Q1 2026 IDEaS in Review

Institute for Data, Energy and Sustainability (IDEaS)

Vienna University of Economics and Business

BMIMI Endowed Professorship for Data-driven Knowledge Generation: Climate Action

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Welcome to the **second edition of the quarterly newsletter** of the Institute for Data, Energy, and Sustainability. This issue focuses on **digitalization in the context of the green transition**, with a particular focus on the growing role of open and large-scale data and Artificial Intelligence. We highlight our work together with and supported by VERBUND and ÖBB on how digitalization shapes trends in the energy and mobility sectors, alongside recent research, teaching, and thesis activities at IDEaS that spotlights our work at the nexus of energy, data, and digitalization.

We also share a preview of exciting initiatives planned for the year ahead -

stay tuned!

We hope you enjoy the read.

Kavita Surana

Quarterly Data Insight

500-2,000 TWh

By 2030, **data centers are projected to consume a range of 500–2,000 TWh of electricity**, a two- to fourfold increase from today. The low end matches Germany's electricity demand today, while the high end exceeds India's, the world's third-largest consumer of electricity.

Community Spotlight

Highlighting the Link between Digitalization and the Environment

The first **Future Foundations talk** centered on the 5th Rule for the Digital World — *"Do not destroy life and nature for technical progress."* In his keynote, **Behnam Zakeri** addressed the often-overlooked environmental impacts of digitalization and AI:

- He showed that under current trajectories ICT could **exhaust 40% of the remaining 1.5°C carbon budget**.
- He highlighted the often-overlooked regional and environmental impacts of data centers and critical raw material extraction: AI-driven **water withdrawal may reach 4.2–6.6 billion m³ by 2027**
- He argued that from an environmental perspective, **AI should be treated as a scarce and strategically deployed resource — not a default mass-market tool.**

Advancing Open Data at the Intersection of Energy and Digitalization

Behnam Zakeri continues to serve on the **Editorial Board of Scientific Data**, a Nature-family journal dedicated to the publication of **high-impact open-access datasets.** In this role, Behnam is closely engaged in debates on the creation, quality, and value of new datasets that enable **quantitative, bottom-up analysis of research questions in energy and digitalization.**

Connecting with Industry Leaders in Digitalization

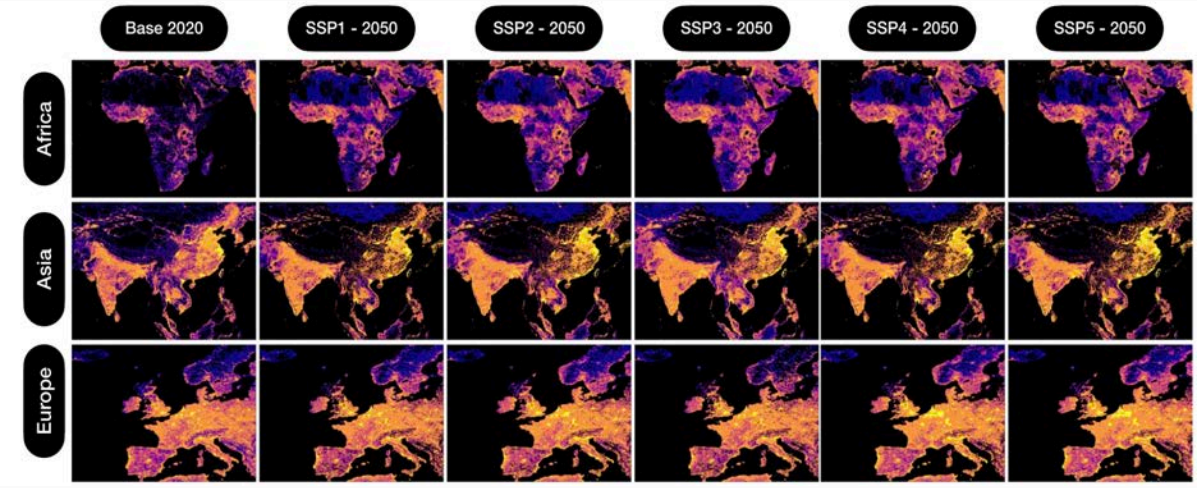
In WU's sustainability talk series *"Leading for a Sustainable Future"* Kavita Surana and **Chuck Robbins, CEO of Cisco**, discussed the trade-offs between the AI's opportunities and its environmental impacts, and the need for business, governments and society to work together in enabling technological change for sustainability goals.

Bringing our Teaching Experience to Policy Forums

At the **Rail Data Forum 2025**, a leading European platform on railway data and digitalization, we exchanged with around **140 experts from operators, public authorities, and industry** on data sharing and interoperability, while showcasing how Industry Labs and student-led projects can support large-scale harmonization efforts.

Research Spotlight

We highlight five recent papers that highlight the **positioning of our research at the intersection of digitalization and energy:**



1 Generating High-resolution Data on Rooftop PV potential on

In *Scientific Data*, Behnam Zakeri and co-authors present a global **machine-learning–based dataset estimating rooftop area growth** from 2020 to 2050 across five SSP scenarios, covering 3.5 million spatial units worldwide.

a Global Scale

2 Unlocking Railway Data for a Digital European Transport System

In *Transport Research Interdisciplinary Perspectives*, Shahrom Sohi, Sri Harikrishnan and co-authors map the **landscape of railway data across Europe**, highlighting the need for stronger data interoperability to advance the Single European Transport Area.

3 Representing Renewable Energy in Large-Scale Climate-Energy Scenario Models

In *Environmental Research Communications*, Behnam Zakeri and co-authors examine how **high-resolution energy system models can i**mprove the representation of wind and solar power in large-scale climate-energy scenarios.

4 Using LLMs for Cross-Border Railway Safety Analysis

In a study presented at the *International Semantic Web Conference in Nara, Japan*, Shahrom Sohi and co-authors show how LLMs can transform **354 multilingual railway accident reports** into structured data for **cross-border rail safety oversight and AI-enabled accident analysis**.

5 Leveraging Data and Network Science in Energy Research

In *Environmental Research Letters*, Kavita Surana and co-authors show how large-scale **digital data and network analytics** can explain and accelerate the co-adoption of solar photovoltaics and battery storage.

Digitalization remains central to our research agenda. Behnam Zakeri analyzes the **direct environmental impacts of digitalization, including data centers**.

Two of our PhD researchers are developing **large-scale open-source datasets on power transmission, hydrogen, and industrial decarbonization**

First research building on the transmission dataset presented at the **AGU Annual Meeting in New Orleans**, the leading community of earth

scientists.

We look forward to sharing further results in upcoming editions of this newsletter!

Teaching Spotlight

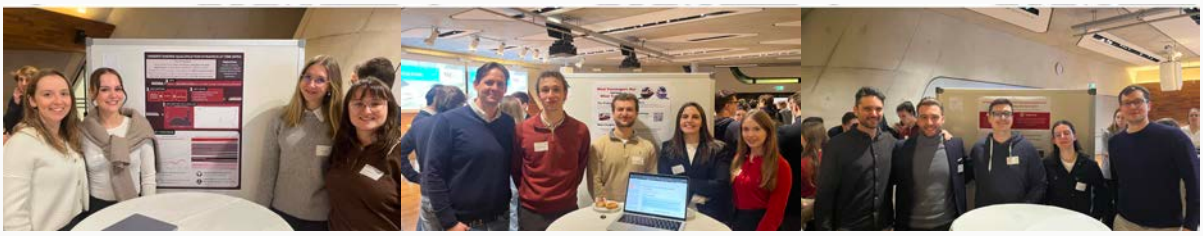
Bringing Energy, Digitalization, and Pedagogical Innovation to the Core of Our Teaching

We place energy and digitalization at the core of our teaching and develop **modern, practice-oriented course formats**, including experimental designs that **integrate generative AI tools** (like AI-supported chatbots) to support learning, analysis, and student interaction. Examples in summer term 2026 include:

- Energy Systems and Climate Change Analysis (PhD, Kavita Surana, PhD)
- Digitalization, Energy and Sustainability (MSc, Kavita Surana, Behnam Zakeri)
- Digitalization for Green Energy Transition (BSc, Kavita Surana, Damiano Alessi)
- Environmental Impact of Artificial Intelligence (BSc, Behnam Zakeri)
- Data Science Lab (BSc, Kavita Surana and colleagues)

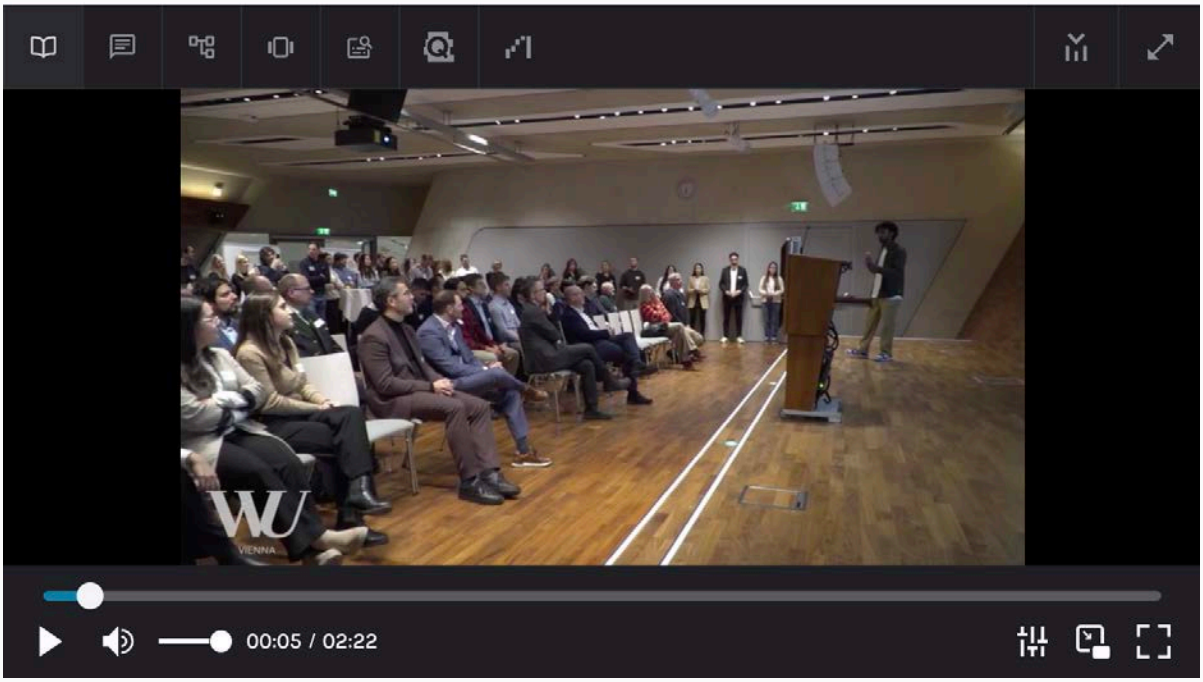
Behnam Zakeri will also continue to further our connections to other universities in Austria, holding a guest lecture in **Global Energy Transitions and Climate Policy,** which is part of the **MSc in Environmental Technology and International Affairs offered by the Technical University of Vienna (TU) and the Vienna Diplomatic Academy.**

Scaling Industry Labs to Deliver Lasting Impact for Students and Partners



In **2024/25**, we completed **eight Industry Labs** with our partners—**four with VERBUND** and **four with ÖBB** — addressing topics at the nexus of **energy, climate, digitalization, and data**:

- With **ÖBB**, 16 students worked on four Labs that resulted in **seven theses**, diving into topics such as AI-supported cross-border railway data translation, digital twin–based passenger information systems, data-driven workforce analytics, and dynamic pricing in rail cargo. Each Lab concluded with dedicated workshops at ÖBB, where results were discussed and further explored with a wider circle of stakeholders.
- With **VERBUND**, student teams addressed regulatory and cybersecurity challenges under the EU Cyber Resilience Act, explored generative AI for energy trading, developed digital tools for fleet electrification, and examined new business models for a digitalized energy sector. The final presentations sparked lively discussions and strong engagement from our partners.
- **VERBUND, Siemens, Research Studio Austria and the Federal Chamber of Commerce will join the 2026/27 edition with new Labs**, and we are exploring partnerships with additional **private- and public-sector partners** to further strengthen this format and increase its value for both students and partners.



Using Large Datasets for Pricing Strategies in Clean Energy Business Models

One of our Industry Lab students, **Kaleb Mulugeta**, tackled a key energy transition challenge: activating **demand flexibility at electric vehicle charging stations**. In collaboration with **VERBUND X**, his master's thesis

designed and tested dynamic tariff schemes using large-scale, minute-level charging data, demonstrating how data-driven pricing can improve load management, system efficiency, and decarbonization outcomes.

Assessing Austria's Digitalization–Decarbonization Pathways in Student Theses

One of our ongoing research tracks examines the **impacts of digitalization on the economy**, focusing on how digital technologies shape energy demand and emissions across key sectors.

- Through **four master's theses**, this work has analyzed sector-specific impacts at the Austrian and EU levels, covering **buildings (Michaela Macko), transport (Josefine Gruber), and industry at Austrian (Sara Toth) and EU (Luca-Luigi Maddaluno) level**.
- This research line is now being extended by integrating these insights into an **energy–economy modeling framework developed at IDEaS**, enabling a systematic, quantitative assessment of digitalization impacts within long-term energy transition scenarios.

What Comes Next

In 2026, we will further advance our research at the **intersection of digitalization, data, and energy** — including work on d**ata center impacts and large-scale open datasets for power transmission, hydrogen, and industrial decarbonization.**

Behnam Zakeri will hold a **talk on the environmental impact of data centers at the University of Edinburgh** (March 2026).

Collaboration remains central. Our **Joint AI Research Track with VERBUND** will expand toward a long-term partnership.

As part of our broader endowment work, we aim to further explore the role of **applied AI and data-driven decision support in green mobility** (for example through European Rail Safety Knowledge Graphs) and support interoperable public transport data exchange (for example by contributing to the Austrian National SIRI profile).

We hope you enjoyed this newsletter, and wish you a great spring!

WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

Univ.-Prof. Dr. Kavita Surana

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kavita.surana@wu.ac.at