Mobile Energy Efficiency
Explained

December 2012

Mobile Energy Efficiency

The GSMA's Mobile Energy Efficiency (MEE) offers two main 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 which
  - helps MNOs measure and monitor the relative efficiency of their radio access networks
  - identifies under-performing networks and quantifies the potential efficiency gains available, typically around 10% to 25% across a MNO's portfolio

- The GSMA's **MEE Optimisation** is a follow-on service that uses the MEE Benchmarking results combined with site audits and equipment trials to firstly analyse the costs and benefits of specific actions to reduce energy and emissions, and secondly to roll out the most attractive solutions

- For operators participating in the Mobile Energy Efficiency service, the GSMA also provides advice on carbon emissions and related issues

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

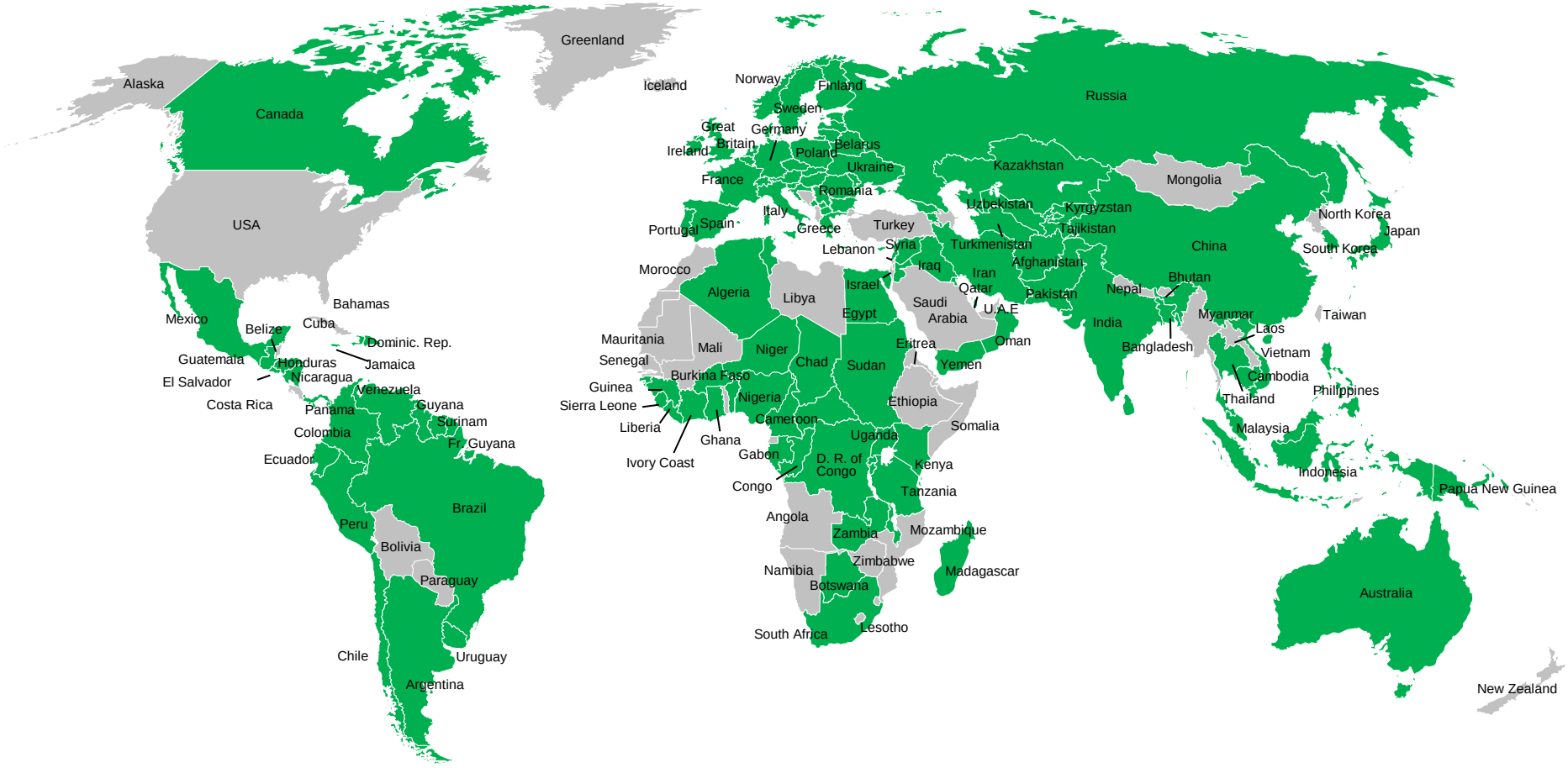
Objectives	Status
■ Launch MEE Benchmarking for MNOs to: – compare multiple networks on a like-for-like basis and against standard energy KPIs – help reduce energy consumption, costs and emissions	✓ (2010)
■ Incorporate in new ITU SG5 energy and carbon methodologies	✓ (2011)
■ Increase participation 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

Mobile Energy Efficiency

MEE participants are located in 145 countries



Participant in MEE

Mobile Energy Efficiency

There are 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***
   - Each MNO receives an individual 40 page Powerpoint results presentation
2. Unique “normalisation” analysis enables like-for-like comparison whilst maintaining confidentiality as external comparisons are made anonymously
3. Annual participation to track improvements year on year and quantify the impact of cost reduction initiatives
4. Insights to improve energy efficiency, including access to case studies from top performing networks
5. Possible participation in energy reduction implementation projects (MEEO) together with innovative capex financing and managed energy contracts
6. Demonstration of positive action on energy and emissions reduction to stakeholders, including regulators

The GSMA provides a unique service; without the GSMA, operators could only benchmark their own portfolio of networks and without like-for-like comparison

The MEE Benchmarking methodology compares networks against 4 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

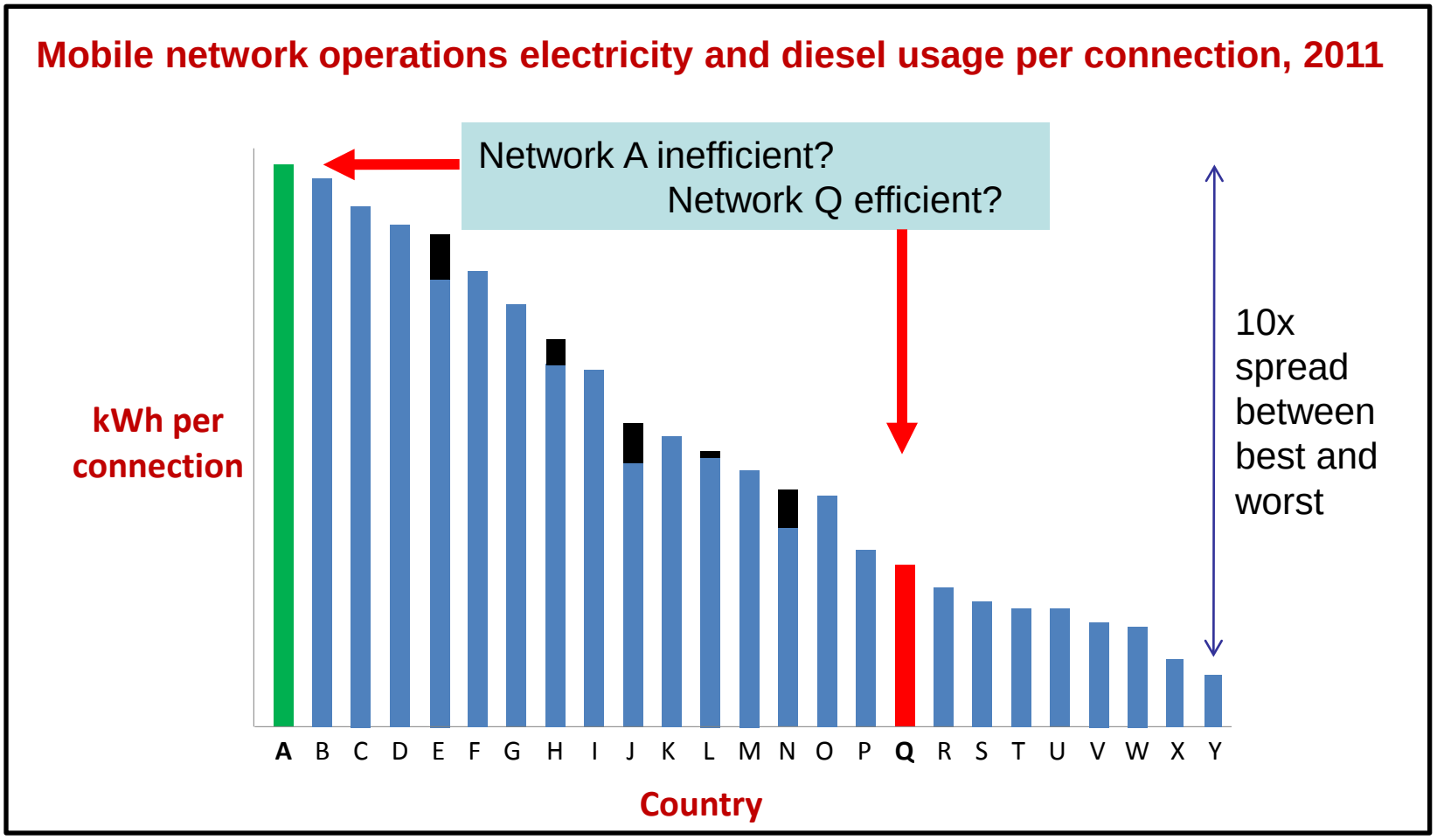
- Unique analytical approach allows MNOs to compare their networks against one another and against their peers on a like-for-like basis
  - Variables outside the MNO's control, e.g. population distribution and climate, are 'normalised' for using multi-variable regression techniques
  - Networks can then be compared like-for-like

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

- How the benefits are achieved by MNOs:
  1. MNO shares energy consumption data with the GSMA in confidence
  2. GSMA sense-checks the data and comes back with any questions
  3. MNO reviews the GSMA analysis and validates
  4. MNO uses 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

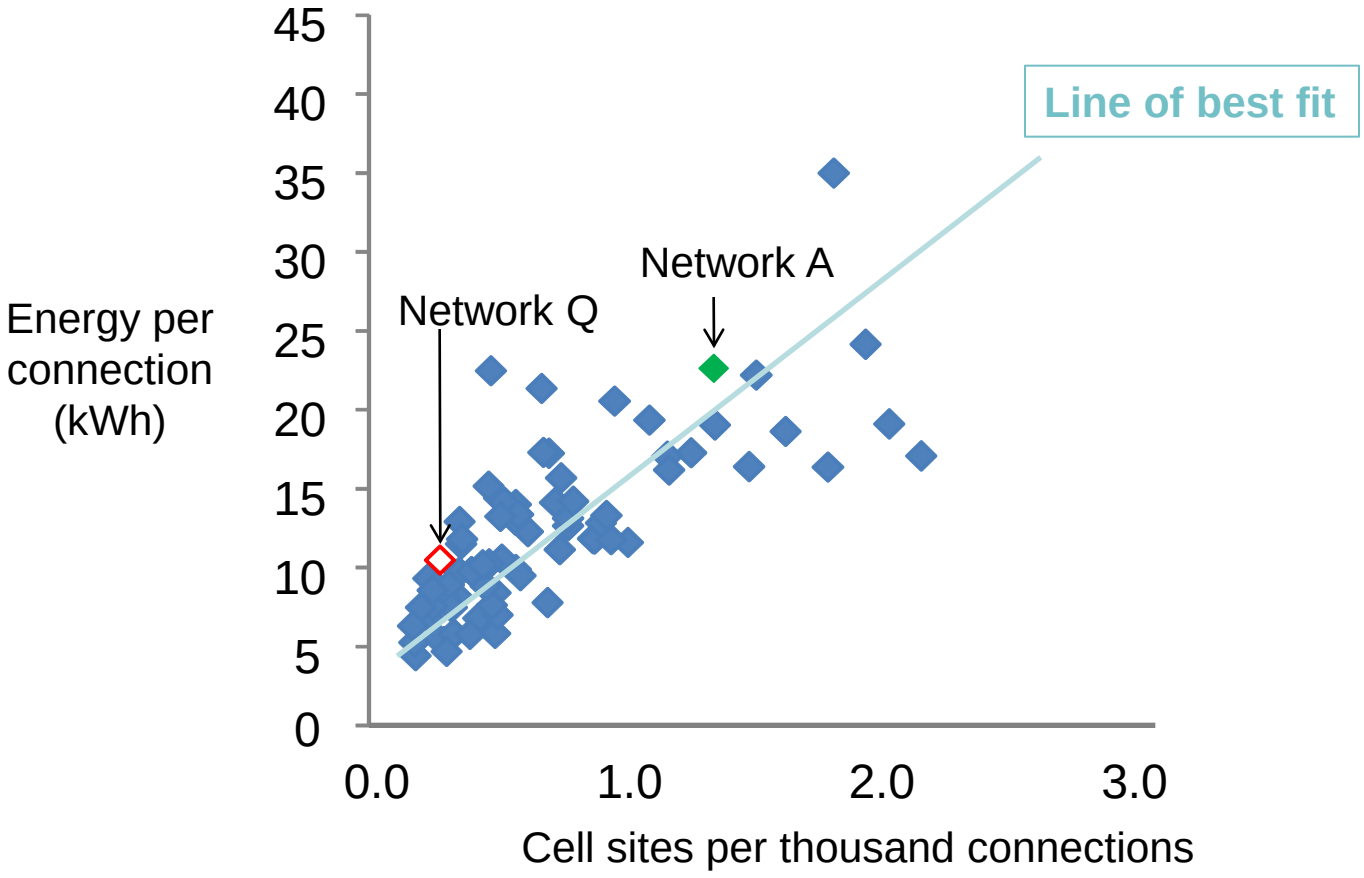
Prior to any "normalisation", Network A appears the most inefficient and Network Q efficient



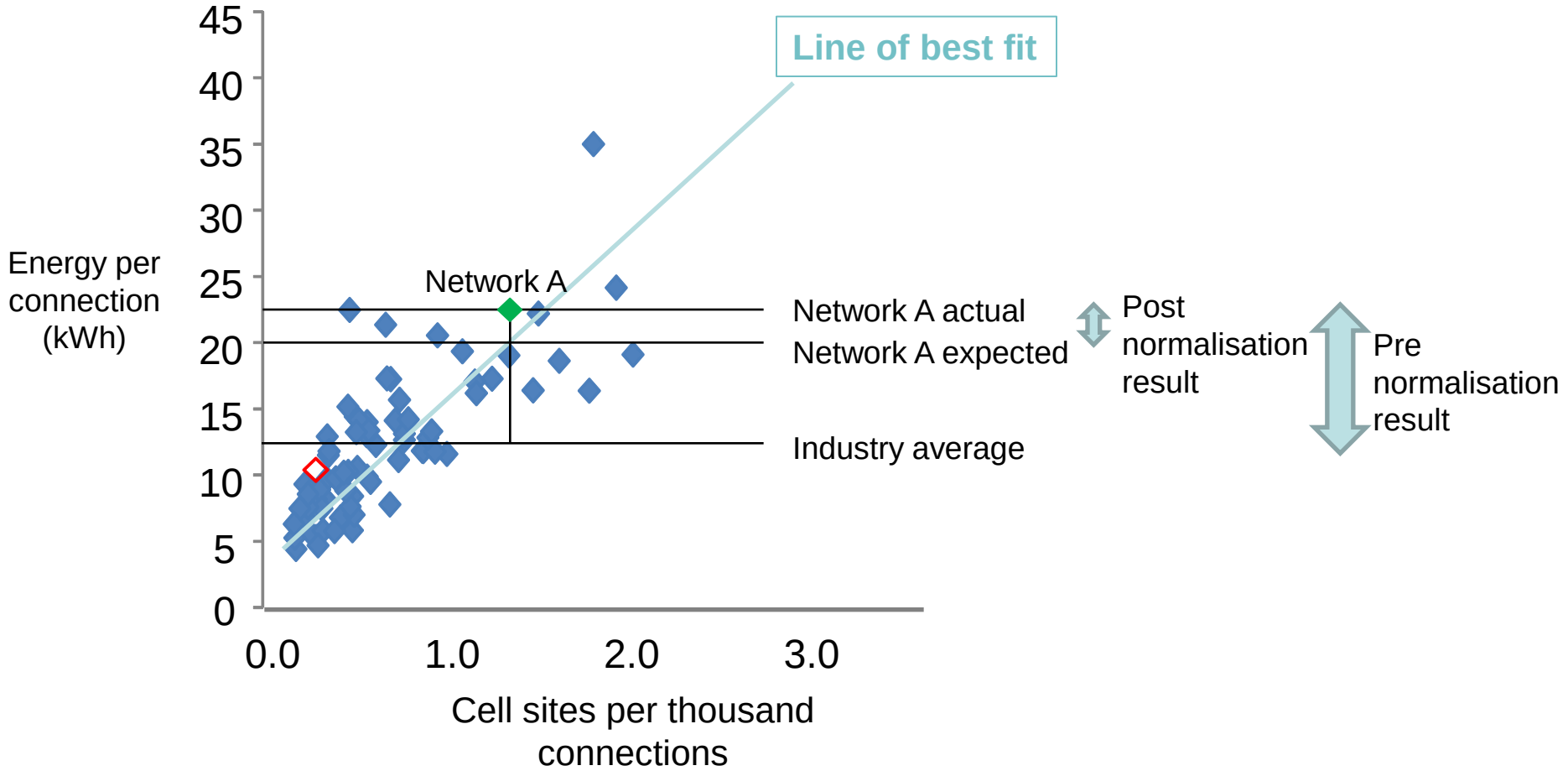
Key Electricity usage Diesel usage

Source: MNOs, UN, GSMA data and analysis

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



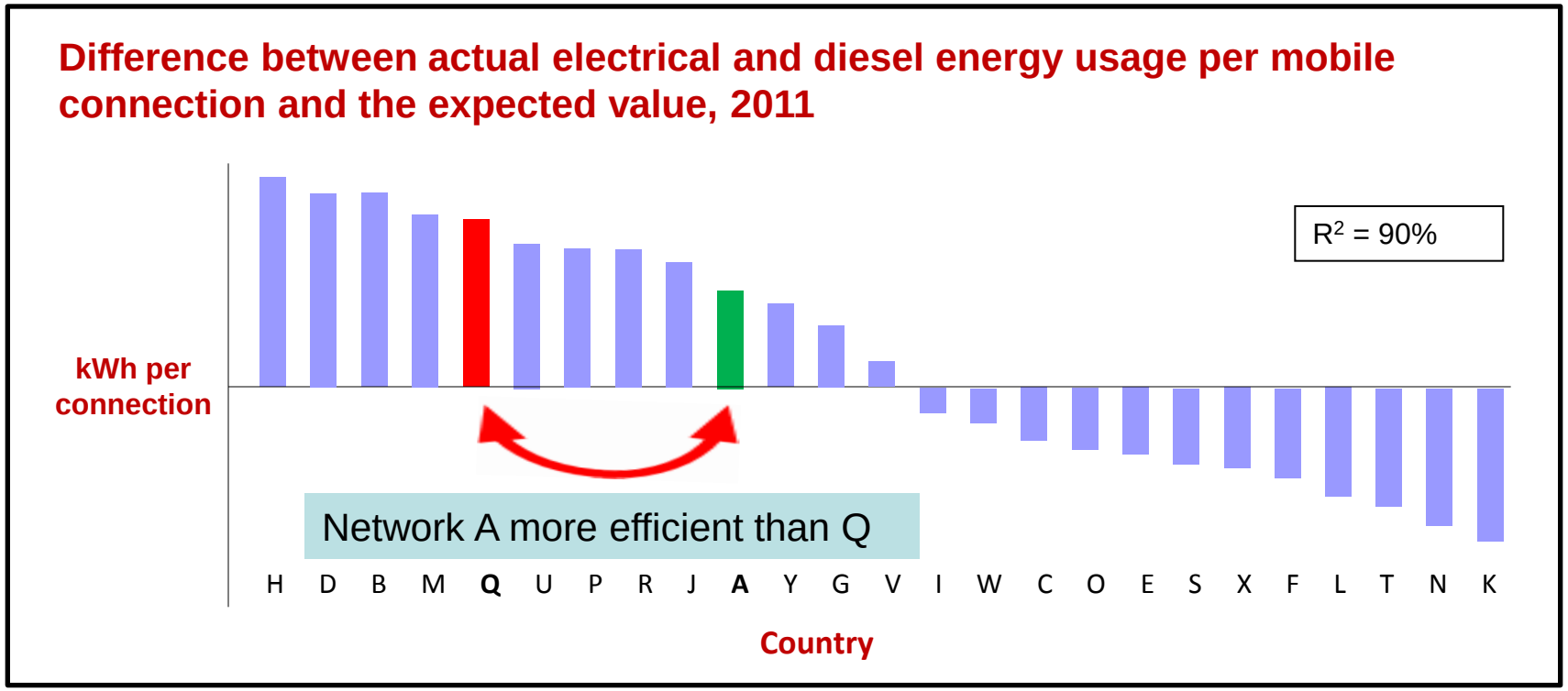
However, it is more meaningful to include other variables in the normalisation

- 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
Data traffic per mobile connection	A measure of how active average connections are in terms of data usage
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 that Network Q



Regression variables

Mobile operations diesel & electricity usage per connection regressed against:

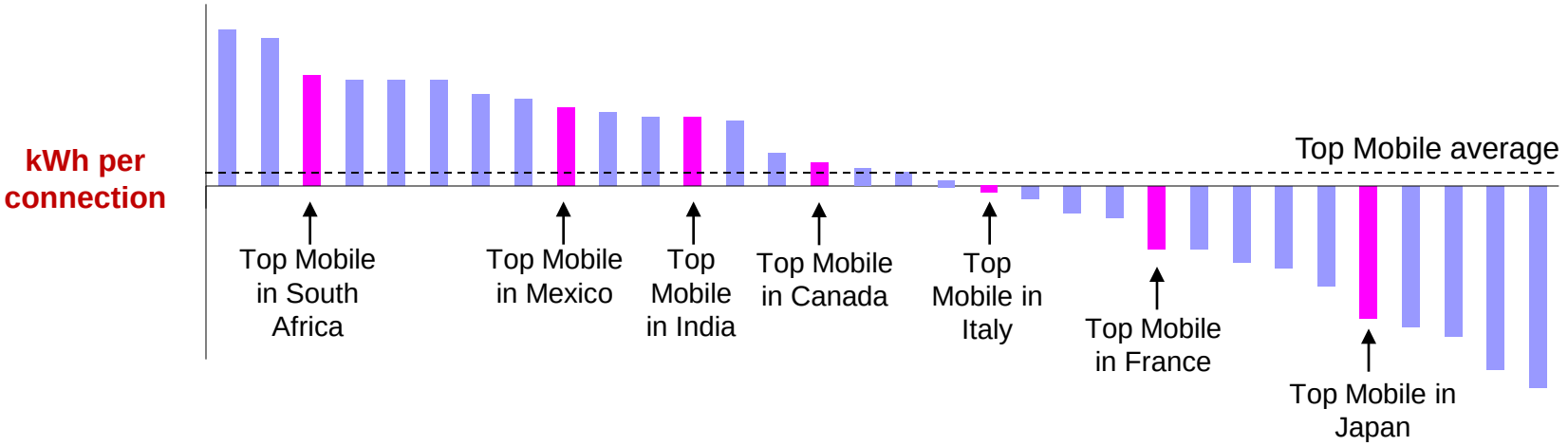
- Number of cell sites per connection
- Data traffic per connection
- Number of cooling degree days per capita (population weighted)
- Voice traffic per connection

Source: MNOs, UN, GSMA data and analysis

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

Difference between operators’ actual electrical and diesel energy usage per mobile connection and the expected value, 2011



Key

- Top Mobile International OpCos
- Other Operators

Regression variables

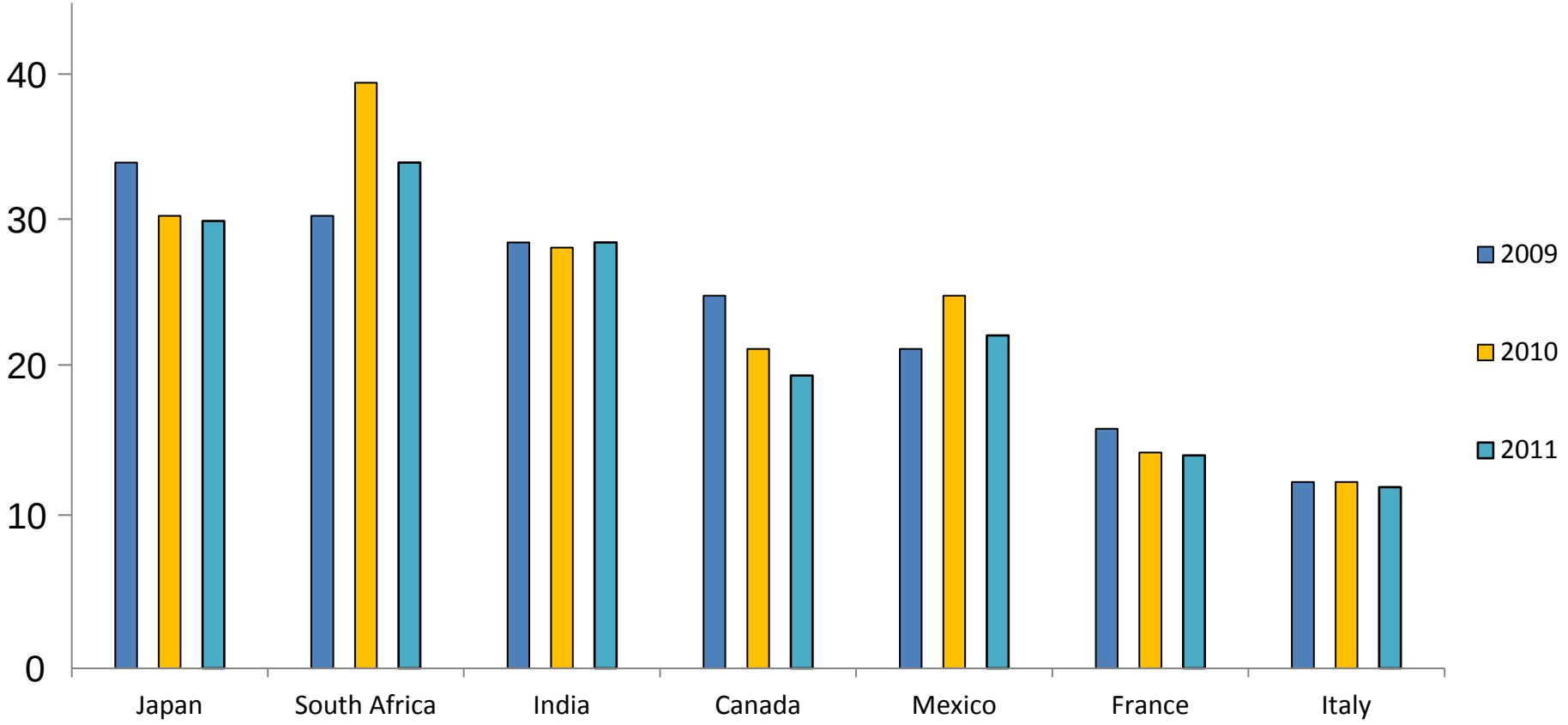
Mobile operations diesel & electricity usage per connection regressed against:

- Number of cell sites per connection
- Data traffic per connection
- Number of cooling degree days per capita (population weighted)
- Voice traffic per connection

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



Example: energy per connection, financials

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 or system integrator	✓ (2011)
■ Prove it works by undertaking first successful project	✓ (2011)
■ Publish case study from first project	✓ (2012)
■ Increase participation and develop MEE Optimisation so that it becomes increasingly useful to operators	Ongoing

MEE Optimisation identifies energy saving measures, estimates the cost benefit for each measure, and implements the attractive ones

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 will help operators with implementation from early 2013

- MEE Optimisation will help with capital equipment finance
  - Capital constraints often means third party finance is preferable. This is also the case for some third parties, such as relatively small systems integrators
  - The GSMA is proposing to assemble a directory of funding sources providing key requirements of these funds and giving information on how to apply for finance
  - The GSMA is discussing the possible aggregation of MEEO contracts with funding providers in order to attract finance with a lower interest rate

- MEE Optimisation will help with contract standardisation
  - Managed energy contracts are complex to structure. E.g. is it variable or fixed fee? How to optimise the accounting treatment? How to estimate the baseline and calculate savings? How to de-risk?
  - The GSMA will assist with managed energy contracts, offering standardised heads of terms as part of MEE Optimisation and advising on how to de-risk the contracts and set them up

The first MEE Optimisation project identified €2m of savings with paybacks of 9-30 months. A second project is under way in Asia

- Telefonica, NSN and the GSMA agreed to collaborate on a MEE Optimisation pilot in Germany, which began in Sept 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 Telefonica, NSN 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

- A second MEE Optimisation project is currently under way in Asia

www.gsma.com/mee

mee@gsm.org

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..."

Mobile Energy Efficiency