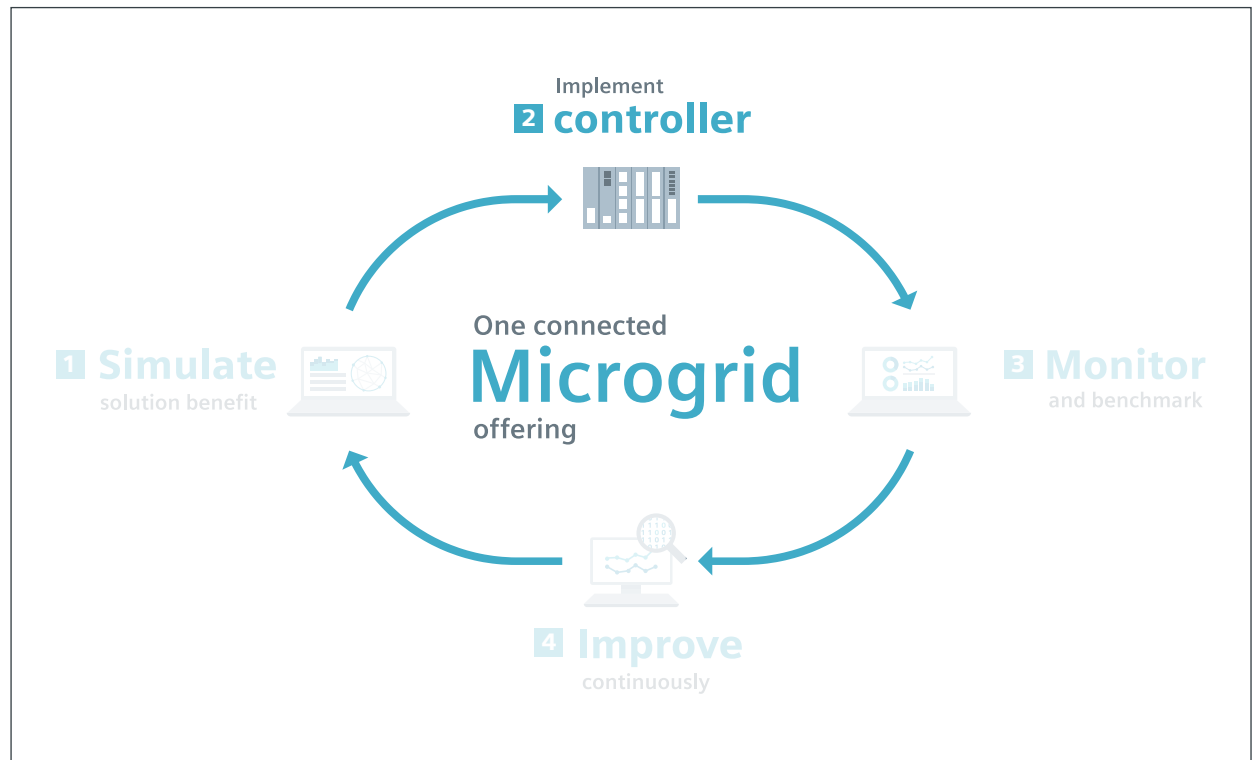


## 2 The right controller for your microgrid

The scope and design of your microgrid determines the appropriate controller to implement. With Microgrid Control – a SICAM Application and Spectrum Power MGMS, Siemens offers the right product for any application.

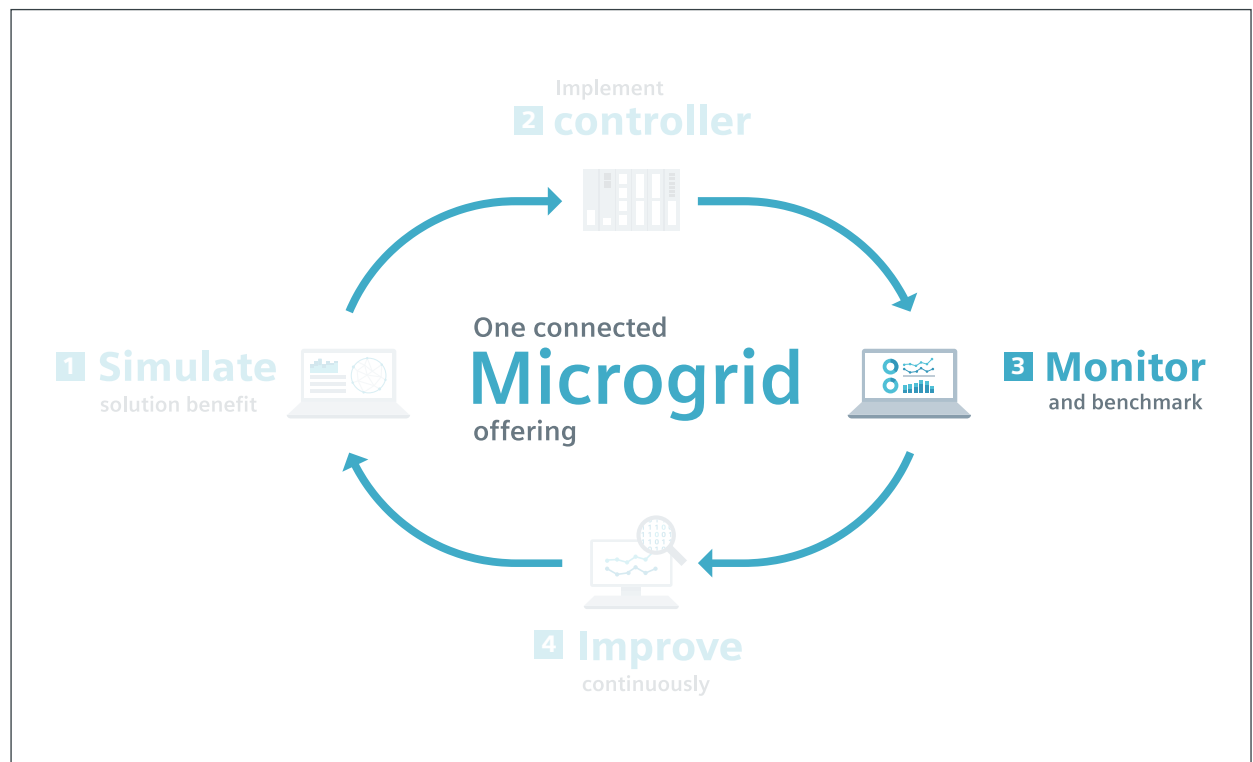
**Microgrid Control – a SICAM Application** ensures reliable monitoring and controlling of microgrids. It protects your independent power supply from blackouts and balances out grid fluctuations and fluctuations in power consumption.

**Spectrum Power MGMS** is a software solution for optimal microgrid management and control. Some of its advanced functions include seven-day load and generation forecasting, unit commitment optimization, load shed, seamless transition to and from island mode, and market participation tools.



### 3 Data gathering and monitoring

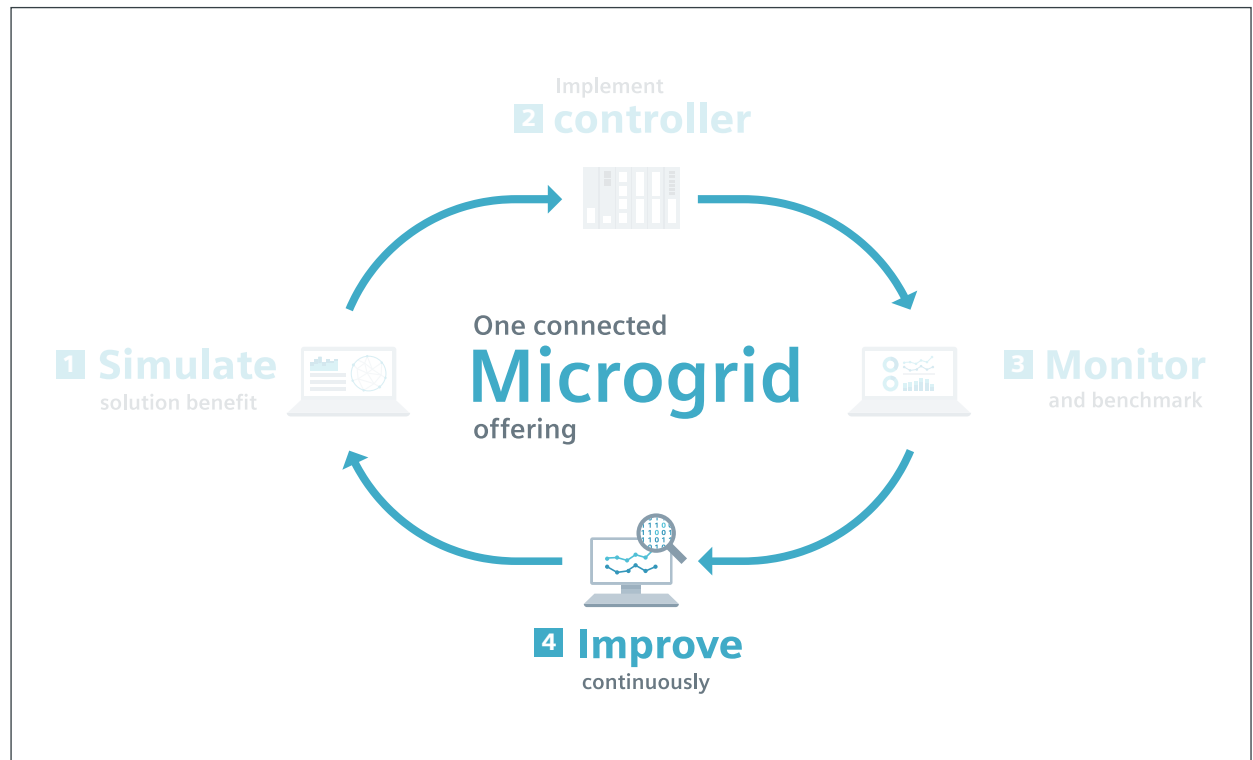
DER Performance Analytics and Management is an IoT energy management platform from Siemens. In a self-contained energy system, it gathers relevant DER data, supports the reporting of KPIs, and provides benchmarking data analytics. During Expo 2015 in Milan, Italy, Siemens managed the entire smart city with this application. It covered not only the grid technologies, but also smart building, smart lighting, and electric mobility.





## 4 Operational improvement through data analysis

Attaining data is good, but not enough. We want our customers to extract the most value from it. Siemens Managed Services supports customers to analyze the data with powerful tools. Based on the analysis, we provide recommendations to improve the operational efficiency system and suggest structural changes. Once the improvements have been identified, the recommended changes can be simulated and the savings can be quantified.





Blue Lake Rancheria, California, USA

Algonquin Campus, Eastern Ontario, Canada

Buenavista del Cobre, Cananea, Mexico

Ventotene Island, Italy

IREN2, Wildpoldsried, Germany

Expo 2015, Milan, Italy

Savona University, Genoa, Italy



# Blue Lake Rancheria, California, USA

## A microgrid on a Native American reservation

- A typical application for the microgrid use case “Municipality”
- A microgrid powers a 100-acre reservation including offices, casino, hotel, and Red Cross safety shelter
- Siemens’ microgrid management software allows the distributed energy resources to be intelligently managed



Blue Lake Rancheria, California, USA

# Algonquin Campus, Eastern Ontario, Canada

## A unique spirit of partnership

- A typical application for the microgrid use case “Campus”
- The College of Applied Arts in Technology is on an ambitious journey to becoming a sustainable institution of the future
- With Siemens, it found a partner to help educate, operate, collaborate, and innovate for a clean energy future



Algonquin Campus, Eastern Ontario, Canada



# Buenavista del Cobre, Cananea, Mexico

## A reliable grid can move mountains

- A typical application for the microgrid use case “Industry”
- Using a Siemens control system, a copper mine realized a 60 percent reduction in downtime and significant cost savings
- Siemens constructed a new state-of-the-art DCC that integrates the Spectrum Power grid control platform



Buenavista del Cobre, Cananea, Mexico

# Ventotene Island, Italy

## How to optimize an island's power supply

- A typical application for the microgrid use case "Islands"
- A SIESTORAGE battery storage system secures the power supply on the Italian island of Ventotene
- The solution enables the more economical and efficient operation of the entire energy system



Ventotene Island, Italy



# IREN2, Wildpoldsried, Germany

Smart technology combined with science

- A typical application for the microgrid use case “Municipality”
- Ingenuity meets pioneering spirit: The first microgrid test of its kind outside the laboratory
- The village set up stable grids with a functioning electricity supply from a range of renewable sources



IREN2, Wildpoldsried, Germany

# Expo 2015, Milan, Italy

## The art of setting up a smart grid

- A typical application for the microgrid use case “Cities”
- At Expo 2015, Siemens delivered the intelligent grid technology that supplied the fair with electricity
- The energy management system was based on sophisticated cloud technology



Expo 2015, Milan, Italy



# Savona University, Genoa, Italy

## IQ power for tomorrow's *dottore*

- A typical application for the microgrid use case "Campus"
- Implement an intelligent microgrid for the university campus in Savona, Italy
- Goal: Provide electrical and thermal energy. Benefits: High efficiency and grid stability, lower emissions, easy control



Savona University, Genoa, Italy

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