



BeGREEN: Project Scope and Objectives

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BeGREEN:

Beyond 5G Artificial Intelligence Assisted Energy Efficient Open Radio Access Network

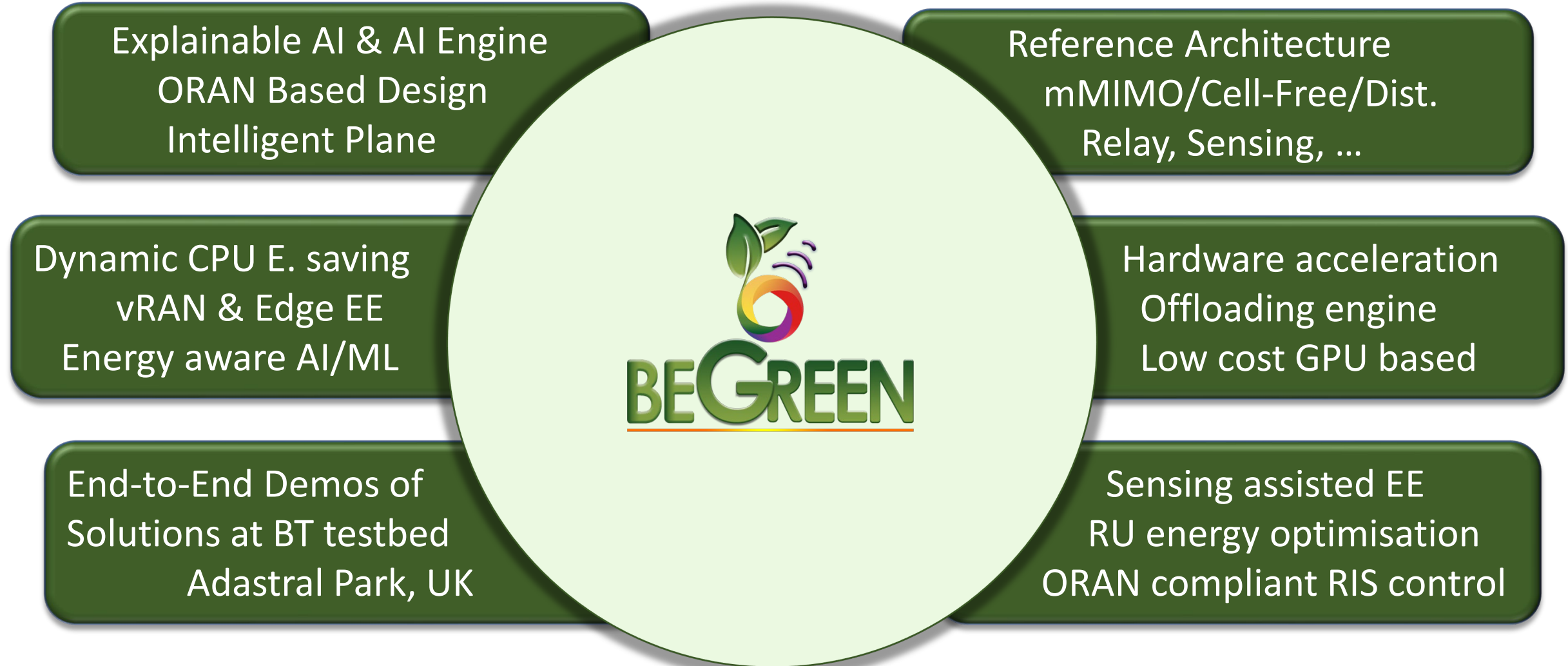
- **Project website:** www.sns-begreen.com
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- SNS-JU 2022 Stream A 01-01 call

- Partners:



BeGREEN Scope & Objectives



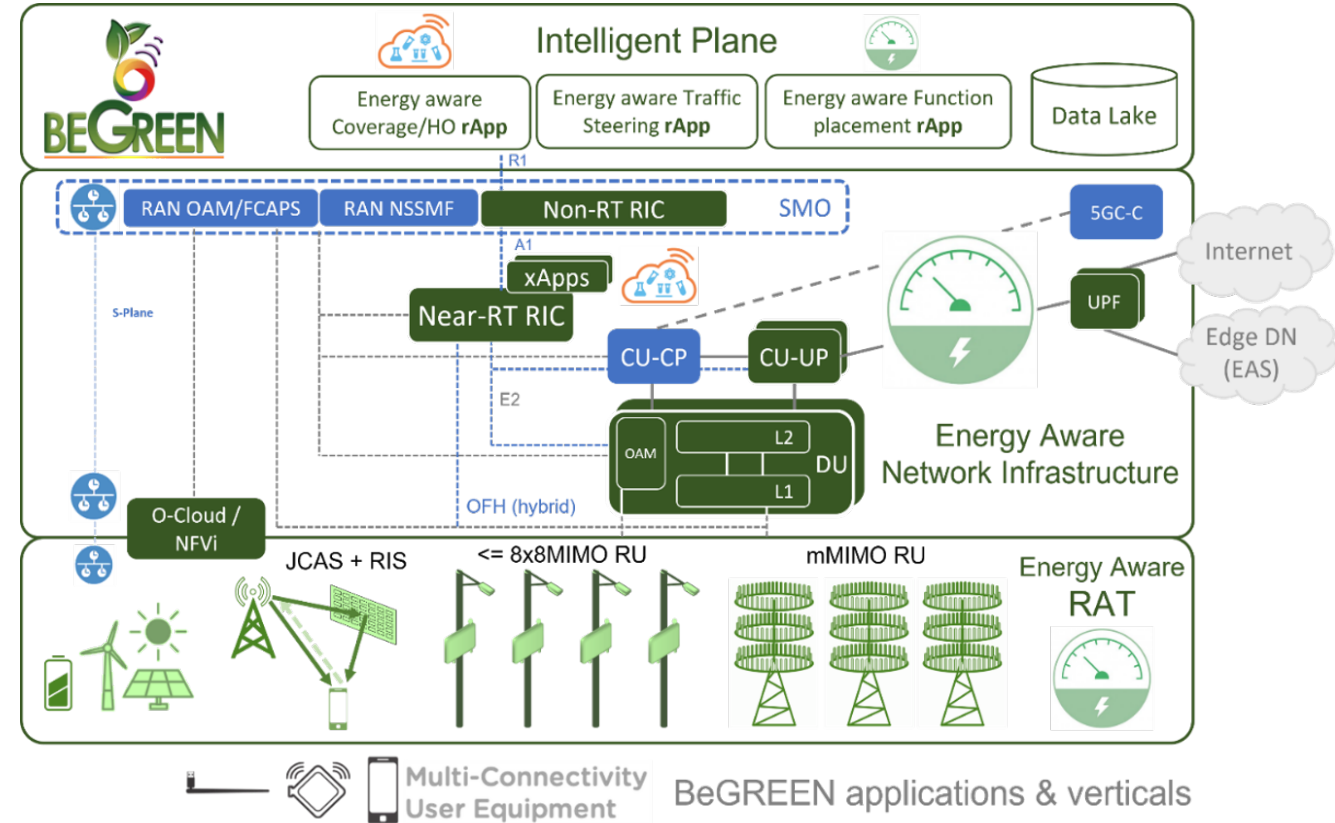
BeGREEN Scope & Objectives



BeGREEN takes a holistic view to provide evolving radio networks that not only accommodate increasing traffic and service levels but also consider power consumption as a factor.

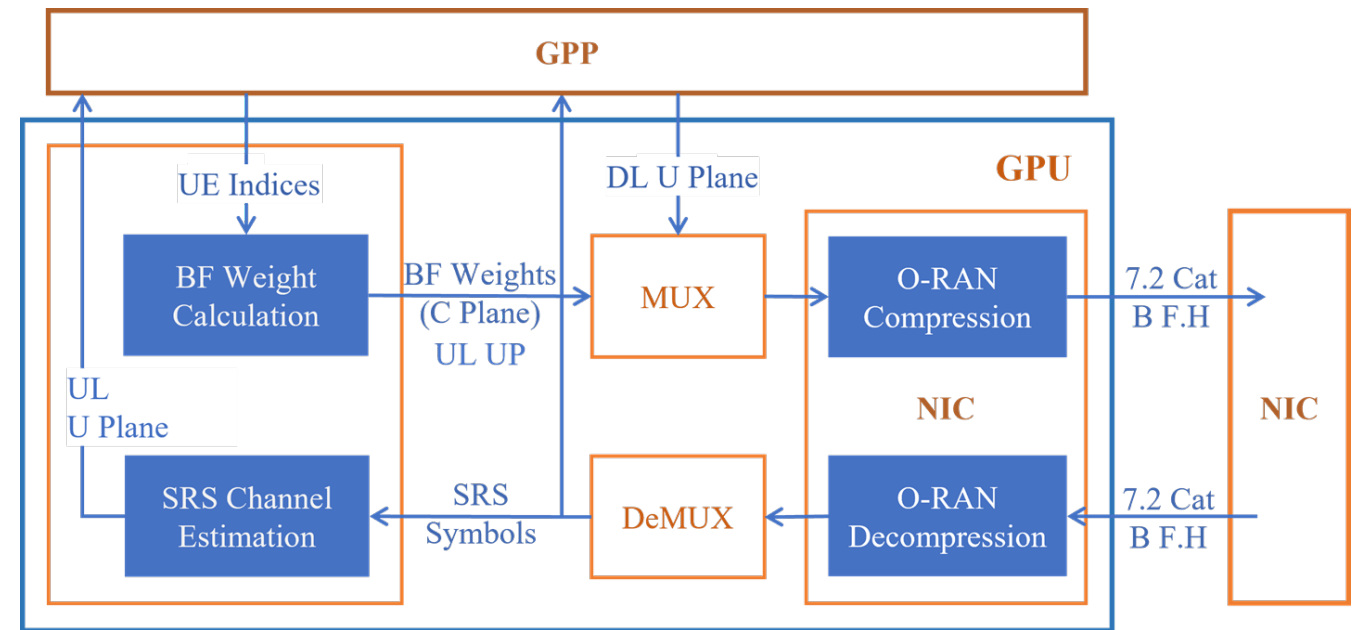
Envisioned Architecture

- ❑ mMIMO and Cell-Free distributed MIMO architecture focusing on the energy utilisation
- ❑ Quantify the combined energy and spectral efficiency impact taking into account practical constraints and elements:
 - Distributed versus centralised
 - Relays (e.g., RIS)
 - Sensing assisted link establishment
 - DU/CU processing load
 - RU power efficiency



Hardware Acceleration

- ❑ Hardware acceleration is a solution for compute-heavy physical layer processing in B5G to keep up with the processing and energy requirements for wideband mMIMO deployments
- ❑ To develop an innovative offloading engine, for energy efficient offloading of mMIMO related processing
- ❑ Proposing a new architecture based on low-cost, off-the-shelf, GPU embedded into the DU
- ❑ Offloaded into the GPU:
 - the beamforming weights related calculation,
 - channel estimation,
 - LDPC and sphere decoding.



- [illegible]

ORAN based 'Intelligent Plane' & Explainable AI

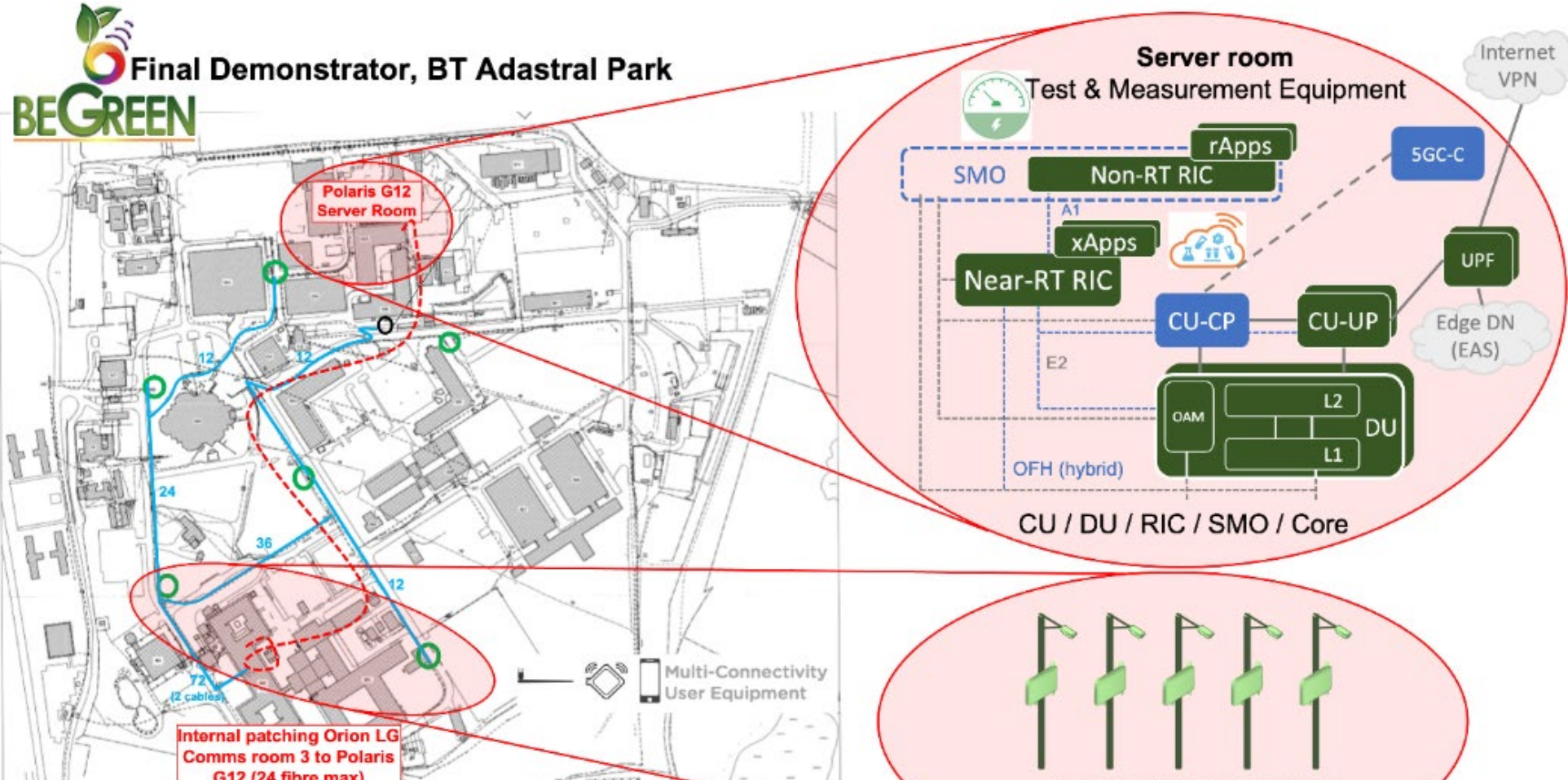


- ❑ Investigate how the O-RAN architecture can be extended to better address energy optimization
- ❑ BeGREEN proposes an AI-assisted energy-aware “Intelligent Plane”, as an additional plane along with user plane and data plane, that allows the data, model, and inference to be seamlessly exchanged between network functions
- ❑ Extend O-RAN interfaces in order to enhance the exposure of energy related metrics and control services to the envisioned energy-aware rAPPs and xAPPs
- ❑ Implement an AI Engine consisted of an execution environment that can host AI/ML models to manage their lifecycle and access to data, where training and inference is envisioned to be performed by AI-driven rAPPs and xAPPs
- ❑ Design of an AI architecture, aligned with the initial specification of O-RAN regarding AI/ML support, to support **explainable** and interpretable **AI** algorithms to accurately pinpoint energy influencing factors of the network functions beyond traffic to calculate energy efficiency rating and an associated energy score

Energy Aware AI/ML and Edge

- ❑ Study the impact of federated learning approaches on the energy efficiency of AI/ML algorithms and its lifecycle management
- ❑ Energy efficiency-aware training mechanisms for on-boarding the proposed AI/ML solutions
- ❑ Dynamical selection of the CPU power saving modes (e.g., C-states) or orchestrate the number of VNF instances to minimize energy consumption according to the utilization patterns of the network and without affecting vRAN and UPF performance to improve energy efficiency at UPF, the CU-UP or the DU
- ❑ Implement mechanisms to jointly control vRAN and Edge resources to minimize the overall energy cost while meeting AI service performance targets
- ❑ Integration with ORAN of innovative technologies like RIS, and relay-enhanced RAN (e.g., IAB) on energy efficiency to impact energy consumption at the edge AI service by enabling intelligent control by means of AI-driven rAPPs or xAPPs

BeGREEN E2E Demonstrations



@ Adastral Park, UK (BT)

BeGREEN use case scenarios to simulate realistic urban scenarios for the power management (e.g., reducing RU PA Tx power or reducing MIMO order) of multiple co-operating RANs and for lower speed mobility scenarios.



Thank You!

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