

# Smart Current

## التيار الذكي



*BLACKOUTS ARE NOT JUST AN ANNOYANCE*



# Smart current – Our innovation, our mission

## Our mission

Prevent blackouts by regulating power-flows with quantum-enhanced GNNs and quantum extracted topological features

## Why is our innovation needed?

Current blackouts could be prevented by better power-flow management, up to 60% of the time<sup>1</sup>  
Optimization works, but is too slow and static

## Our stack

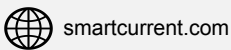
Blackout response and prevention machine learning models



Open-source quantum circuit implementations



Online blackout response dashboard



Regulate power-flows

Graph **neural network**



Quantum enhanced



"Classical features"



Quantum Topological Data Analysis



Electrical grids

# Middle East North Africa is the 2nd highest Geo-economic region in both frequency and duration of power outages

16.45  
Average Blackouts  
per Month  
avg. 4.9 hours

>200\$B  
Yearly  
economic  
loss

SDG affected

strongly

medium

unaffected



# Value Proposition Overview



## Problem – Blackouts

- > 200\$B economic loss in MENA <sup>1</sup>
- Up to 60% risk reduction with better flow-management <sup>2</sup>
- Classical GNNs can help, but not capture all topological features



## Solution – Business value in MENA



Bring the **power of quantum** to the manage energy grids



**Adapt** to the need of our partners



**Collaboration** across MENA for a better future

**Market:** Yearly investments in power **80+B!** <sup>3</sup>



**Client proposition:**

Efficiency improvements and risk minimization for grid operators



No direct **competitors**, indirect competitors can be partners



## 6 months (training & partnership)

Phase 1

Cost~500,000 <sup>1</sup>

## 3+ years (Deployment & Research)

Phase 2

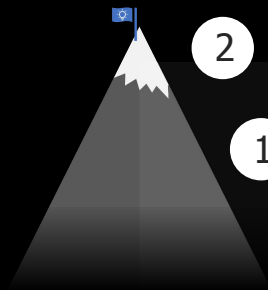
Cost~20,000,000 <sup>2</sup>

<sup>1</sup> [De Gruyter](#) <sup>2</sup> [JEPE](#) <sup>3</sup> Frost & Sullivan

# Business | How our innovative solution creates value



## Bring the **power of quantum** to the manage energy grids



2

**Leverage the power of quantum computers** as hardware matures

- Topological data analysis
- Quantum enhanced neural networks

1

**Value now** – Implement our classical graph neural network and further develop our quantum enhancements in cooperation with industry partners



**Adapt to the need of our partners**

Our approach based on graph neural networks and close collaboration with grid-managers allow tailored use-cases beyond grid-management: **Grid planning and maintenance, efficiency optimization, stability evaluation ...**



## **Collaboration across MENA for a better future**

Collaborate across MENA with governments and non-government entities. Establish local quantum competences.

## Improve and save the lives of ordinary people



## Competitors

| Competitor            | Description  |
|-----------------------|--|
| <b>Voltus™</b>        | <ul style="list-style-type: none"><li>• Focus on energy distribution</li><li>• <b>Technology platform</b></li><li>• Focus on profit maximization</li></ul> |
| <b>SPINE LLC</b>      | <ul style="list-style-type: none"><li>• <b>Consultancy</b></li><li>• Broad support beyond grid management</li></ul>  |
| <i>Grid-operators</i> | <ul style="list-style-type: none"><li>• Could implement inhouse management software</li></ul>  |

While potential competitors exist ...

- None provide our quantum expertise
- Use optimization, with slow turnaround
- Few of them in the MENA region

Different business focus and all of them could be **business partners!**

# Roadmap



## 6 months



Training

Validation on DR POWER dataset (over 1TB)

Cost ~20,000إ.د



Infrastructure

AWS Sagemaker API

IBM Quantum Cost ~150,000إ.د



Business

Create partnership with one key MENA government

## 3+ years



Training

Addition of government-specific databases

Cost ~120,000إ.د



Infrastructure

Govt. On-premises, IBM Quantum

Cost ~150,000إ.د



Research

Create partnership with one key MENA government



Personnel

Yearly Cost ~600,000إ.د





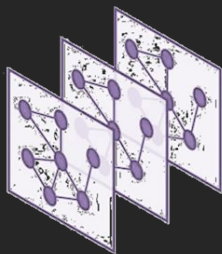
# How we built it

Prevent blackouts by regulating power-flows with quantum-enhanced GNNs and quantum extracted topological features

**4** Regulate power-flows

**3**

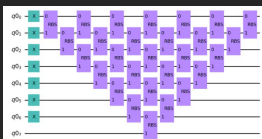
Graph **neural network**



Graph network



Quantum enhanced

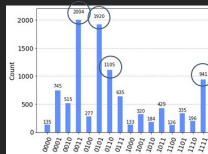


Features

|   | 1   | 2 | 3  | 4  | 5   | 6  |
|---|-----|---|----|----|-----|----|
| 1 | 0   | 1 | 12 | 0  | 0   | 0  |
| 2 | -1  | 0 | 0  | -1 | 0   | 0  |
| 3 | -12 | 0 | 0  | 8  | 0   | 0  |
| 4 | 0   | 1 | -8 | 0  | 3   | 0  |
| 5 | 0   | 0 | 0  | -3 | 0   | 19 |
| 6 | 0   | 0 | 0  | 0  | -19 | 0  |

Adjacency Matrix

Quantum



**1**



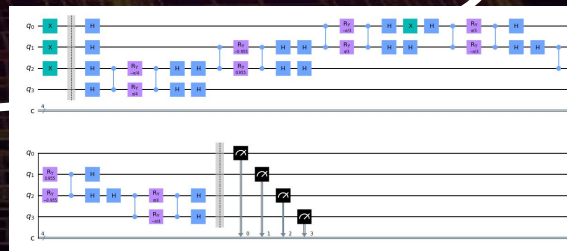
**Electrical grids** naturally map to an undirected graph

**2**

**Feature Extraction**

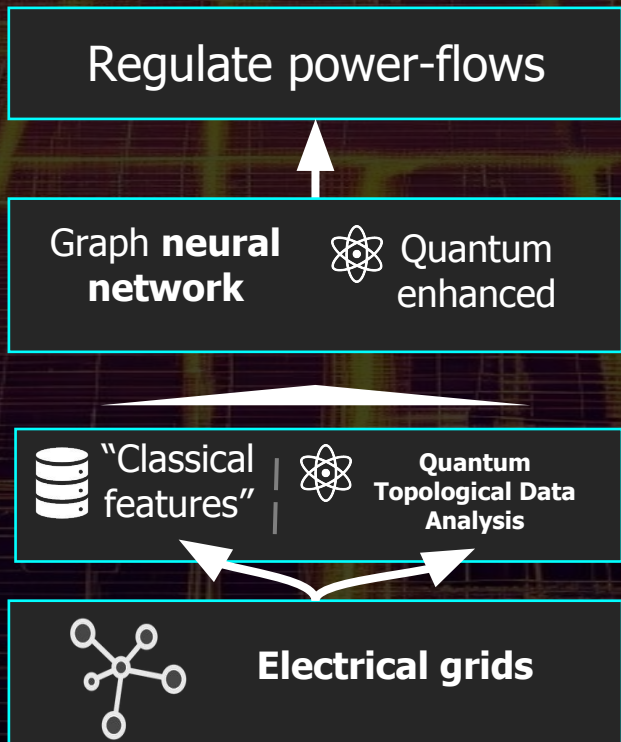
“Classical features”

“Quantum Topological Data Analysis”





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