

GREEN VIABILITY

GSMA Renewable Energy Trial in Sri Lanka

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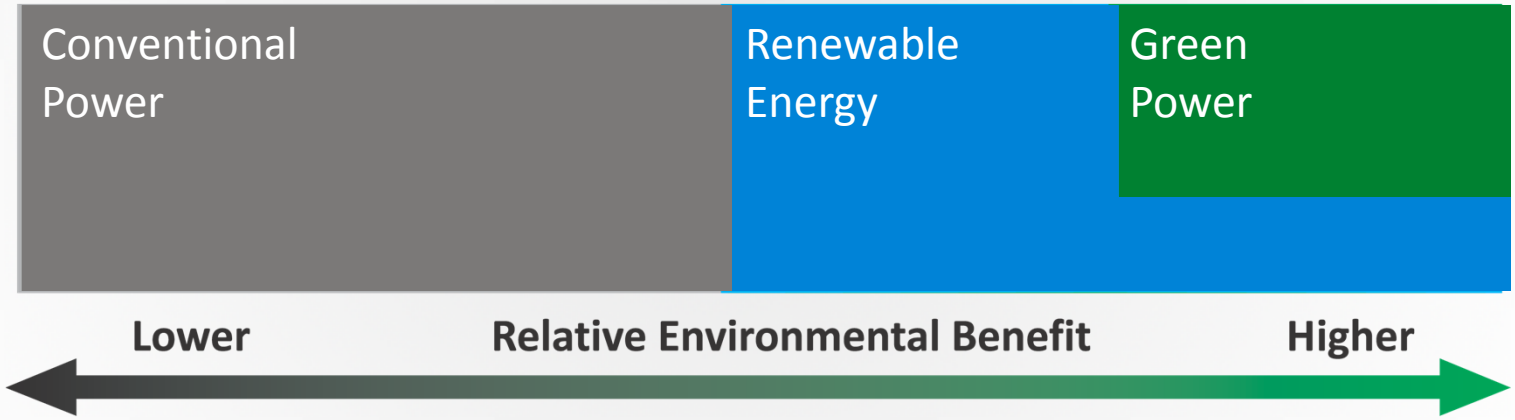
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This Presentation will Cover…

- Green Power in the “Mobile” Context
- The Transition – “Possibility” to “Reality”
- Elevating Green Power to the Mainstream
- Defining ‘Dream’ Renewable Energy KPI
- GSMA Multi Vendor Green Power Trial
- The Triple Bottom Line & Green Power Nexus

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What is Green Power?

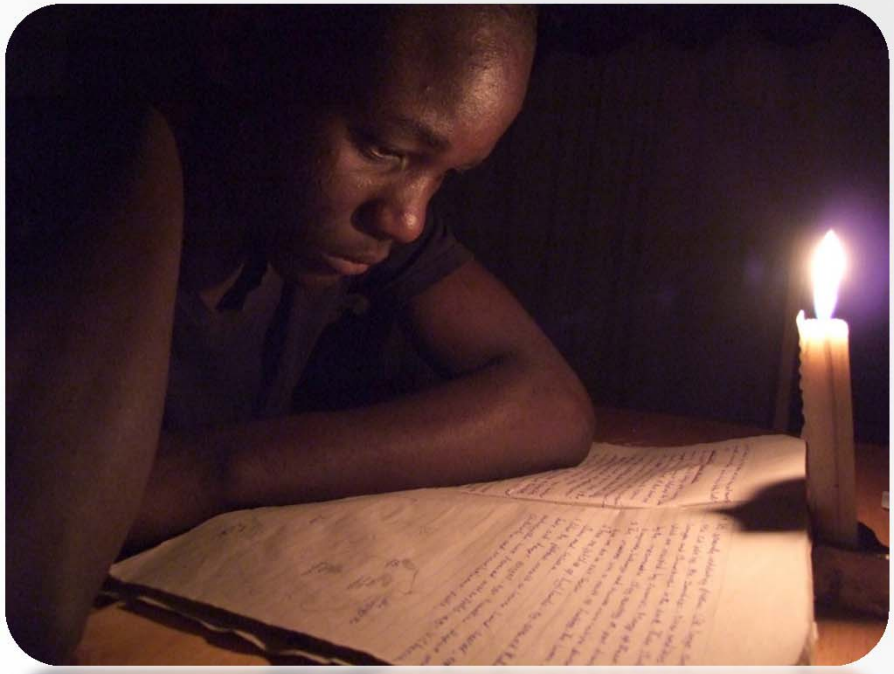


Green power is a subset of renewable energy and represents those renewable energy resources and technologies that provide the highest environmental benefit. EPA defines green power as electricity produced from **solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources**."

Source: US Environmental Protection Agency (EPA)

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Why Green Power?



Green Power and Mobile

Future Mobile Growth:

- *Increasingly off Grid Populations*

Off Grid Power Generation:

- *High Cost (Fuel and Opex)*
- *Adverse Environmental impact*
- *Manual Intervention*
- *Unreliable*
- *Lacks Scalability*

- **1.6bn People are Deficit in Access to Grid Electricity**
  An Additional 1bn People have Unreliable Access
- **Growing Carbon Footprint of the Mobile Industry**
  Mobile Networks Around the World are Locked in to Carbon Intense Power Sources that Contribute to Environmental Degradation

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Green Power for Mobile – Drivers and Motivators



Operational (Off Grid)

Generator Operations & Maintenance
Build up of "Delivered Diesel" Cost
Manual Ops - Fuel, Security Related

Commercial

Investment in Generators
Fuel Cost Escalation
Up-Scaled Opex Structure





Environmental Footprint

CO2 Emission Escalation in Developing Countries
Industry Carbon Footprint vis Rapid Growth
Global Incentives and Regulations on Emissions
Waste Management - Burnt Oil and Used Oil Filters

Green Power for Mobile

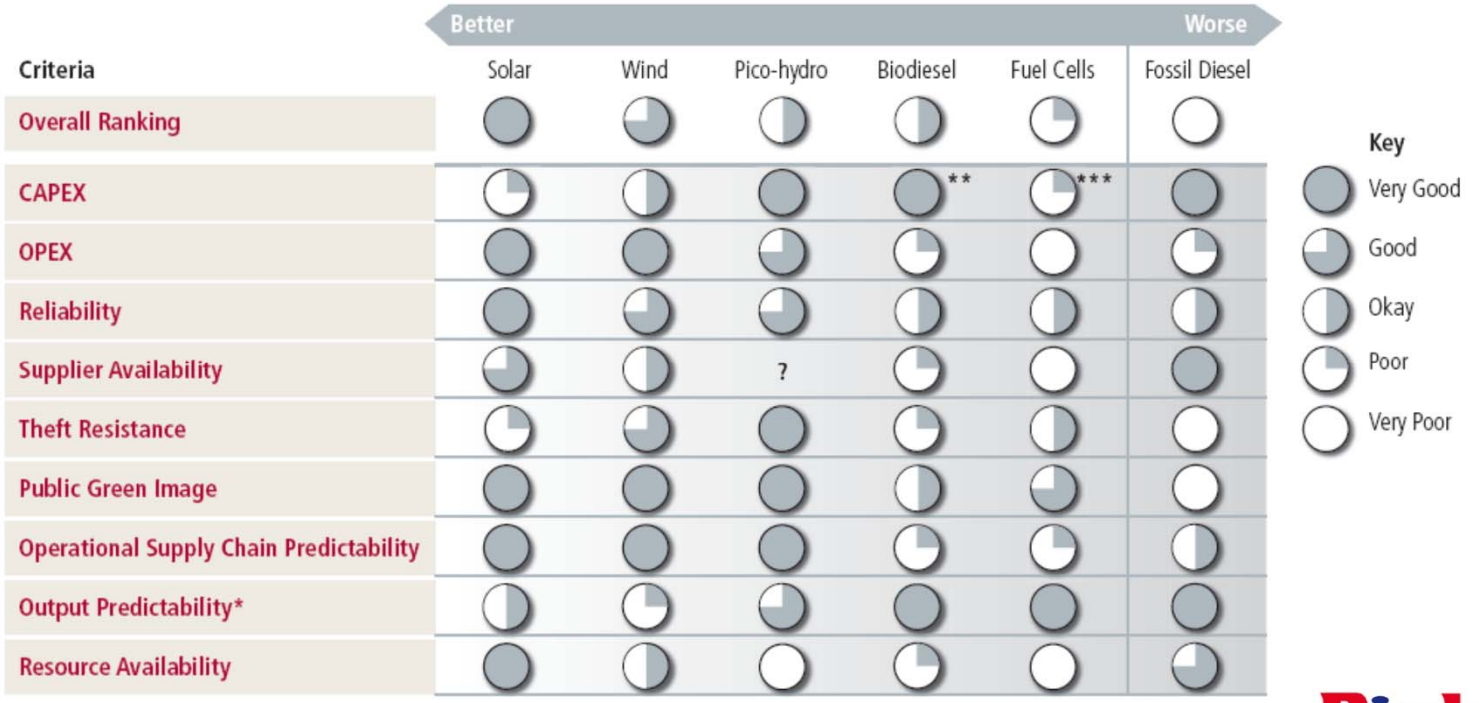
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Green Power Inputs – Preferred Core Alternatives

1. Wind
2. Solar
3. Pico hydro
4. Biodiesel
5. Fuel cells
6. Fossil Diesel

Opportunity

Green Power Technologies & Solutions

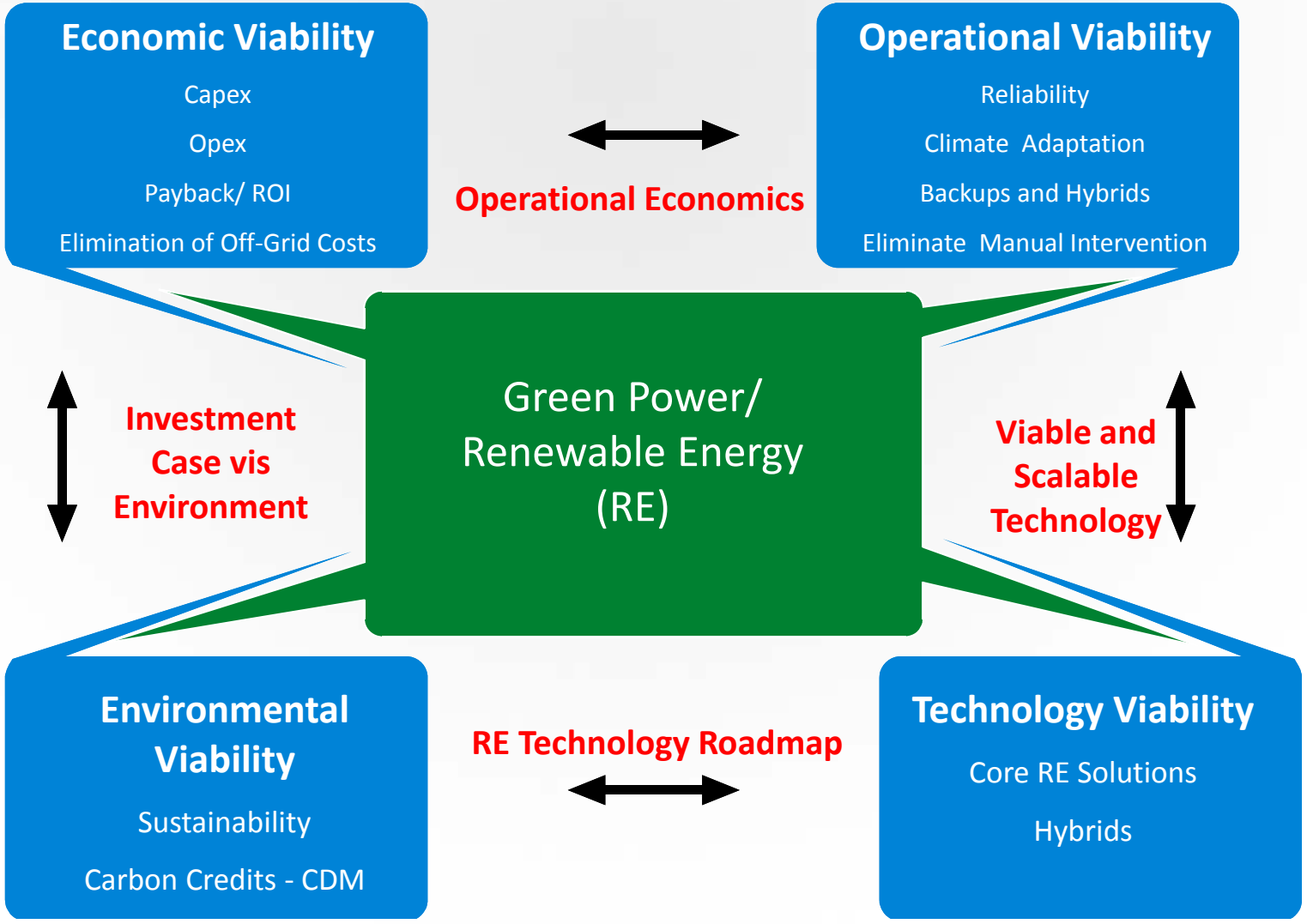


Source: GSMA Analysis

*Assuming fuel is constant **Assuming purchase of biofuel from supplier ***Fuel cell CAPEX forecast to improve rapidly

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Compelling in Context – The Transition to Reality

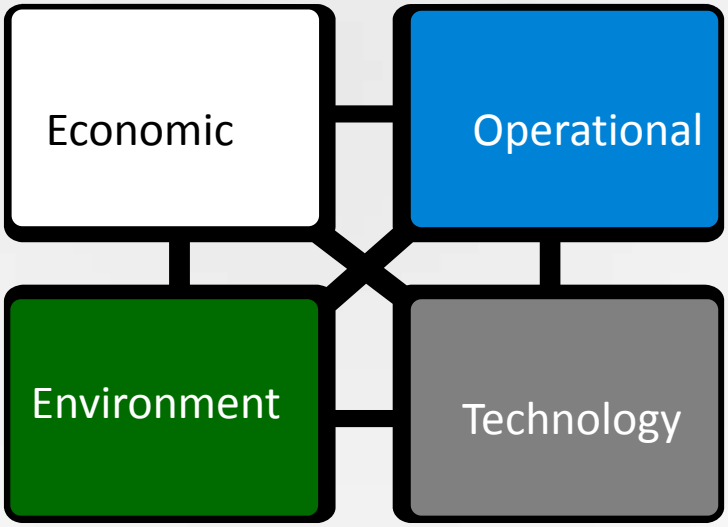


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Accelerating the Transition to Reality

- **Need to Quantify**

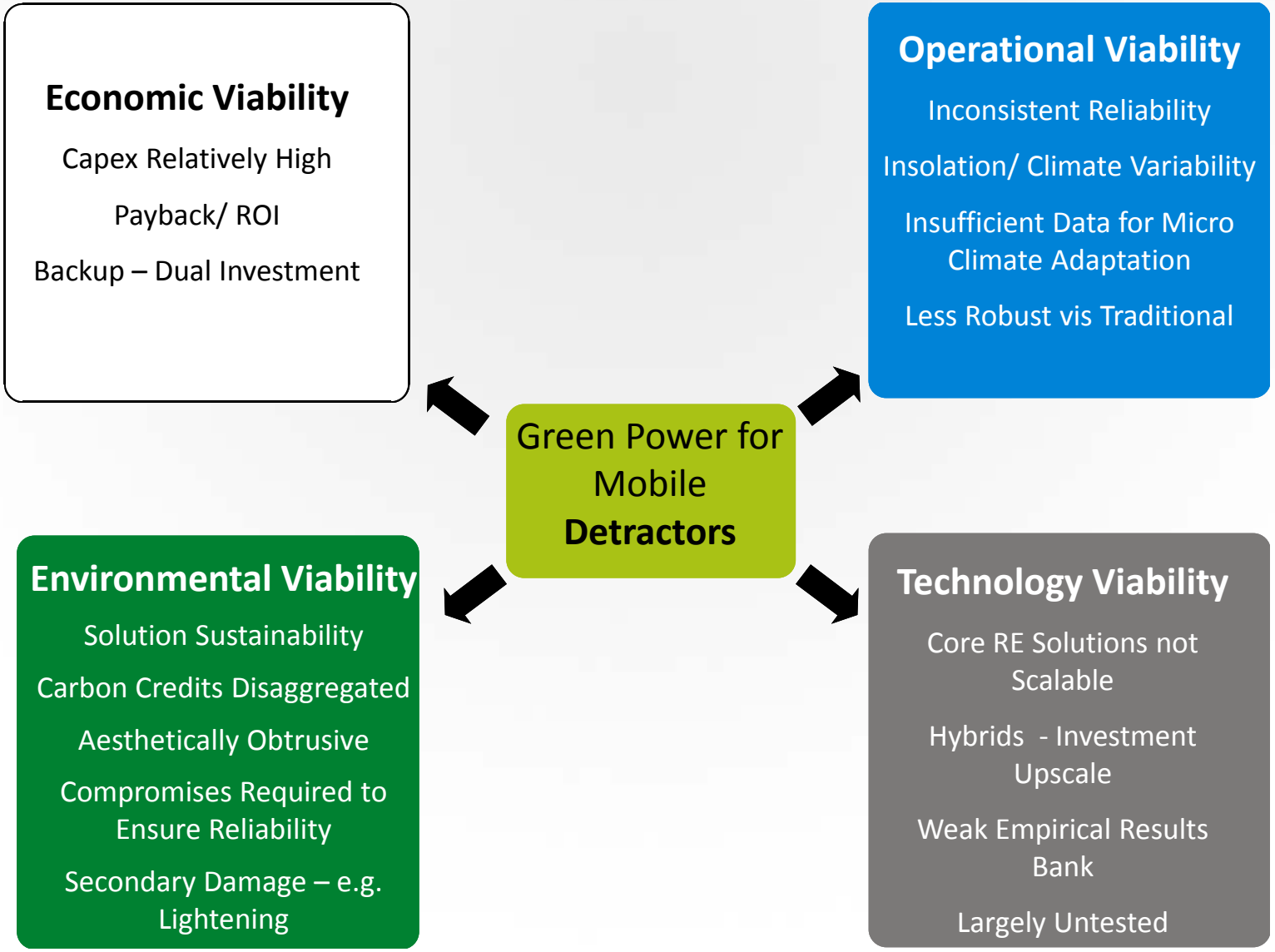
4 Dimensional Model & Business Case



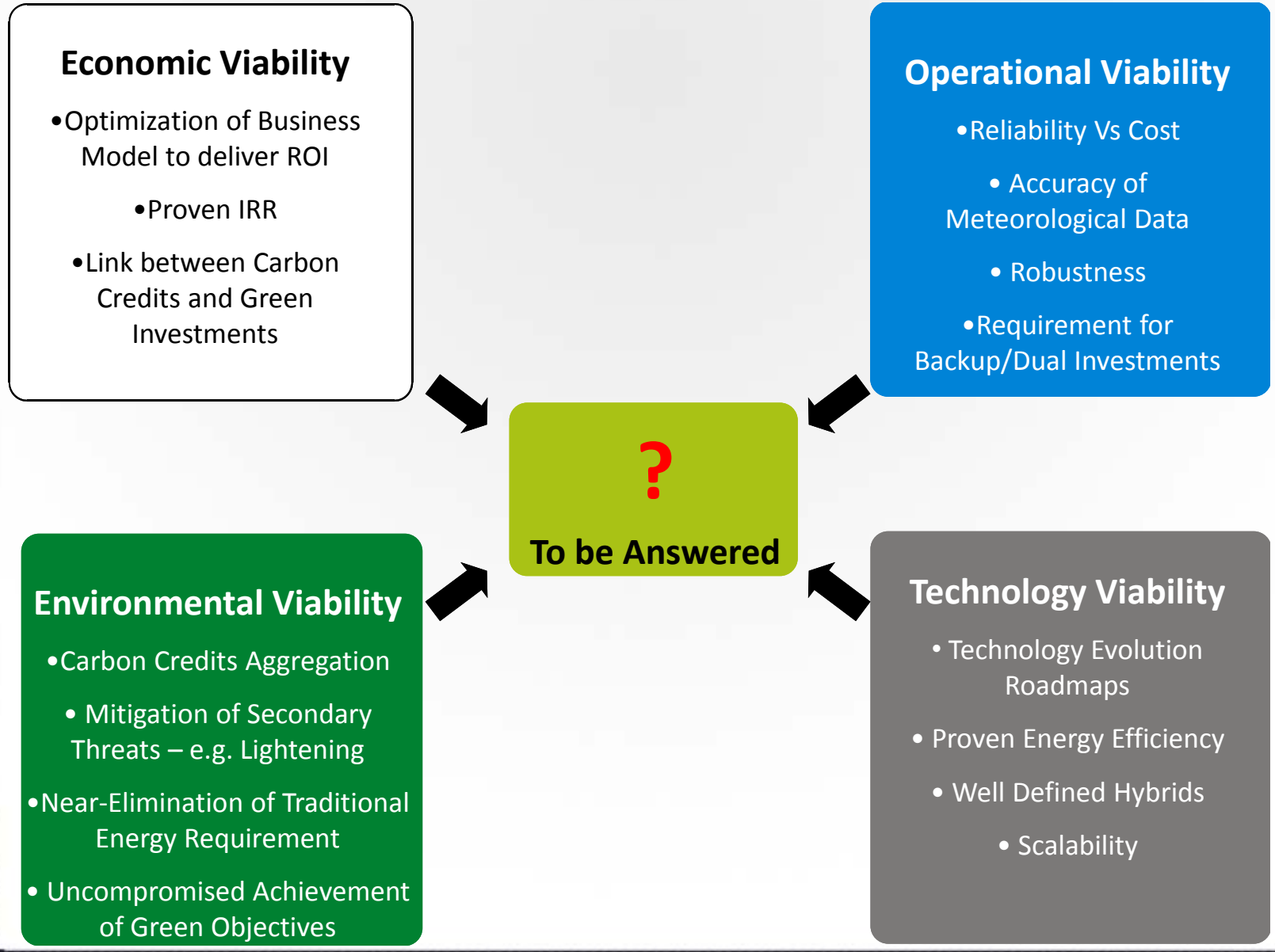
- Generate Robust **Data Points** from Typical Operating Environments
- Identify Gaps and Build Industry Roadmaps in to the Future
- Accelerate **Motivation of 'Scale'** in RE Technology/ Solutions
- Motivate **Triple Bottom Line Approach Within the Mobile Industry**

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Why Not Green Power for Mobile?

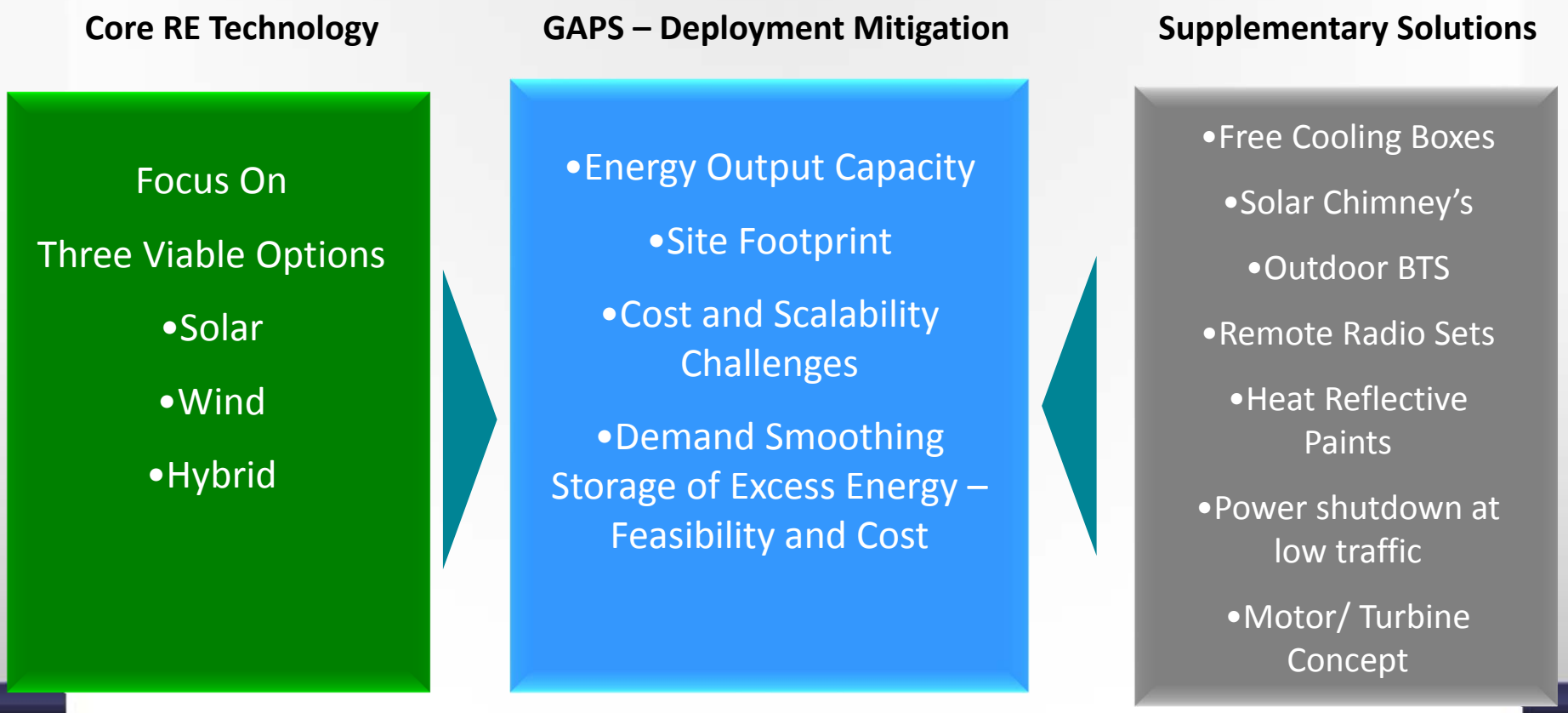


Precursors to Mainstream RE Deployment



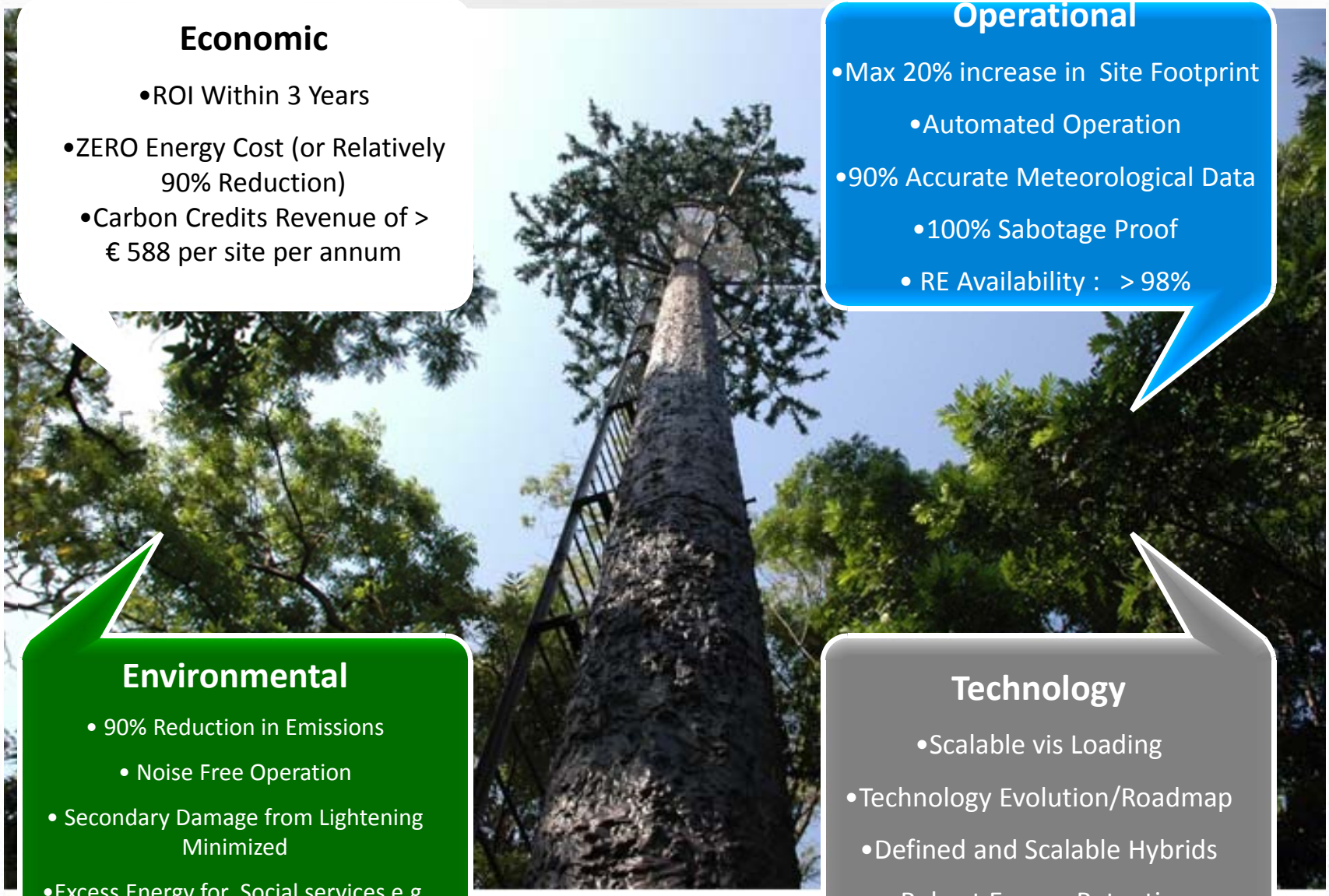
Supporting Solutions – Enhancing Operational Viability

Traditional & Purpose Designed **Supplementary Technologies/Solutions** can be Deployed to **Bridge RE Technology/ Operating Viability Gaps**



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Defining a ‘Dream’ RE Site – Envisioning the “Ideal”



Economic

- ROI Within 3 Years
- ZERO Energy Cost (or Relatively 90% Reduction)
- Carbon Credits Revenue of > € 588 per site per annum

Operational

- Max 20% increase in Site Footprint
- Automated Operation
- 90% Accurate Meteorological Data
- 100% Sabotage Proof
- RE Availability : > 98%

Environmental

- 90% Reduction in Emissions
- Noise Free Operation
- Secondary Damage from Lightening Minimized
- Excess Energy for Social services e.g. Water Distribution

Technology

- Scalable vis Loading
- Technology Evolution/Roadmap
- Defined and Scalable Hybrids
- Robust Energy Retention

Setting Green Power Balanced Scorecard Metrics

Economic

- Site Cost Benchmark – Capex & Opex
- Capex Saving – Generator Scaling
- Diesel Saving per Month for 1KWH load ~ 1300Ltrs
- Opex Saving 24/7 Gen Vs RE – 1300 $ /month per 1KWH Load

Environmental

- Emission Saving per Subscriber (quarterly)
- Emission Saving per Base Station Site
- Reduction of Operator Annual Carbon Footprint

Technology

- Site Configuration Benchmark vs Output
- Loading Indexed Performance Measure (Generation and Retention)
- Performance Sensitivity vis Supplementary Solutions
- MTBF Measure vs Cumulative Usage

Operational

- Core RE Output Measure (e.g. Wind 1KW, Solar 2KW)
- Core RE Availability Measure
- MTBF Measure
- Climate Variability – Availability Measure
- Manual Intervention Measure (e.g. Visit/Month)

TYPICAL CARBON VALUE OF EMISSIONS FROM DIESEL-POWERED BASE STATION

CO2 emission - 2.7kg/Ltr

Annual emission 2.7 X 1300 X 12 /1000 => 42 tonnes

Annual CO2 emission per KW => 42 tonnes

Source: GSMA Development Fund

GSMA Multi Vendor - Green Power Trial

Economic Viability

- Before/After Scenario Comparison
- Down Scaling of Traditional Energy
- Cost Landscape - Multi Vendor RFP Process
- Capex / Opex Trade-Off Quantification

Operational

- Identification of Most Appropriate Wind and Solar data
- Reliability Measurement – Multiple Conditions
- Establishment of O&M Procedures
- GSMA Best Practice

The Trial at Dialog Telekom is Designed to Refine & Perfect the Scorecard

Environment

- Quantification of Net Emissions
- Quantification of Carbon Credits
- Derive Potential for Extended Applications

Technology

- Wind/Solar Combined System
- Hybrid and Supplementary Solution Integration Validation
- Scalability Testing
- Long Term – Roadmap Validation and Lifetime Testing

GSMA Trial Overview – 10 Green Power Sites

The GSMA Green Power Trial with Dialog Aims to Produce a Show Case for the Industry. Phase one of the Trial Runs from September 08 through to June 2009.

OBJECTIVES

- Demonstrate Commercial Case for RE
- Establish Field Performance of RE Systems
- Develop Best Practice for the Deployment & Operation of RE

SCOPE

- Build Commercial Case for RE at a Network as well as Site Level
- Site Dimensioning & Engineering
- Knowledge Transfer & Best Practice Spawning

RISK/ ISSUE MANAGEMENT

- Ensuring Planned Sites are Appropriately Dimensioned
- Reliability Assurance – Design and Operating Considerations
- Equipment Sourcing and Logistics

Over the Past 18 months, the Dev' Fund has Supported Three Renewable Energy Trials in India, Namibia and Vanuatu (with Wind, Solar and Biofuels)

Project Status – 2 Green Power Sites Already 'Live'

Two Green Power Sites Went Live in the First Week of February 2009

Randenigala (Remote Mountain)



24/7 Gen Power Site Converted to Solar/Wind Hybrid Site with S/B Generator

Weerawila (Remote Costal)



On-Grid Site – Mission Critical Hub - RE to Potentially Replace/Downsize Standby Generator, Load Share

Dialog Telekom – Green Power Trial Sites

Randenigala (Remote Mountain)



Key Site Challenges : Unreliable grid, Diesel Delivery Related Logistic Issues.

24/7 Generator Site Converted to Wind/Solar Hybrid Site with Standby Generator

Vision : Generator Free Operations

Generator Only (Previous)

Off-Grid. 24/7 Generator
Capex: USD 8.7K
Opex : USD23K p.a
High Level of Manual Intervention

Hybrid Solution (Trial)

Solar+ Wind + Generator
Capex : USD86K

3000AH Exide batteries.

Expected Generator Hours <120 per month

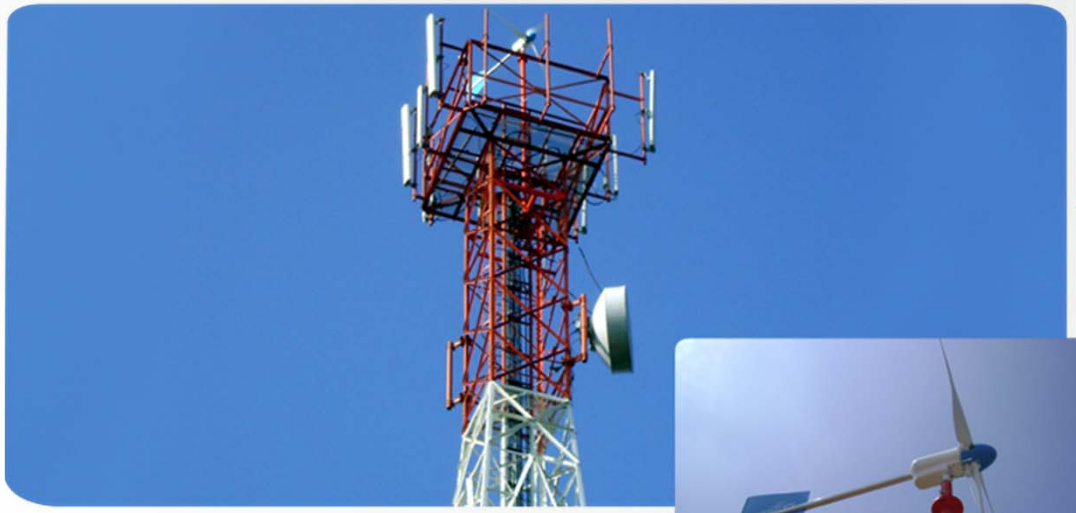
3 kW Southwest Wind Power Turbine Tower Head Mounted.

6 kW BP Solar PV array.

Prelim Observations : Wind Output Not Consistent, Solar Close to Expectation

Dialog Telekom – Green Power Trial Sites

Weerawila (Remote Costal)





Site Challenges : Unreliable Grid Power, High Availability Hub Site

Commercial Power Available, RE will be used as a Back-Up Source (Potential to Replace Standby Generator) and for Load Sharing (Grid Cost Reduction)

Hub Site Requiring Gen Backup (Previous)

Gen Free High Reliability (Trial)

Grid + Wind + Solar with Enhanced Power Reliability

Capex : USD50K

1 kW Kestrel Wind Turbine Tower Head Mounted.

2 kW BP solar PV array
1200AH Exide batteries

Load sharing Configuration

Prelim Observations : Wind Satisfactory, Solar on Target

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Dialog Telekom/GSMA Trial – Core Solution Vendors

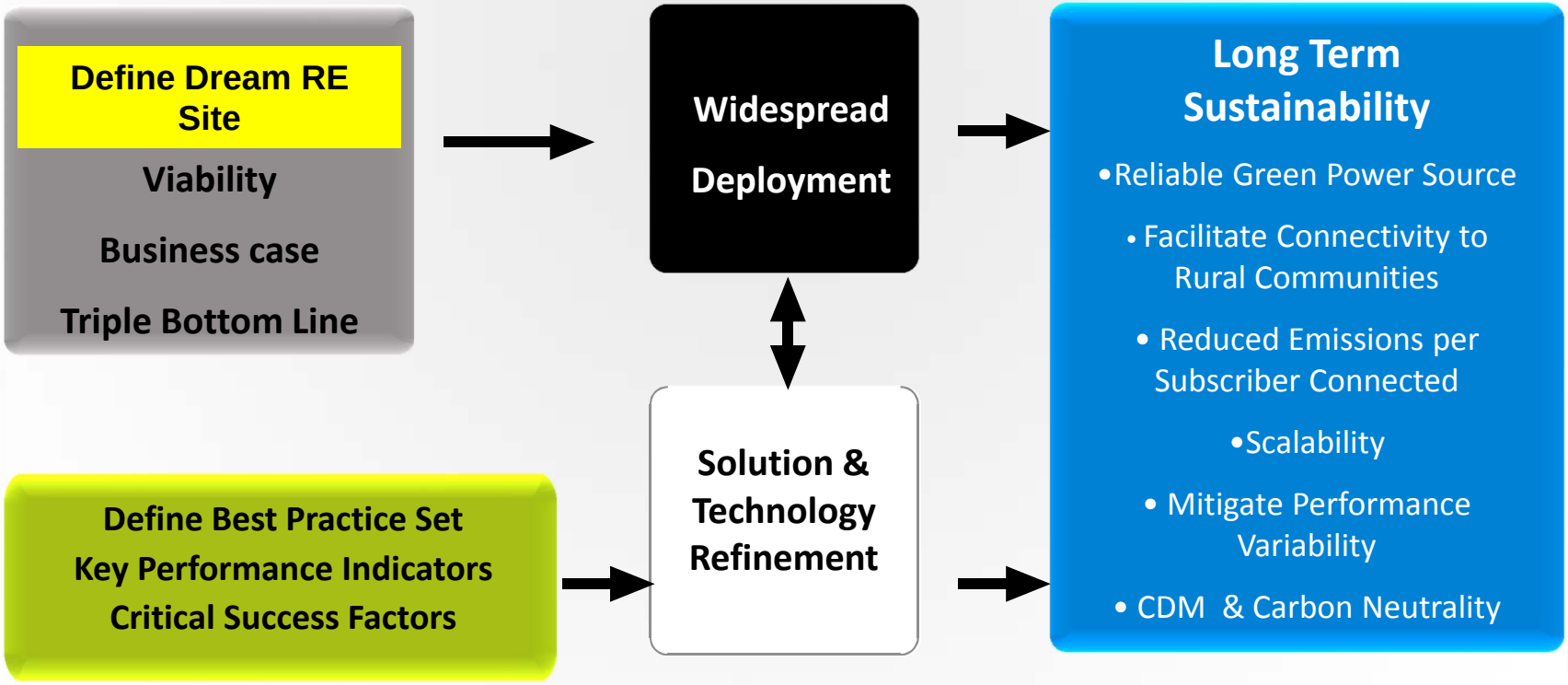
- ***Phase 1 – RE Equipment Vendors***
- Wind Turbines => Kestrel, Southwest Windpower,
- BP Solar – Solar panels
- Power Oasis – Power controllers
- Exide – Power batteries

Solar and Wind Core RE are the Primary Trial Targets at Dialog due to Higher Probability of Reaching Viability Benchmarks vis Operating Environment.

The Trial will be Extended to Other RE Options Subsequently

Supplementary Solution Vendor – Stultz Free Cooling Boxes

Dialog Green Power Vision



- Lever Project Results to Define Dream Site and Expectations
- Design-in Scalability in order to Lay Foundation for Green Network
- Lever Clean Development Mechanism (CDM) Towards a Carbon Neutral Position

Catalyze Public Policy on Green Energy for a Cleaner Planet

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The Mobile Industry and Its (Level 1) Environmental Footprint

The Env. Impact Within the Industry's Immediate Sphere of Control

- Resources
- Consumption & Depletion
- Energy (Direct / Indirect)
- Primary Raw Material
- Non Biodegradable Man Made Material

Manufacturers

Service Providers

Consumers

Level 1 Footprint

(+)

- Renewable energy
- Waste management
- Green Innovation
- Recyclable Materials

(-)

- Material Depletion
- Environmental Degradation
- Waste Streams
- Stock Piling of e-waste

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Looking Beyond Level 01

…. But the Mobile Industry has Been Proven to be an **All Pervasive Driver** of

- Economic Development &
- Social Development

Digital Empowerment
of the global citizen



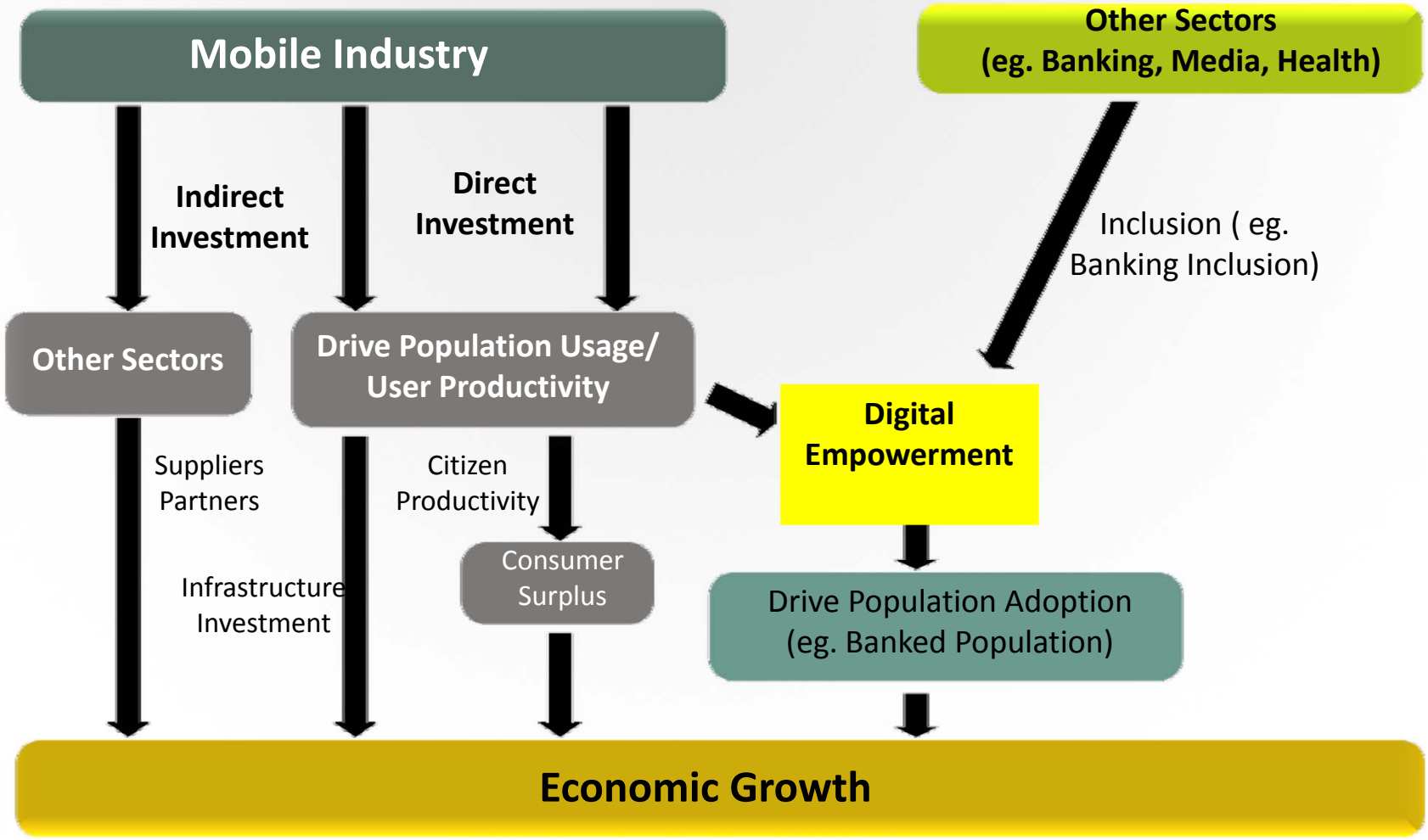


Information Society

"Mobile" Accelerates the Estabishment of a Citizen Driven Information Society

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Digital Empowerment & the Mobile Industry



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Information Societies are “Green”

The Mobile Industry should Apply Equal Focus to it’s Level 2 Environmental Footprint.

Net Environmental Footprint of the Mobile Industry

	Net Environmental Outcome	Environmental Outcome Derived From Socio Economic Development
	Level 01	Level 02
(+)	•Renewable energy •Waste management •Green Innovation •Recyclable Materials	•Positive Environmental Footprint of an Information Society • Diminishing Rates of Consumption • Enhanced Productivity
(-)	•Material Depletion •Environmental Degradation •Waste Streams •Stock Piling of e-waste	Health and Safety • EMF Concerns • Lifestyle Related

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Citizen Level 'Carbon' Equation

Net Footprint of Manufacturer

(+) & (-)

Mitigation

Recyclable Material

Green Innovation

Nano Materials

Net Footprint of Service Provider

(+) & (-)

Mitigation

Renewable Energy

Bridging the Digital Divide

Innovation

Waste Recycling

Digital Empowerment

Citizen

Information Society



(+)

- Positive Environmental Footprint of an Information society
- Diminishing Rates of Consumption
- Enhanced Productivity

(-)

- Health and Safety
- Rate of material
- Depletion
- Env' Degradation
- Waste Stock Piles

Net Positive Likely to Out-Weigh by Far the Negative Footprint?

Mobile – a General Purpose Technology (GPT)

ICTs have been recognized as General Purpose Technologies

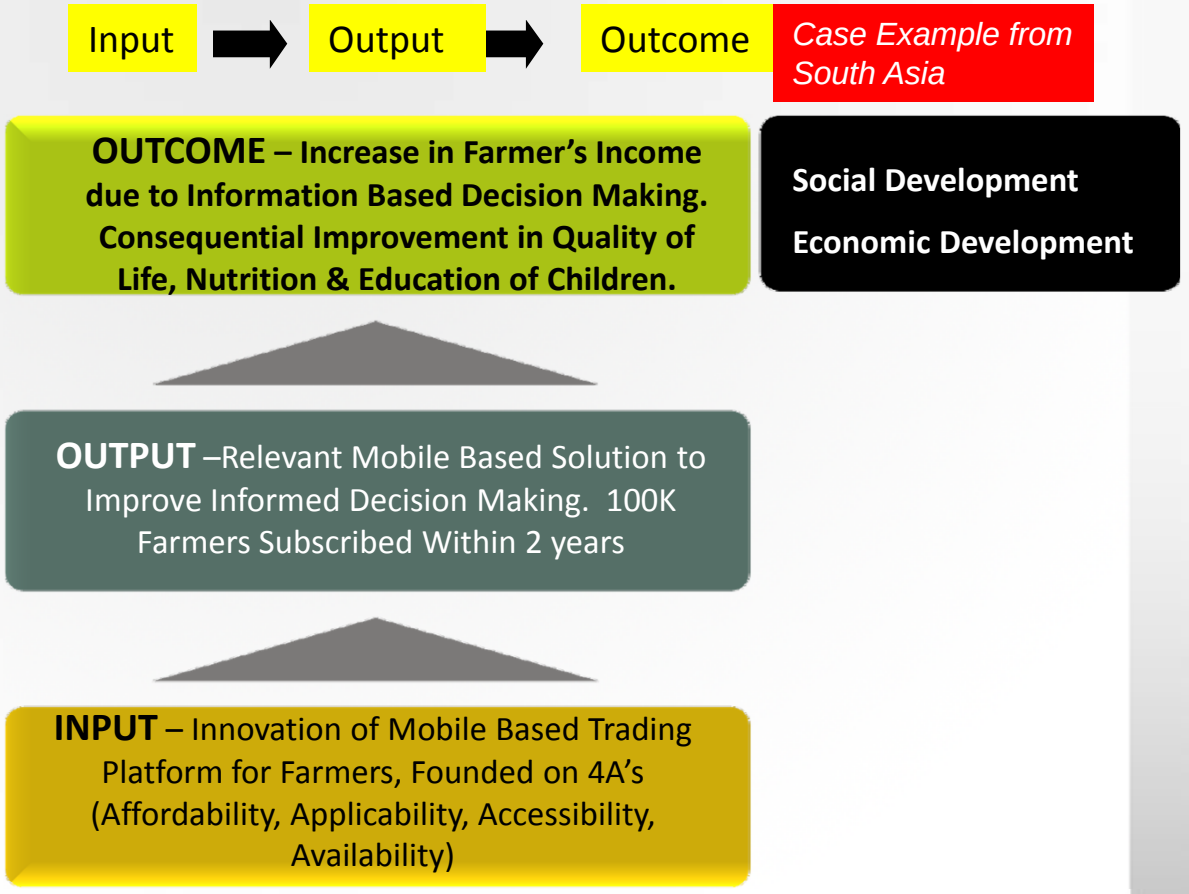
GPTs Have the Potential to:

- Transform Micro and Macro Economic Dynamics
- Enhance Productivity
- Create New Services and Markets

GPTs have 3 Characteristics

- Pervasiveness
- Improvement
- Innovation Spawning

Source: ITU

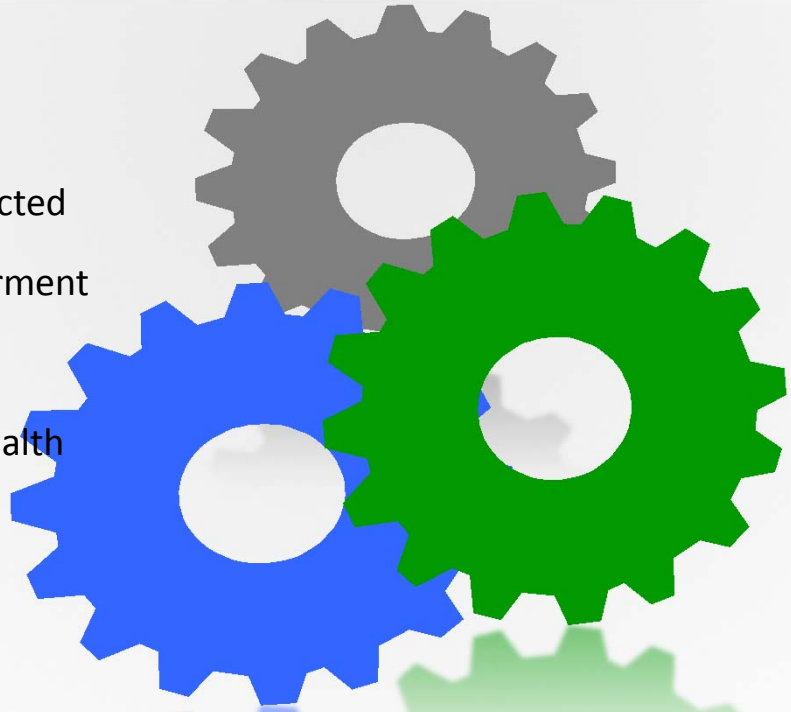


Mobile Telephony thereby has the Potential to Deliver Sustainable Development Across a Triple Bottom Line Business Model

Green Power for Mobile – the Triple Bottom Line

Societal

- Connecting the Unconnected
- Socioeconomic Empowerment
- Green Job Creation
- Improved Community Health
- Access to Knowledge
- Connectivity & ICT4D



Economic

- Capex Optimisation
- Green Power RoI
- Opex Optimization
- Business Model for BOP
- Carbon Credits & CDM
- Sustainability

Integration of TBL Results in Sustainable Development

Position as Mobile Industry Objective for the Next Decade?

Environmental

- Establishment of a Sustainable Development Model
- Cleaner Planet Through Reduced Emissions
- Minimum Alteration of Biophysical Environment & Ecosystems

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Conflicts and Conundrums

- **Long Term Vs Short Term**
  - Green Involves Long Term Payback
  - Post – Financial Crisis Cash Cycles are Increasingly Short
- **Investment & Effort Vs Reward**
  - Socioeconomic Dividends not Easily Measurable
  - CDM – Mechanism for Distributed Contribution?
  - Industry Often Under-Rewarded
    - Taxes
    - License / Spectrum fees

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The Mobile Industry – A Driver of Global Sustainability

More than 2/3rds of the World's Population is Digitally Empowered by the Mobile Industry

If We Can Manage Our **Primary Environmental Footprint** at **Close to Neutral** levels and Accelerate the Delivery of **Socio-Economic Development** We could collectively **Drive Global Sustainability**

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