

# 5GrEEEn

## Green Mobile Networks

Reducing energy consumption for mobile access networks such as base stations and mobile user terminals for sustainable and affordable mobile internet growth.



### Co-operation with EIT ICT Labs

Towards Green 5G Mobile Networks activity in Future Networking Solutions. Thanks to the complementing partner roles, Telecom Italia, Ericsson, KTH and AALTO Universities, EIT ICT Labs activity allowed to develop green mobile network solutions by applying technology transfer from academia to established companies such as a telco vendor. Involvement of the mobile operator in the experimentation process allowed testing some of the green network solutions using real network traffic data from the base stations. This collaboration would not be possible without this EIT ICT Labs activity.

### Network power consumption critical in cities

Power consumption is a crucial issue that is going to become even more important as the number of cells increases through densification. Although the smaller cells involved in 5G will result in lower power requirement, there will be both small and larger cells, leading to increasing interference. Additionally, the larger number of cells will make the real time tuning of power distribution even harder. The core innovation is to adapt the bandwidth required for the traffic and in this way reducing power consumption. The innovation is based on studies of power consumptions and on a simulation tool that can compute potential savings in power consumptions. The simulation package is used in education and is under consideration for extension and potential product as a simulation tool.

### 90% energy savings with 5GrEEEn compared to today

It has been shown that it is possible to reduce the energy consumption up to 90% compared to 2010 reference. Up to now, the existing mobile networks cannot adapt to the user needs and traffic fluctuations during the day resulting in waste of energy especially during low traffic hours.



### Societal Impact

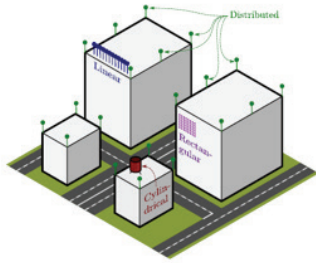
Mobile internet has become a part of everyday life connecting everything and everyone that can be connected asking for more capacity in mobile infrastructures deployed in the cities. Green Mobile Networks will allow network operators to boost their capacity without any increase in the cost to provide sustainable and affordable mobile connectivity for

all. Decreasing energy consumption and hence the CO2 emissions result in cost reduction since energy is an essential part of the overall cost.

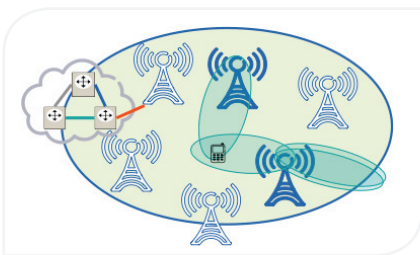
### Key Facts

Some of the green mobile network solutions such as infrastructure deployment and traffic adaptive dynamic network operation can be already used in near future thanks

to the standardization contributions during past years in 5GrEEEn activity. We have studied green mobile infrastructure design and its economic feasibility using cell micro sleep feature in our activity during 2013 and 2014 which then became a product in September 2014 as a part of a large software release in Ericsson called 15A. Please see the news release [www.ericsson.com/news/1857801](http://www.ericsson.com/news/1857801).



**Green Mobile Networks will allow network operators to boost their capacity without any increase in the cost to provide sustainable and affordable mobile connectivity for all.**



There are a lot of papers and also even an educational tool in Royal Institute of Technology (KTH) showing how energy can be saved. Various WSs have been organized in different Co-location Centres. For 5G Systems we are in a very early stage for commercialisation such as 5G radio interfaces. However some of the energy optimized network deployment and operations solutions we have developed during 5GrEEen can be already used in near future thanks to the standardisation contributions in 5GrEEen. Several achievements of 5GrEEen Innovation can be divided into three:

1. We have studied deployment optimization and economic feasibility of base station sleep feature in 5GrEEen during 2013 and 2014 which allows cells to switch to a low energy mode when there is no transmission even in a millisecond time frame. This study catalyzed the release of its cell micro sleep feature by Ericsson as a part of a product in September 2014 as a software release. Similar to this, the 5GrEEen solutions will be potentially commercialized through large telco vendors since they should be integrated to existing network equipment and infrastructures.
2. "Green mobile terminal" innovation in 5GrEEen, the "energy-efficient proxy" allows mobile user terminals save energy. This has various commercialization options. The benefits are either decreased energy consumption (up to 80%) and lower content delivery time (up to 50% lower) for web content. The technology can be deployed by an operator, a third-party solution provider or content owner. The commercialization could be performed by a larger company, like a network vendor or software company, as a new product. Aalto Center for Entrepreneurship (ACE) is currently helping the researcher on commercialization work.
3. "Green Mobile Cloud" innovation showcased via the "Cloud RAN demonstrator" that it is possible to drive the cost of operating the cellular infrastructure down and allow the system to adapt to the variable mobile service requirements. The cost reduction will come from two factors: 1) Simplified software development compared to embedded system design. 2) Economy of scale as standard Cloud technologies can be utilized. Combined with other advancements, C-RAN can potentially open up new market for cellular infrastructure as a service for small local operators (rural broadband), building and facility owners, factories and utility companies and help improving the sector productivity and quality of life.

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