

Doctoral Thesis

assigned by the research area

Propulsion Systems

covering the topic

„Resilient and Autonomous Multi-Energy Systems: Modeling, Simulation and Assessment of Critical Energy Infrastructures“

Short description:

The overall objective of this work is to develop robust and resilient energy supply concepts for integrated multi-energy systems under normal and disrupted operating conditions.

A modeling and simulation framework combines electrical, thermal, and fuel-based energy carriers, renewable generation, storage, conversion technologies, and prioritized consumers.



A resilience-oriented assessment methodology evaluates autonomy, security of supply, flexibility, and the ability to maintain critical functions during disturbances.

The work focuses on system modeling, resilience and autonomy metrics, technology assessment, and scenario-based validation for secure and efficient future energy infrastructures.

Content and time schedule:

- Technology screening, characterization, and integration
- Development of resilience, autonomy and system performance indicators
- Implementation and parameterization of representative disruption scenarios
- Development of simulation-based assessment and decision-support methods
- Preparation of the written dissertation and documentation of the developed methodology

Start: immediately
Duration: approx. 3 years

Head of institute & Supervisor:

Univ.-Prof. Dr.-Ing. Christian Trapp, +43 (316) 873-30000, christian.trapp@tugraz.at

Contact:

Dipl.-Ing. Roland Lorbeck, +43 (316) 873-30033, lorbeck@tugraz.at

Date: 31.08.2026

Master's Thesis

covering the topic

"Modeling and Resilience Assessment of Integrated Multi-Energy Systems"

Short description:

The objective of this Master's thesis is to investigate the modeling and resilience assessment of integrated multi-energy systems under normal and disrupted operating conditions.

The considered system combines electrical, thermal, and fuel-based energy carriers with renewable generation, storage and conversion technologies as well as prioritized consumers.



Suitable simulation models and assessment methods are applied to analyze energy autonomy, security of supply, flexibility, and the ability to maintain critical functions during disturbances.

The thesis contributes to simulation-based methods for the design and assessment of resilient future energy infrastructures.

Content and time schedule:

- Familiarization with integrated multi-energy systems and existing simulation models
- Modeling and parameterization of selected generation, storage, conversion, and consumption technologies
- Definition and implementation of representative operating and disruption scenarios
- Application and evaluation of resilience, autonomy, and system performance indicators
- Simulation, analysis, documentation, and preparation of the written Master's thesis

Start: immediately / by arrangement

Duration: approx. 6 months

Head of institute & Supervisor:

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Date: 29.09.2026

Studentische Mitarbeit

im Themenfeld

"Multi-Energy-Systeme & Energieresilienz"

Kurzbeschreibung:

Wir suchen eine motivierte studentische Unterstützung für unsere Forschungsaktivitäten im Bereich resilienter und autonomer Multi-Energy-Systeme.

Die Forschung verbindet elektrische und thermische Energiesysteme sowie Kraftstoffe mit erneuerbarer Erzeugung, Speicher- und Konversionstechnologien und priorisierten Verbrauchern in integrierten Energiesystemmodellen.

Als Teil des Forschungsteams unterstützt du bei Technologierecherche sowie der Entwicklung von Szenarien und der Auswertung von Resilienz- und Systemkennzahlen.



Die Stelle eignet sich besonders für Studierende mit Interesse an Energiesystemen, erneuerbaren Technologien, Simulation, Python und Datenanalyse.

Aufgaben und Tätigkeitsbereich:

- Technologierecherche, Screening und Aufbereitung technischer Daten
- Vorbereitung und Parametrierung von Betriebs- und Störungsszenarien
- Auswertung von Simulationsergebnissen, Resilienzkennzahlen und Systemperformance
- Erstellung von Diagrammen, Auswertungen und technischer Dokumentation

Beginn: ab sofort / nach Vereinbarung

Beschäftigungsausmaß: 12-16 Stunden/Woche

Institutsleiter:

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Datum: 29.09.2026