Image: © istock-zhengzaishuru

GET.transform
Transforming Energy Sectors Globally

GET.transform Workstream: Renewable Energy Grid Integration

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DEUTSCHE ZUSAMMENARBEIT

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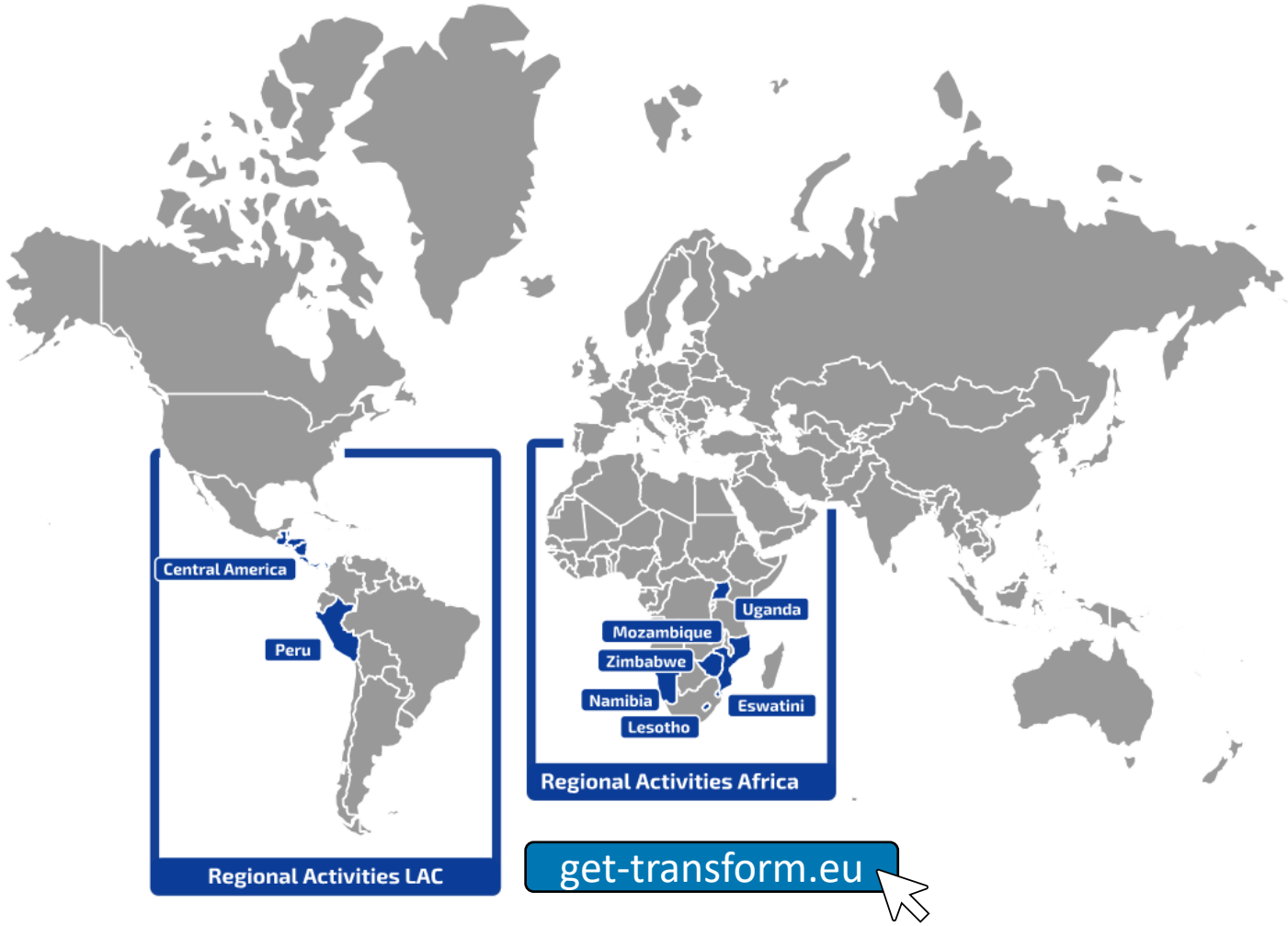
Contents

What is GET.transform?

- Technical assistance (TA) and capacity building for the **public sector** to establish conducive policy and investment frameworks for the transition of the energy sector
- Hub of expertise with **> 50 renowned (inter)national energy experts**
- Implementation through **regional** and **country windows** with expert staff on the ground incl. secondments
- **Scaling across countries** through collaboration with regional institutions and other TA initiatives



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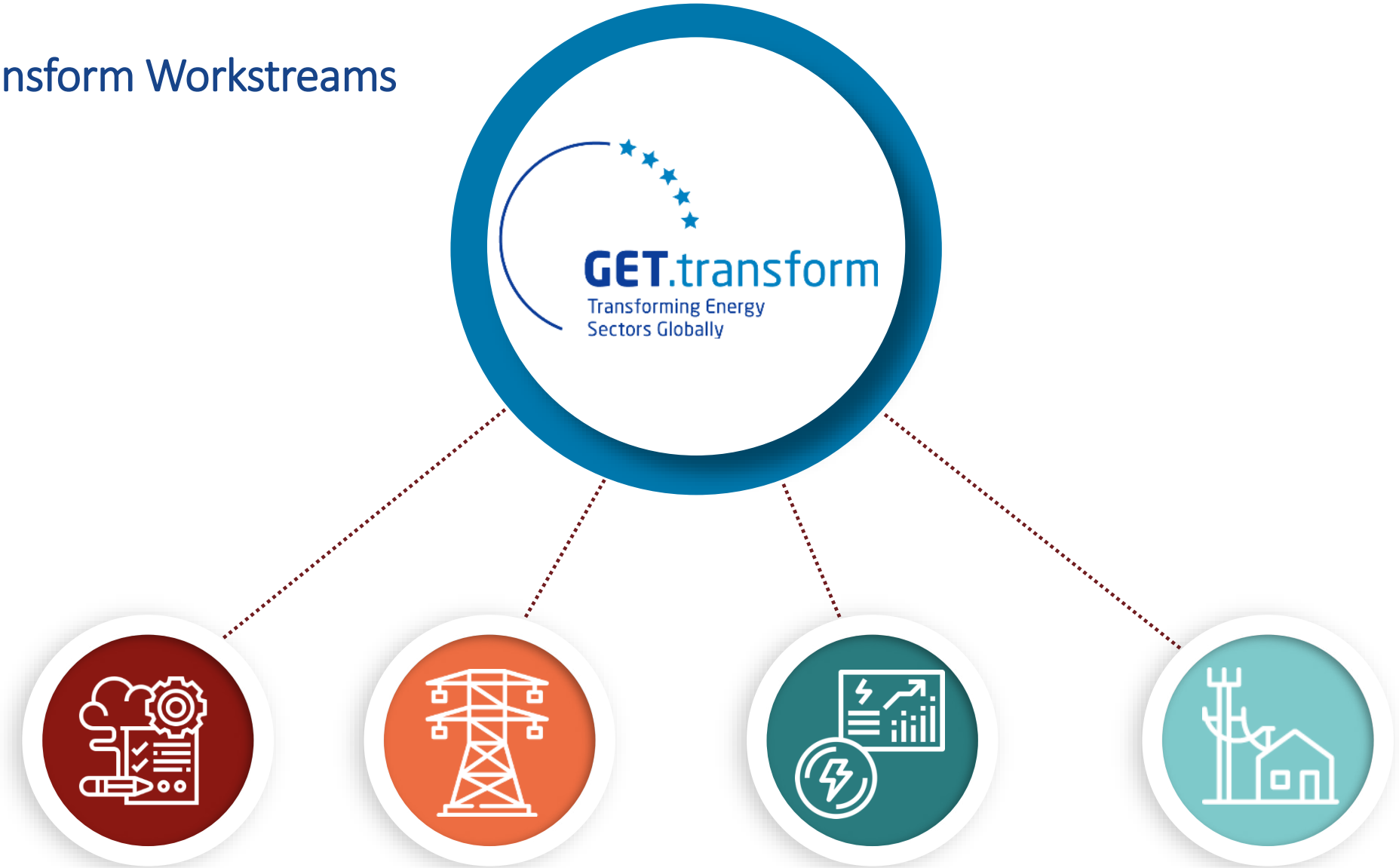
GET.transform Workstreams



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Relevance of RE Grid Integration

Successfully integrating renewable energy into the grid requires innovative technologies, **sound policies**, and **robust infrastructure**.
- *Fatih Birol, IEA*

The **flexibility** of renewable energy sources, coupled with advancements in **grid management technologies**, enables **reliable** and **dispatchable power generation**, supporting **grid stability and resilience**. - *IEA*

Grid integration challenges can be overcome through **comprehensive planning**, **supportive policies**, and **international collaboration**.
- *IRENA*

The integration of renewable energy with **energy storage systems** is a cost-competitive option that can enhance the **flexibility** of the grid while providing several benefits, including dispatchability, firm supply, and **ancillary services**. This has the potential to **reduce dependency** on fuel-based thermal generation, … – *World Bank*

Effective grid integration is crucial for maximizing the benefits of renewable energy, including **cost reductions**, **energy security**, and **environmental sustainability**. - *IRENA*

Outline

Why is RE Grid Integration important for a sustainable Energy Transition?

What are some activity highlights of GET.transform so far?

What are some key lessons around RE Grid Integration?

What are the main components of RE Grid Integration and GET.transform's support approach?

What can GET.transform offer in support of RE Grid Integration?

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Why is RE Grid Integration important for a Sustainable Energy Transformation?

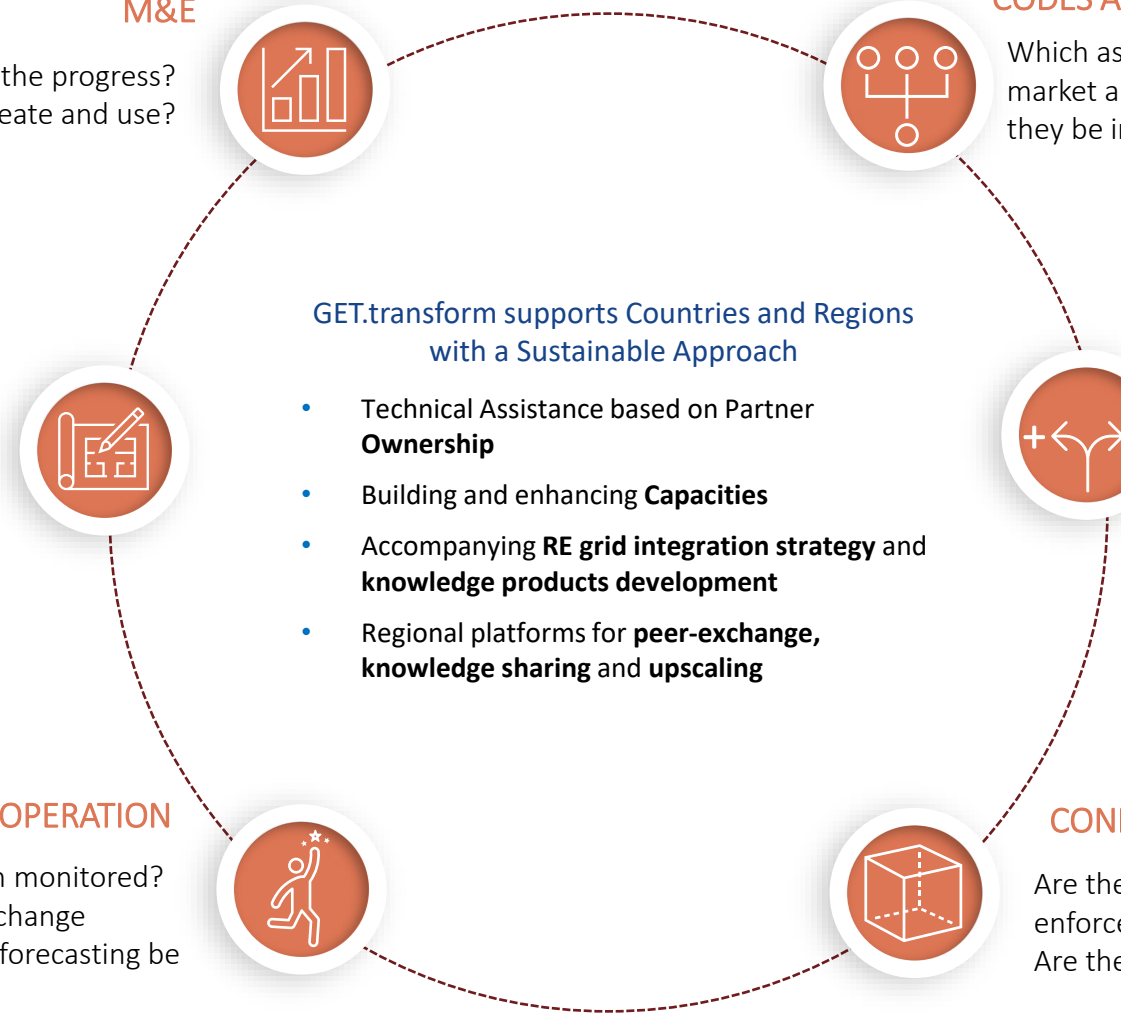
KEY ASPECTS TO CONSIDER:

- Power system reliability, stability and resilience
- Geopolitical security of supply and import dependence
- Accessibility
- Affordability

BENEFITS OF VRES GRID INTEGRATION:

- Enhance **energy security** and **diversification**
- Improve **cost effectiveness** of electricity generation
- Increase **system sustainability** and **reduce carbon emissions**
- Foster **economic development** and **job creation**
- **Reduce dependance** on fossil sources

Prominent Components of RE Grid Integration



M&E

How to effectively track the progress? Which indicators to create and use?

CODES AND STANDARDS

Which aspects do the current connection, market and operation codes cover? How could they be improved?

PLANNING

Are grid hosting capacity information available? Is the grid adequacy assessed? Is there enough flexibility to support vRES[1] grid integration? Are there existing TSO[2] - DSO[3] planning exchange platform?

CONNECTION

Are there compliance and validation checks to enforce grid connection codes?
Are the roles of the different actors clearly defined?

OPERATION

How is real time operation monitored? Are there data storage/exchange platforms? How can vRES forecasting be improved?

INNOVATION

What are the existing programs about smart grid management and operation? How is sector coupling envisaged?

GET.transform supports Countries and Regions with a Sustainable Approach

- Technical Assistance based on Partner **Ownership**
- Building and enhancing **Capacities**
- Accompanying **RE grid integration strategy** and **knowledge products development**
- Regional platforms for **peer-exchange, knowledge sharing** and **upscaling**

1: variable Renewable Energy Sources 2: Transmission System Operator 3: Distribution System Operator

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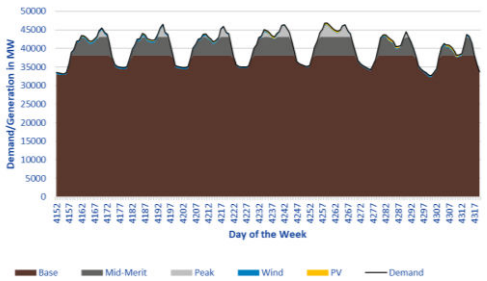
5-Phase Model: Establishing an Eco-System for System Operators

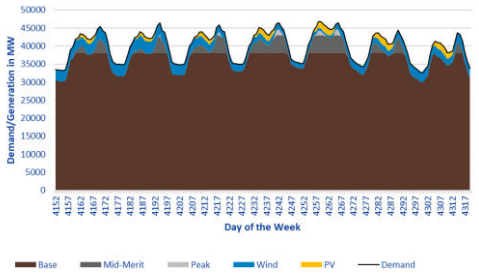
Operating and planning power systems with large shares of variable renewable energy sources

Phase 1:
First vRE installations



Develop grid codes and compliance procedures

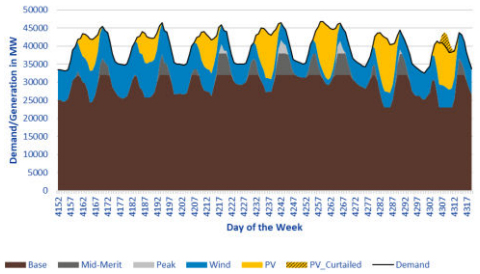
Phase 2:
vRE a niche market



Execute grid studies at local and regional levels

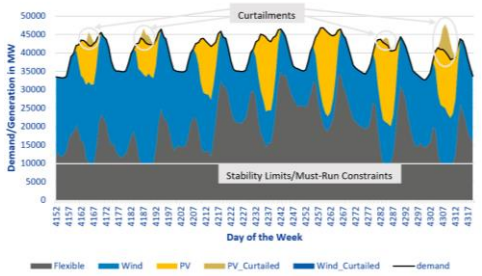
Review operational procedures and discuss **vRE forecasting**

Phase 3:
vRE an important source of electricity



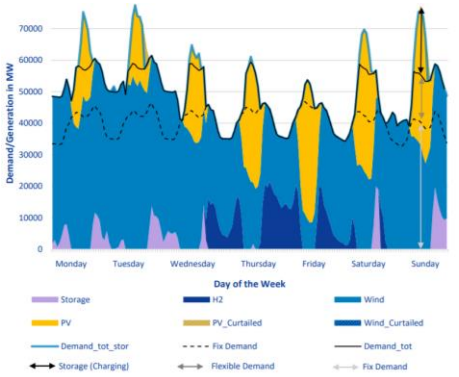
Analyse and identify **flexibility requirements** and resources

Phase 4:
vRE the dominant source of electricity



Analyse and identify **stability requirements** and resources

Phase 5:
100% renewables



Restructure market

Develop short, mid and long-term **storage technologies**

Explore **sector coupling**/synthetic fuels to make use of vRE excess generation

Model Source: MPE/IEA

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RE Grid Integration – Advisory Services

Renewable Energy Grid Integration

Overarching Activities

- Capacity Building
- Knowledge Products
- Stakeholder Engagement
- Peer-to-Peer Exchanges

Key Topics

Grid Codes	Transmission System Planning & Operation	Distribution System Planning & Operation
Grid Code Development and Review	Grid Impact Studies/ Methodology Development	Grid Impact Studies/ Methodology Development
Market Rules and Grid Application Procedures	Grid Stability and Flexibility Needs Studies (incl. battery storage, hydrogen)	Hosting Capacity studies
Grid Code Compliance & Validation	Ancillary Services and Remuneration Schemes	Distributed Generation Management
Grid Interconnection Guidelines	Wind and PV Forecasting Systems	Smart Grid Development

Key Partners

Regulatory Authorities, Transmission System Operators, Distribution System Operators

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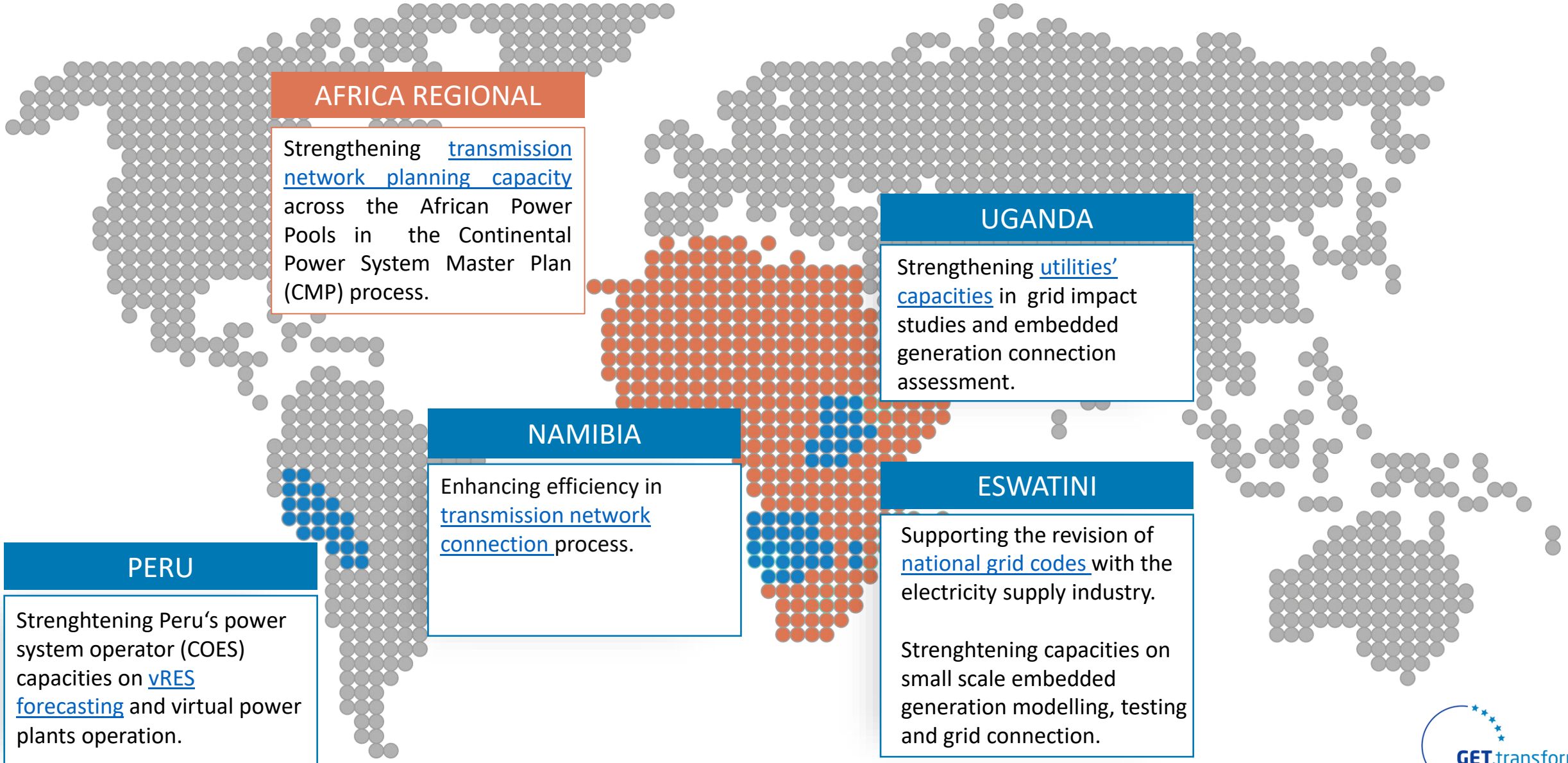
Partnerships and Transformation Experts

GET.transform RE Grid Integration Support Highlights



AFRICA REGIONAL

Strengthening transmission network planning capacity across the African Power Pools in the Continental Power System Master Plan (CMP) process.

UGANDA

Strengthening utilities' capacities in grid impact studies and embedded generation connection assessment.

NAMIBIA

Enhancing efficiency in transmission network connection process.

ESWATINI

Supporting the revision of national grid codes with the electricity supply industry.

Strenghtening capacities on small scale embedded generation modelling, testing and grid connection.

PERU

Strenghtening Peru's power system operator (COES) capacities on vRES forecasting and virtual power plants operation.

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Deep-Dive into vRES Grid Integration Support in Eswatini: Updating Grid Codes

OBJECTIVE

- Eswatini strengthens its power sector regulatory environment and harmonises its **grid codes** with the South African PowerPool (SAPP) Regional Grid Code.

THE CHALLENGES

- **Ensuring alignment** between different grid codes including the revised Network Code and Renewable Power Plant Code.
- **Identifying key stakeholders** with defined roles and responsibilities to understand expectations and **generate consensus** for **successful implementation**.
- Defining a clear **implementation plan** for the **Distribution Network Code** that corresponds to stakeholders' expectations.

OUR SUPPORT

- Support Eswatini's Ministry of Natural Resources and Energy with **expertise**, **capacity building**, **inputs** and **methodologies** for the enhancement of the National Grid Code.

EXPECTED RESULTS

- Updated set of existing **grid code documents**, newly developed **Distribution Network Code**, **strengthened** grid codes development capacities.

SCALING UP

- Upscaling and sharing best practices through **peer-exchanges** at the regional level in the **Southern African Power Pool.**

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What GET.transform Offers

- Trusted international and regional partner institutions
- Combination of technical expertise, cultural awareness, local knowledge
- Relations to public entities internationally, allowing for facilitation of experience exchange
- Long-term staff on the ground, close relationships to partners
- In consequence, in-depth knowledge on political situation, context, challenges, cooperation between public bodies
- Expertise in organisational development
- Partner-centred process with strong ownership, ensuring sustainability of the support

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Thank You for Your Attention

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