



Mobile Energy Efficiency *Explained*

March 2012

Mobile Energy Efficiency

The GSMA's Mobile Energy Efficiency (MEE) offers two services to MNOs: MEE Benchmarking and MEE Optimisation

- Energy efficiency is a strategic priority for mobile network operators globally. As mobile use expands, so does the demand for energy, particularly by the network infrastructure
- The GSMA's **MEE Benchmarking** service is a management tool that helps MNOs measure and monitor the relative efficiency of their radio access networks, identifying under-performing networks and quantifying the potential efficiency gains available, typically around 10% to 25% across a MNO's portfolio
- The GSMA's **MEE Optimisation** (MEEO) is a follow-on service that develops action plans for MNOs to reduce network energy costs and greenhouse gas emissions in under-performing networks. The service is run in partnership with a third party, e.g. a vendor, and it identifies individual energy saving measures and assesses the business case

MEE Benchmarking was launched in November 2010. Now it has 35 MNOs participating, which is over half of global mobile subscribers

Objectives

Status

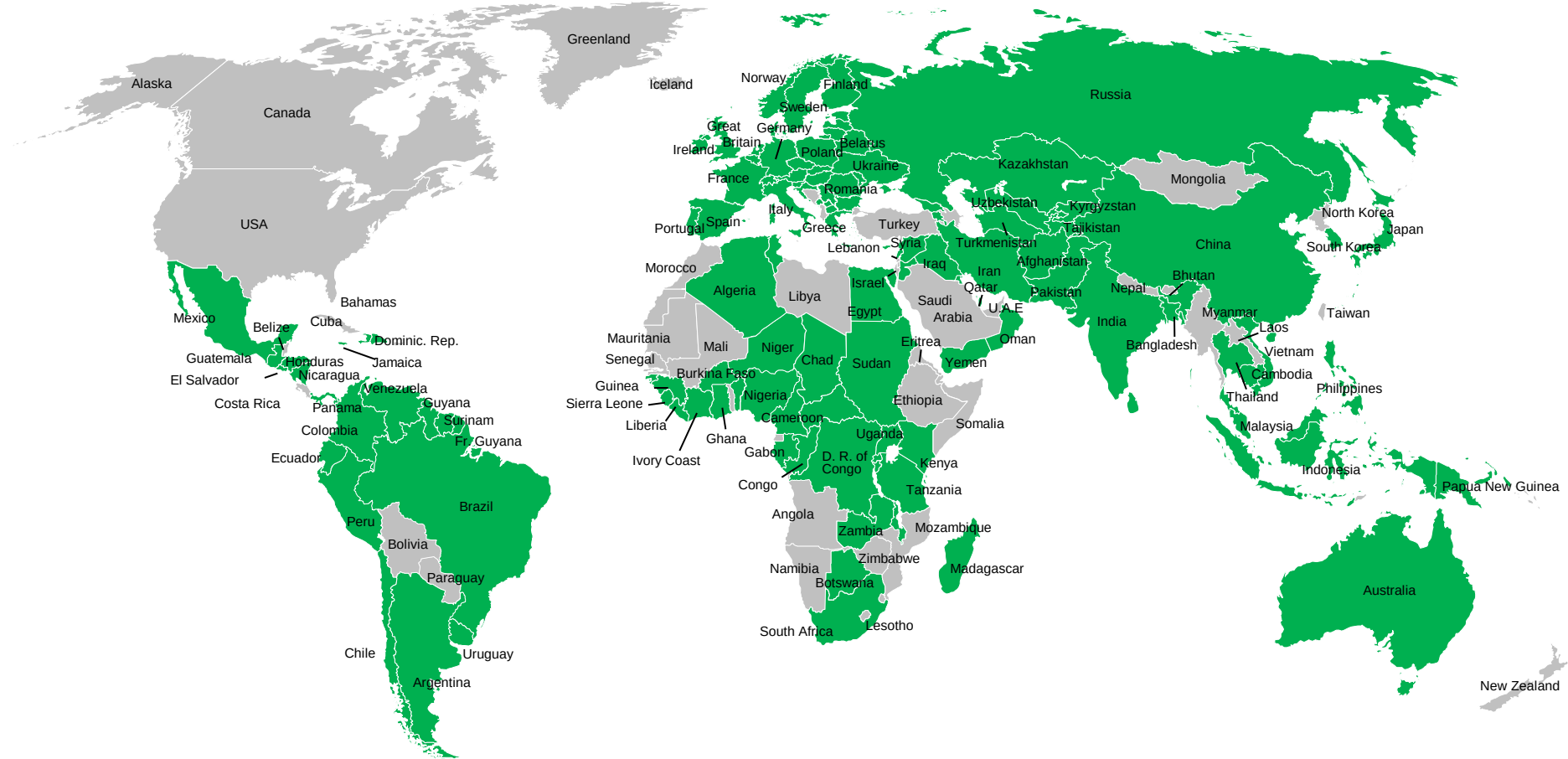
- | | |
|---|----------|
| ■ Launch MEE Benchmarking for MNOs to: | ✓ (2010) |
| – compare multiple networks on a like-for-like basis and against standard energy KPIs | |
| – help reduce energy consumption, costs and emissions | |
| ■ Incorporate in new ITU SG5 energy and carbon methodologies | ✓ (2011) |
| ■ Increase participation and develop MEE Benchmarking so that it becomes increasingly useful to operators | Ongoing |
| ■ Coordinate with other industry and regulatory stakeholders so that the benchmarking methodology is adopted as a global standard by the industry | Ongoing |

Currently 35 MNO participants, accounting for more than 200 networks across 145 countries and over 50% of global mobile subscribers

Selected participants in MEE



MEE participants are located in 145 countries



 Participant in MEE

Six key benefits of MEE Benchmarking for MNOs

1. A detailed analysis of relative network performance against a large dataset:
potential energy cost and carbon emissions savings of 10% to 25% per annum are typical for underperforming networks
2. Unique “normalisation” analysis enables like-for-like comparison
3. Suggested high level insights to improve efficiency
4. Annual participation to track improvements over time and quantify the impact of cost reduction initiatives
5. Demonstration of positive action on energy and emissions reduction to stakeholders
6. Confidentiality: external comparisons are made anonymously

The MEE Benchmarking methodology compares networks against four KPIs using a unique normalisation methodology

- Networks are compared against four Key Performance Indicators (KPIs)
 1. Energy consumption per mobile connection
 2. Energy consumption per unit mobile traffic
 3. Energy consumption per cell site
 4. Energy consumption per unit of mobile revenue
- Unique analytical approach allows MNOs to compare their networks against one another and against their peers on a like-for-like basis
 - Variables outside the MNO's control, e.g. population distribution and climate, are 'normalised' for using multi-variable regression techniques
 - Networks can then be compared like-for-like

How are the MEE Benchmarking benefits achieved and which data is required from operators?

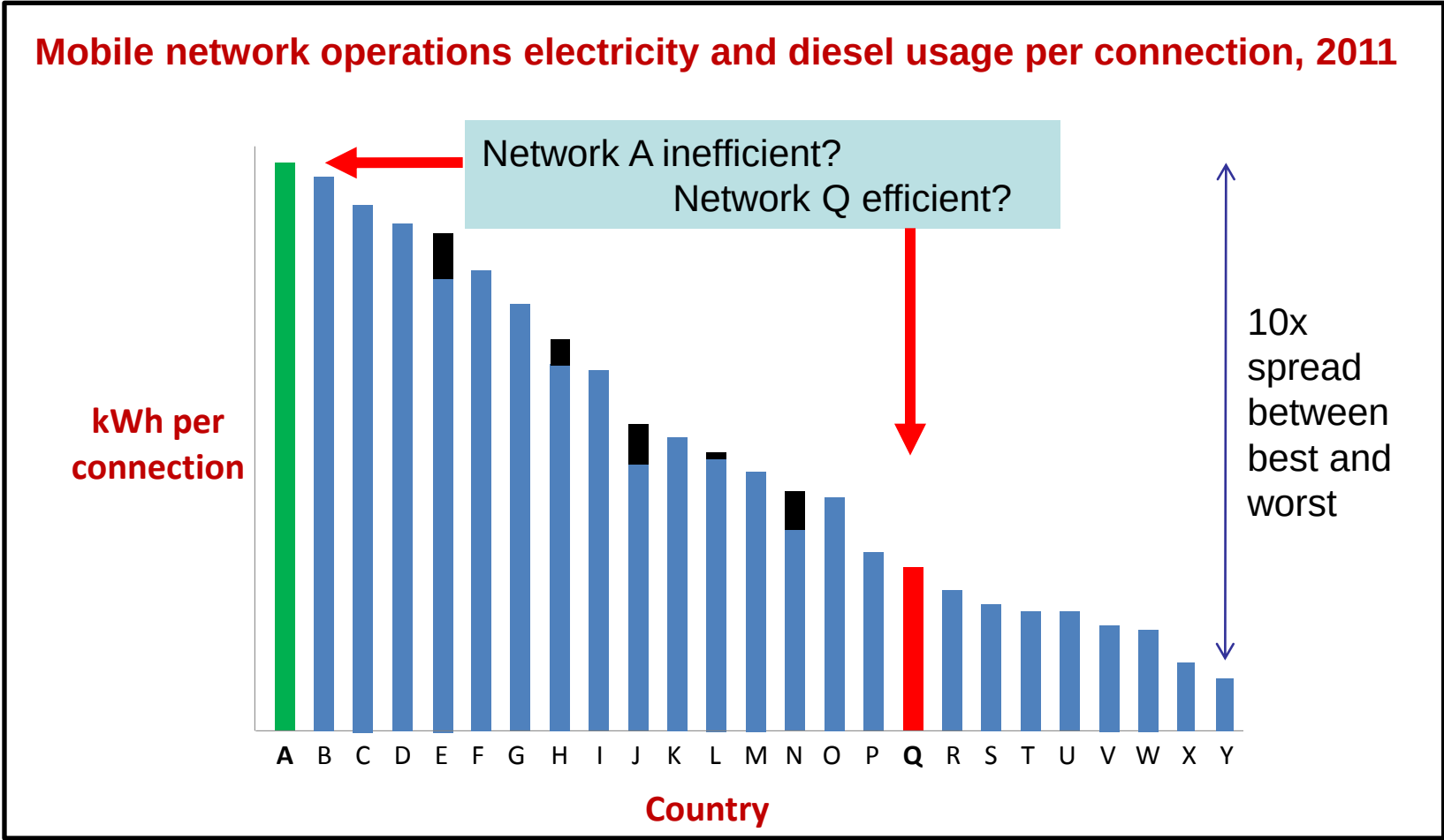
■ How the benefits are achieved

1. Share energy consumption data with the GSMA in confidence
2. GSMA to sense check data and come back with any questions
3. Review the GSMA analysis and validate
4. Use the benchmarking results and high level insights to refocus or refine current and future energy efficiency improvement initiatives

■ The data required from operators:

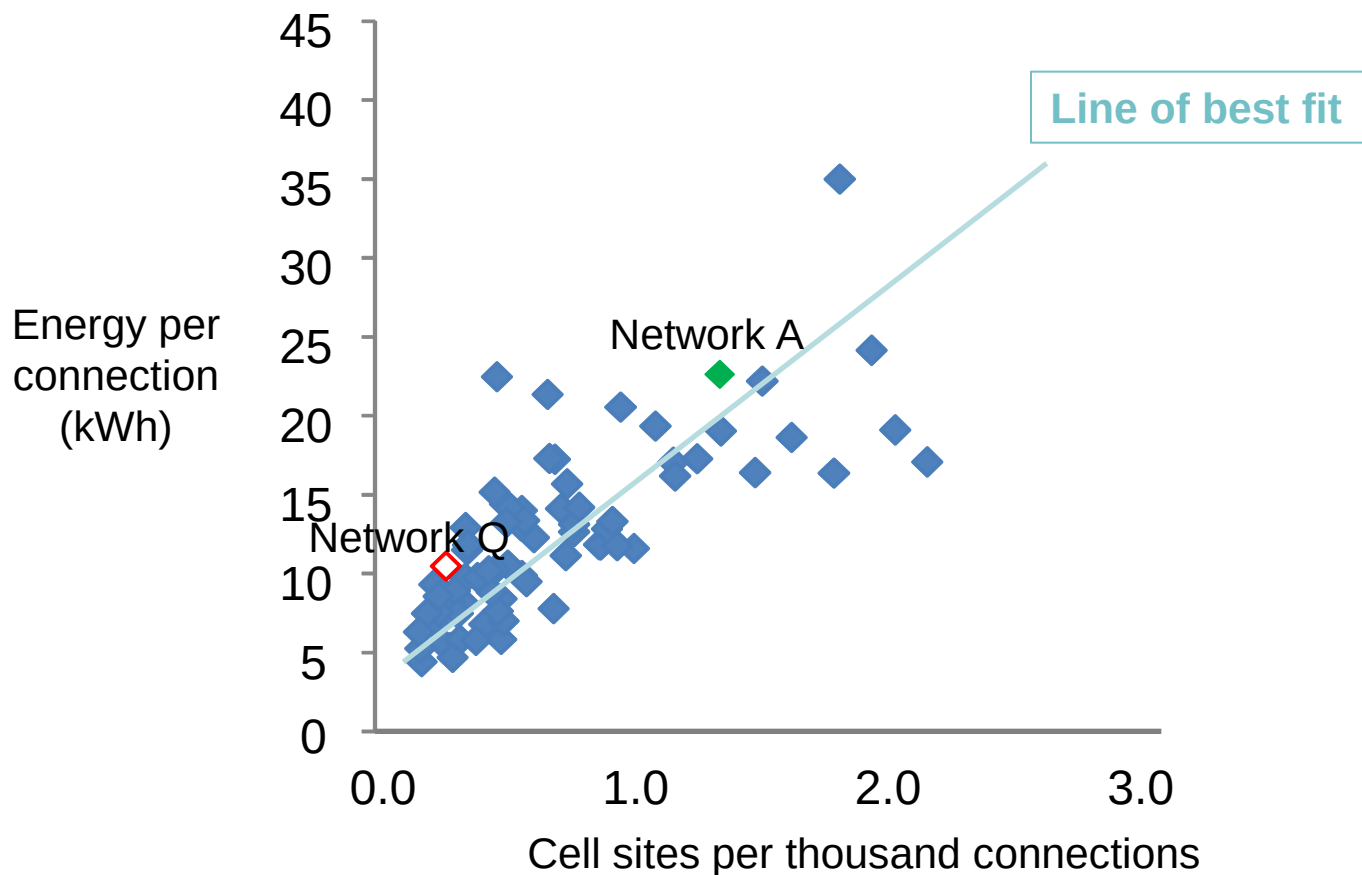
- Mobile network electrical energy usage and diesel energy usage
- Number of physical cell sites and number of technologies
- % coverage (geographic, population)
- Number of mobile connections, mobile revenues
- Minutes of mobile voice traffic, bytes of mobile data traffic

Prior to any “normalisation”, Network A appears inefficient and Network Q efficient

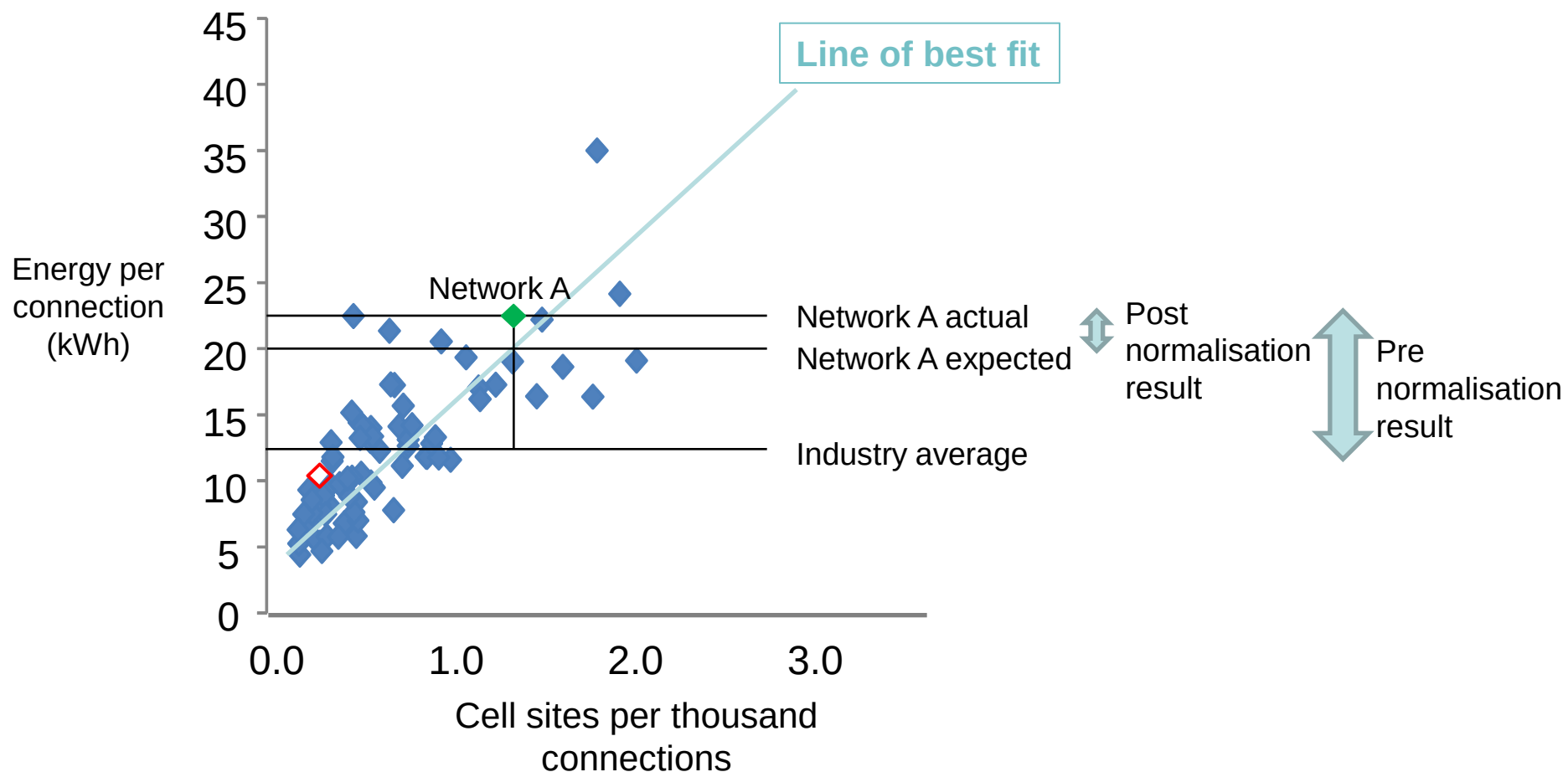


Key ■ Electricity usage ■ Diesel usage

There is a strong relationship between number of cell sites per connection and energy per connection



Normalising for cell sites per connection still shows Network A to be high energy but only just



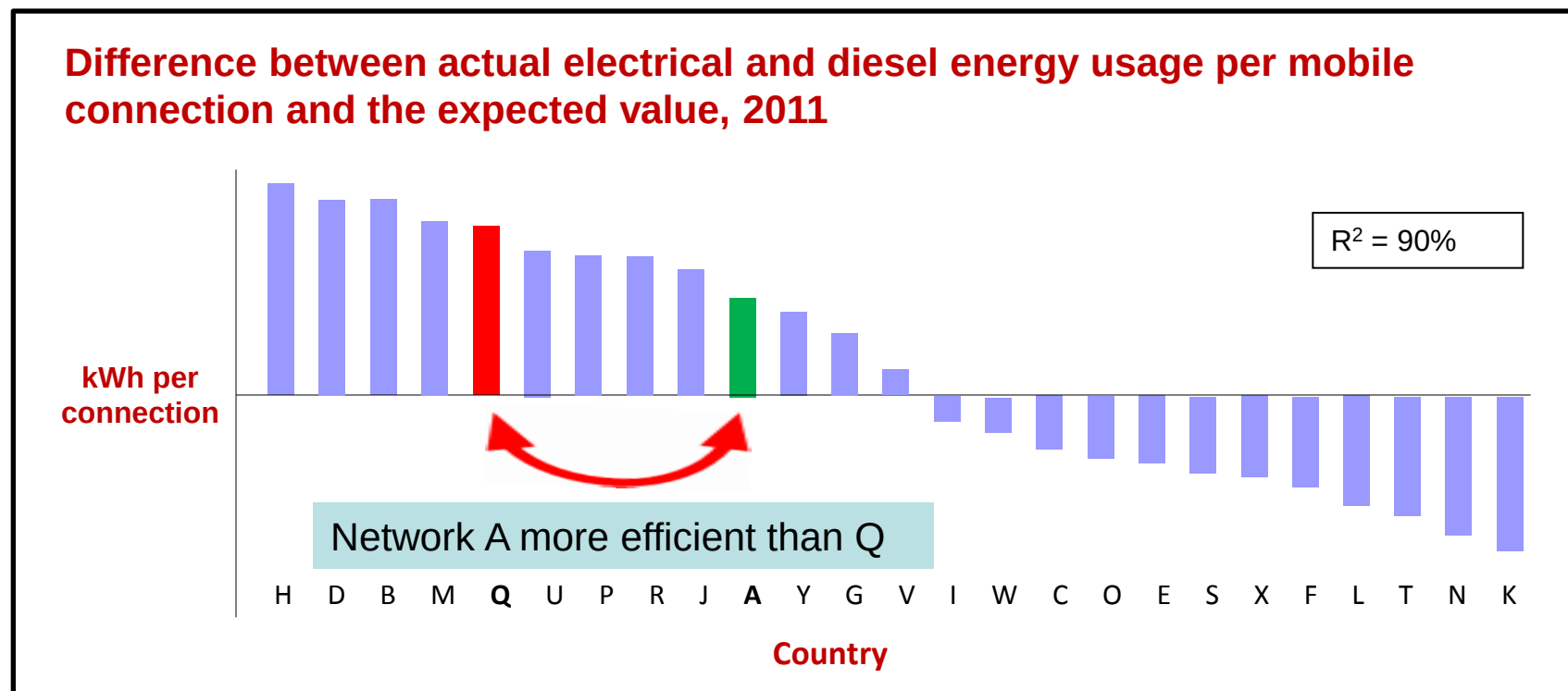
However, it is more meaningful to include other variables in the normalisation

- Energy per connection is normalised using the following four variables:

Normalisation variable	Comment
Number of cell sites per mobile connection	A single measure that accounts for population density, market share, topology and technology
% 3G connections of all mobile connections	3G customers use more data and as a result are likely to require more network energy consumption
Number of cooling degree days per capita (population weighted)	A measure of temperature that more accurately reflects the energy needed for cooling
Voice traffic per mobile connection	A measure of how active average connections are in terms of voice usage

- The regression analysis thus captures the impact of country, market and technology factors. Other variables are also tested in order to compare statistical significance, run sensitivity analyses and to verify the results

Normalisation against four variables shows a truer picture: Network A is actually more efficient than Network Q



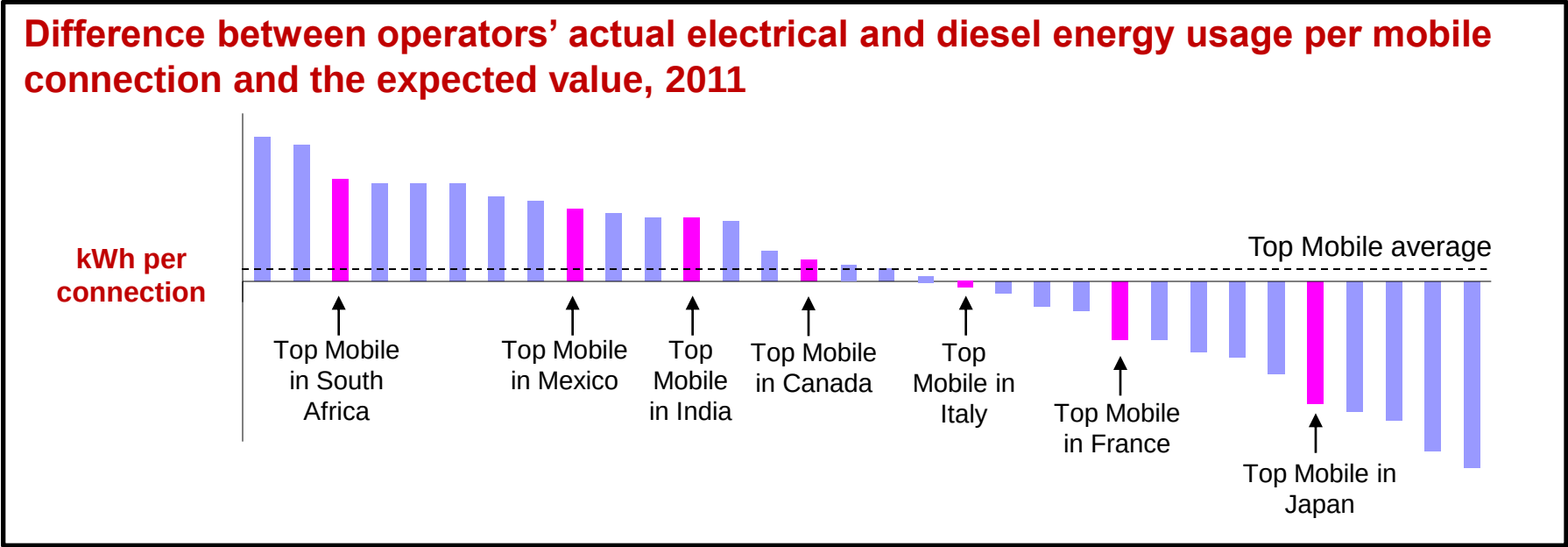
Regression variables

Mobile operations diesel & electricity usage per connection regressed against:

- Number of cell sites per connection
- % 3G connections of all mobile connections
- Number of cooling degree days per capita (population weighted)
- Voice traffic per connection

Operators, such as “Top Mobile”, receive anonymised comparisons against other MNOs, with their networks highlighted

E.g. Feedback to operator “Top Mobile” on normalised energy per connection



Key

- Top Mobile International OpCos
- Other Operators

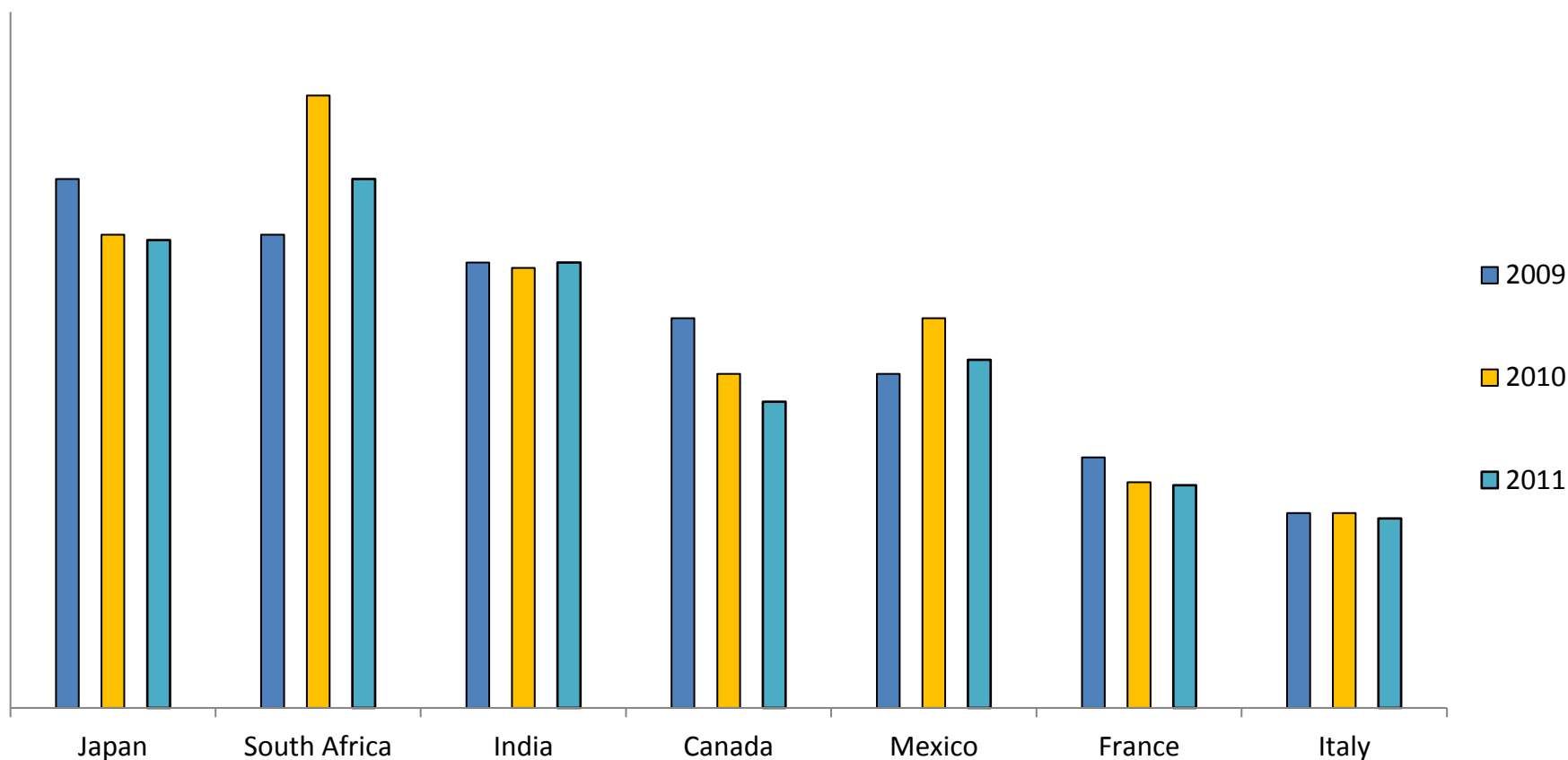
Regression variables

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Before normalisation, Top Mobile's energy per connection has reduced year on year for Japan, Canada, France and Italy

Mobile operations' average estimated RAN grid electricity and diesel generated electricity usage per mobile connection (kWh / connection)

Top Mobile



The benchmarking results imply that Top Mobile could reduce RAN energy costs by circa \$90m per annum, a 15% reduction

								Illustrative
2011	RAN energy (GWh)	Electricity cost (\$/kWh)	Diesel cost (\$/l)	Estimated energy cost (\$m)	% saving to average	% saving to top quartile	Saving to average \$m	Saving to top quartile \$m
Canada	424	0.09	1.18	38	3%	13%	1	5
France	289	0.11	1.37	32	0%	2%	0	0
India	3666	0.14	0.69	313	9%	21%	28	66
Italy	225	0.31	1.35	70	0%	6%	0	4
Japan	586	0.18	1.11	107	0%	0%	0	0
Mexico	289	0.15	0.62	38	14%	26%	5	10
South Africa	257	0.04	0.94	11	25%	34%	3	4
Total	5736			608			37	89

Whilst these are clearly estimates, they indicate that energy savings with an order of magnitude of \$90m p.a. should be achievable. It is not possible to determine how much of the \$90m p.a. is cost-effective using the MEE Benchmarking analysis. MEE Optimisation service addresses this

MEE Optimisation was launched in 2011 and has successfully completed its first project

Objectives

	Status
■ Launch MEE Optimisation to develop action plans for MNOs to reduce network energy costs and GHG emissions in under-performing networks. The service: - identifies individual energy saving measures and assesses the business case for each measure - is run in partnership with a third party, e.g. a vendor	✓ (2011)
■ Prove it works by undertaking first successful project	✓ (2011)
■ Publish case study from first project	Q1 2012
■ Increase participation and develop MEE Optimisation so that it becomes increasingly useful to operators	Ongoing

MEE Optimisation identifies energy saving measures and estimates the cost benefit for each measure

Energy saving measure	Capital cost (\$m)	Annual saving (\$m)	Payback (Months)
Upgrade to high efficiency rectifiers			
Implement free air cooling on certain cell sites			
Install energy saving features			
Adjust air conditioning temperature set points			
Install smart meters and establish monitoring process			
Etc.			

MEE Optimisation's first project identified €2m of savings and paybacks of 9-30 months

- An operator, vendor and the GSMA agreed to collaborate on a MEE Optimisation pilot, which began in September 2011 and concluded by the year end
- The approach taken in the MEE Optimisation project was to:
 1. Assemble a team of energy experts from the operator, vendor and the GSMA
 2. Choose a subset of 20 representative cell sites, gather and analyse required data, and visit some of the sites
 3. Assess the information gathered and summarise results
- Estimated annual savings identified of €2m in the RAN
 - financial paybacks of 9 to 30 months
 - savings are in addition to measures currently being implemented, which include switching more cell sites to free cooling

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22 March 2011, Vice-President of the European Commission Neelie Kroes on the GSMA's MEE Benchmarking service:

"...it's great to see the Mobile sector's Green Manifesto getting some real teeth today with 17 new recruits signing up to the GSM Association's Mobile Energy Efficiency Network Benchmarking Service..."