iDT4GDC

More sustainable data centres via artificial intelligence and digital twins

By combining artificial intelligence (AI) and digital twins (DT) in an open-source platform, the ITEA project iDT4GDC (Intelligent Digital Twin Platform for Climate-Neutral Data Centres) will improve data centre power consumption and carbon emissions worldwide.

Addressing the challenge

Data centres are essential for Artificial Intelligence, Industry 4.0 and the digital economy in general. However, they suffer from high power consumption and low energy efficiency, making them responsible for 0.6% of global CO_2 emissions. Despite sustainability concerns, their energy consumption continues to rise rapidly. AI can be employed to answer to these issues but faces practical challenges concerning data scarcity. Additionally, data centres are mission-critical infrastructures for business continuity, so operators tend to be extremely risk-averse about introducing new technologies.

Proposed solutions

iDT4GDC proposes a solution: a novel AI platform to digitalise, optimise and automate data centre operations and management towards greater sustainability. Using the EU Climate Neutral Data Centre Pact as a reference model, this will be a scalable, retrofittable and open-source platform that can service a range of data centre-specific use-cases that optimise five pillars: energy, carbon, water, circular economy and governance. The novelty of the solution lies in three aspects. First, the platform will integrate with DT infrastructure, including sophisticated system for modelling a data centre's underlying physical system and affiliated circular energy system. Second, custom AI models will be introduced that are unique to data centre use-cases. Third, robotic process automation and low-code techniques will be employed for

easy adoption. With a multi-country consortium, iDT4GDC partners can address both high-performance and general-level data centre scenarios, aiming for full deployment by 2030.

↑ Main activities in the iDT4GDC project

Projected results and impact

iDT4GDC offers significant advantages over existing solutions: DTs can synthesise diverse training data to address data scarcity and can validate AI insights, helping mitigate operator aversion by avoiding direct system deployment risks. AI can also leverage real-time data to uncover hidden patterns, enabling data centres to anticipate changes, optimise performance and accurately improve their efficiency. The project objectives

are therefore to improve data centre power usage effectiveness – the ratio of energy consumption by computing equipment versus cooling – to 1.4 or below and to achieve a clean energy adoption rate of 75% for data centres worldwide by 2030. Proof-of-concepts will take place in Türkiye and the United Kingdom to showcase the technical solutions in different climates. Such proofs-of-concept will pave the way for
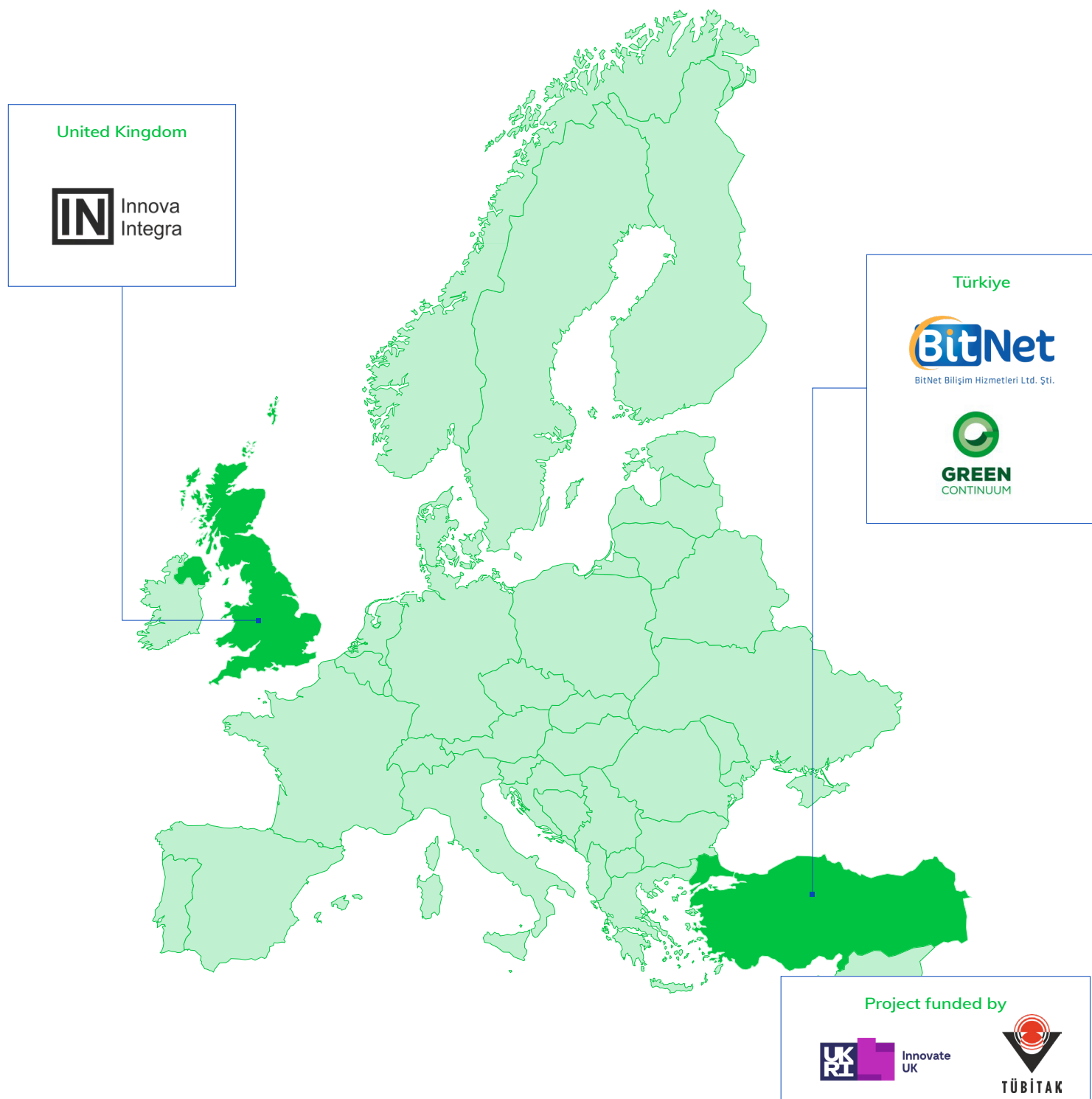
further commercialisation, allowing the consortium to expand in the carbon-neutral data centre market predicted to be worth USD 109 billion in 2030. In doing so, iDT4GDC will target not just data centre operators but also financial investors and policymakers, aiming for the comprehensive coverage needed to make a significant, long-lasting impact.

Project partners

United Kingdom

IN Innova Integra

Türkiye

BitNet
BitNet Bilişim Hizmetleri Ltd. Şti.

GREEN CONTINUUM

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TÜBİTAK

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