

# GÉANT and GreenStar Network – powering networks through renewable energy

## Harnessing green power to lower ICT energy consumption

Today's global economy relies on information and communication technologies (ICT), linked by communications networks to operate. But with the vast majority of the electricity powering these networks generated from fossil fuels and the rapid expansion in ICT use, greenhouse gas emissions need to be addressed.

When it comes to ICT networking one of the major uses of energy is in datacentres and network nodes, so powering these with renewable energy sources would therefore dramatically reduce emissions. Consequently the GreenStar Network (GSN) project was created in 2010 to prove the viability of using green energy sources, initially in research networking, that can reduce ICT's carbon footprint.

### International green networking

Funded by Canadian National Research and Education Network (NREN) CANARIE, the GSN works by creating a network of international nodes within datacentres, powered solely by renewable energy. This means that ICT applications and traffic running across this network do not rely on fossil fuels while still providing the highest levels of performance.

Originally created as a transatlantic project, in October 2011 the European GSN elements were reorganised into an independent, self-contained network of nodes, linked through the pan-European GÉANT network to the hub in Dublin. There are currently four nodes in the European network, all powered by renewable energy sources. Two of these are in Ireland, run by Irish NREN HEAnet, using electricity generated by solar and wind power; one in Iceland, belonging to Nordic Regional R&E Network NORDUnet, runs on energy created from a combination of geothermal and hydropower sources; while the fourth in Spain, operated by i2CAT and connected by Spanish NREN RedIRIS, also uses solar power.



### The Challenge

Demonstrate the potential of renewable energy to power international networks and reduce carbon emissions.

### The Solution

The GreenStar Network uses the GÉANT network's high speed Bandwidth on Demand links to create an interactive green network, which includes advanced middleware to maximise how renewable-powered resources are used.

### Key Benefits

Through a flexible, virtualised international network running between three countries, GreenStar provides a potential future model for the greener operation of commercial networks without impacting performance.





## Network and Bandwidth on Demand

All of these nodes are connected through GÉANT, using a mix of GÉANT IP, GÉANT Plus dedicated point to point circuits as well as the new Bandwidth on Demand (BoD) multi-domain connectivity service. BoD enables the fast, automatic creation of dedicated high speed links between different network points within minutes, providing guaranteed bandwidth for the GSN. This is vital to being able to transmit monitoring and control data in real-time, allowing the GSN to provide a guaranteed service to users of the network .

## The future for green networking

The current Mantychore Project integration activity with the project is scheduled to run until 2013 but is already proving the underlying concepts. It is demonstrating both that green energy can be used to power datacentres and that network activity can be migrated sufficiently quickly and seamlessly so that green energy use is maximised, thereby reducing the overall carbon footprint. While the GSN is a pilot project involving research networks, it aims to serve as a test-bed for new technology and techniques that can eventually be deployed across commercial networks to deliver green benefits for all.

## Monitoring and virtualisation

Many renewable power sources, such as solar and wind are less predictable than traditional fossil fuel energy. Therefore matching available capacity with current demand to make best use of green energy is the key aims of the GSN and this involves sophisticated middleware (from the open source Mantychore project) for monitoring, control and visualisation of activities. This makes sure that the maximum amount of processing is carried out within 'green' nodes through a Cloud-based model that monitors usage and migrates workloads between nodes in line with demand and available green energy supplies.



The GreenStar Network aims to demonstrate that it is possible to reduce the carbon footprint of ICT without decreasing performance. The successful deployment of a GSN hub in Europe shows how international research collaboration can reduce ICT greenhouse gas emissions by using renewable energy sources. None of this would be possible without flexible, high performance international research networks such as GÉANT that provide the real time monitoring and control to deliver a virtualised green architecture. The techniques and technology within the GSN project have far-reaching potential to reduce emissions, and GÉANT's guaranteed performance is central to project success.

*Mohamed Cheriet, project instigator, GreenStar Network.*

## Bandwidth on Demand

Bandwidth on Demand (BoD) is the GÉANT project's new multi-domain connectivity service - the world's first and only multi domain service for automatic bandwidth provisioning. It enables National Research and Education Networks to automatically establish a point to point circuit in minutes. This provides a flexible, user-focused service making it simple to deliver the bandwidth users need, when they need it. The service will be offered at national level to academic, research and other users, by their NRENs across the GÉANT Service Area. Currently undergoing operational testing with six NRENs, the GÉANT BoD service is an integral part of the GreenStar Network Project.

## connect • communicate • collaborate

The world is criss-crossed with high-capacity data communications networks, connecting and serving research and academic institutions across the globe. The most advanced of these is GÉANT, which together with Europe's national research and education networks (NRENs) connects 40 million users in over 8,000 institutions across Europe.

GÉANT provides the GreenStar Network with the guaranteed high capacity, flexible connections needed to ensure maximum usage of resources powered by green energy. Controlling and sharing network resources in a virtualised environment requires sophisticated monitoring tools and GÉANT's Bandwidth on Demand service provides the perfect infrastructure to deliver guaranteed performance to users.

### For more information:

GÉANT: [www.geant.net](http://www.geant.net)

GÉANT Bandwidth on Demand: <http://bod.geant.net>

GreenStar: [www.greenstarnetwork.com](http://www.greenstarnetwork.com)

HEAnet: [www.heanet.ie](http://www.heanet.ie)

NORDUnet: [www.nordu.net](http://www.nordu.net)

RedIRIS: [www.rediris.es](http://www.rediris.es)

