Green Power for Mobile
Operator Trials and Projects
Dubai Working Group Meeting (March, 2009)

GSMA Development Fund

David Taverner

Programme Manager

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Presentation Objectives

- Present real life key learnings from green power implementations
- Highlighted that green power solutions are financially and technically viable
- Use of green power solutions is a complex process and operators are advised to seek external assistance until sufficiently skilled

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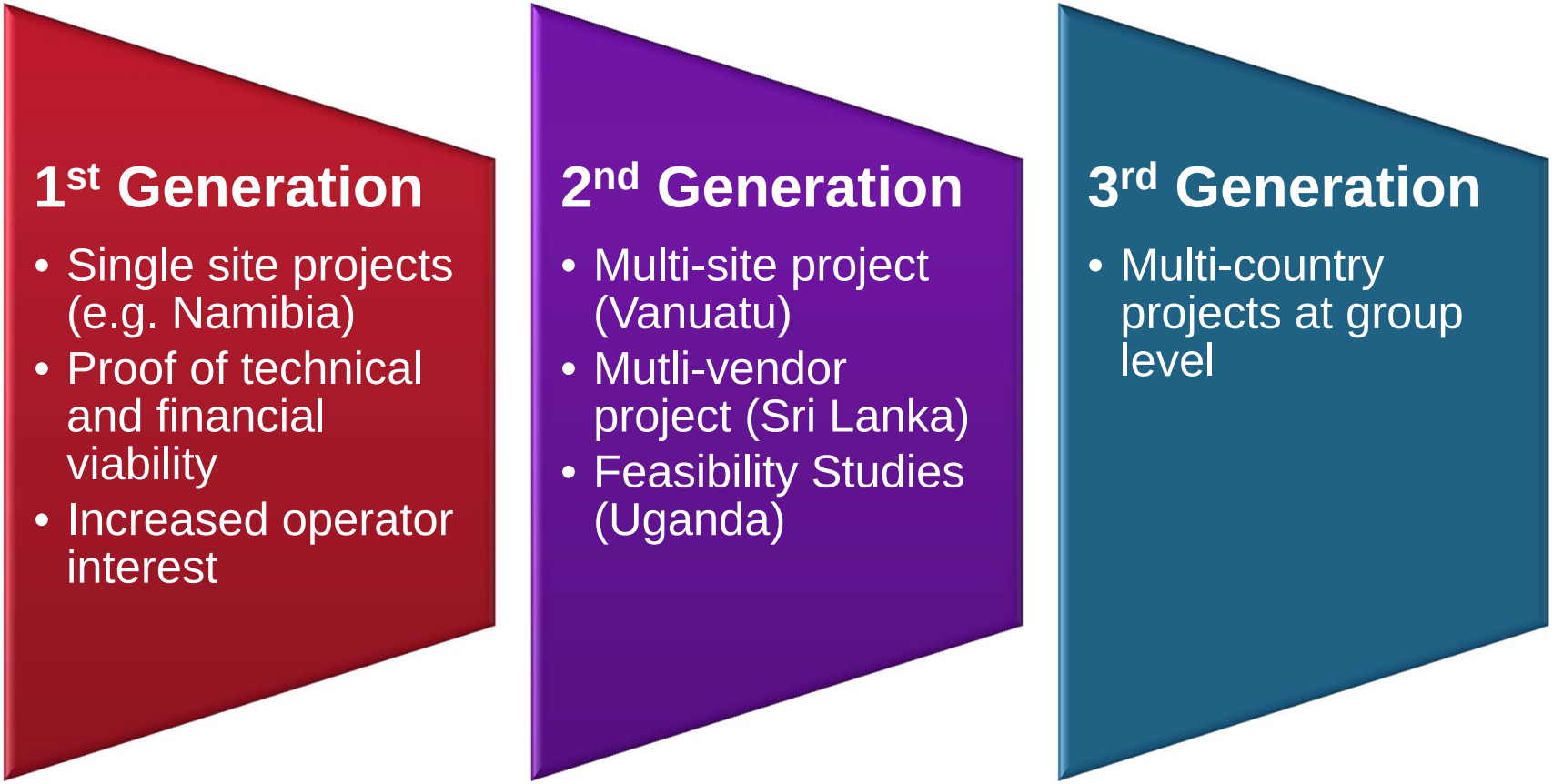
Agenda

- History of GPM Projects
- Project Delivery Model
- Digicel Vanuatu Case Study
- Wrap Up and Questions
- Appendix – Operator Project Experience

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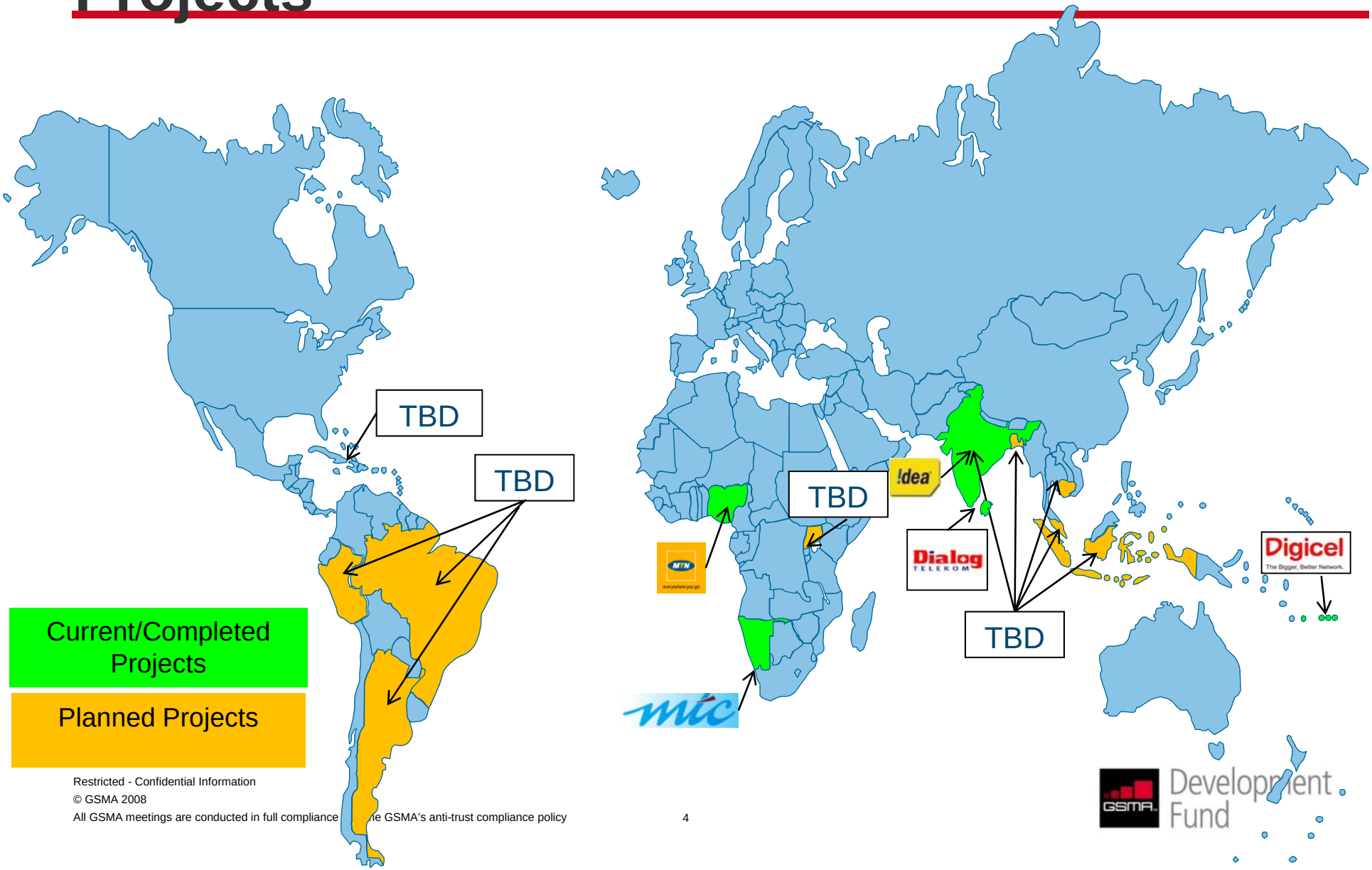
Green Power for Mobile - Evolution of Project Delivery



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Green Power for Mobile – Operator Projects



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Single Site Solar/Wind Hybrid BTS Trial in Nambia – MTC



- Confirmed **technical viability** of solar/wind solution supporting a 1.2kW base station
- Confirmed **financial viability** of less than 3 year payback period
- GSMA report available now

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Multi Site Biodiesel BTS Trial in India – **Idea Cellular**



- Test the **technical feasibility** of jatropha biodiesel for use in base station diesel generators
- Definition of the **operations and maintenance process**
- Definition of **logistical processes**
- Idea Cellular now biodiesel at more than **350 base stations**
- GSMA report available now

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Commercial Scale Rollout of Solar/Wind Hybrid BTS in Vanuatu (25 sites) – Digicel



- Demonstrated the viability of wind and solar solutions in **commercial scale rollouts**
- Define **best practice methodology** for commercial scale rollouts
- Understand **disaster planning** considerations in hazardous environment
- GSMA report available in May

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Commercial Scale, Multi-Vendor Rollout of Solar/Wind Hybrid in Sri Lanka (10 sites) – Dialog



- Define a **best case renewable energy** site
- Use both **renewable energy** and **energy efficiency** approaches
- Identify which technologies were suited to **specific network scenarios**
- Highlight the multitude of **top-tier green power vendors**

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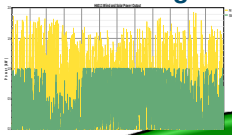
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Project Delivery Model

Site Designs



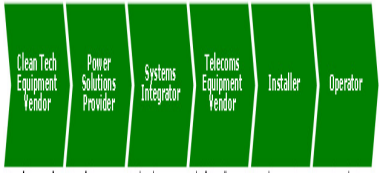
Solution Design Tools



Template Project Plans



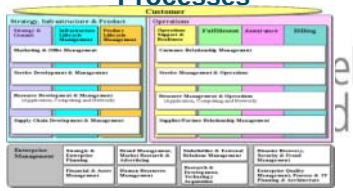
Value Chain



Centre of Excellence Development



Impact on Organisation Processes



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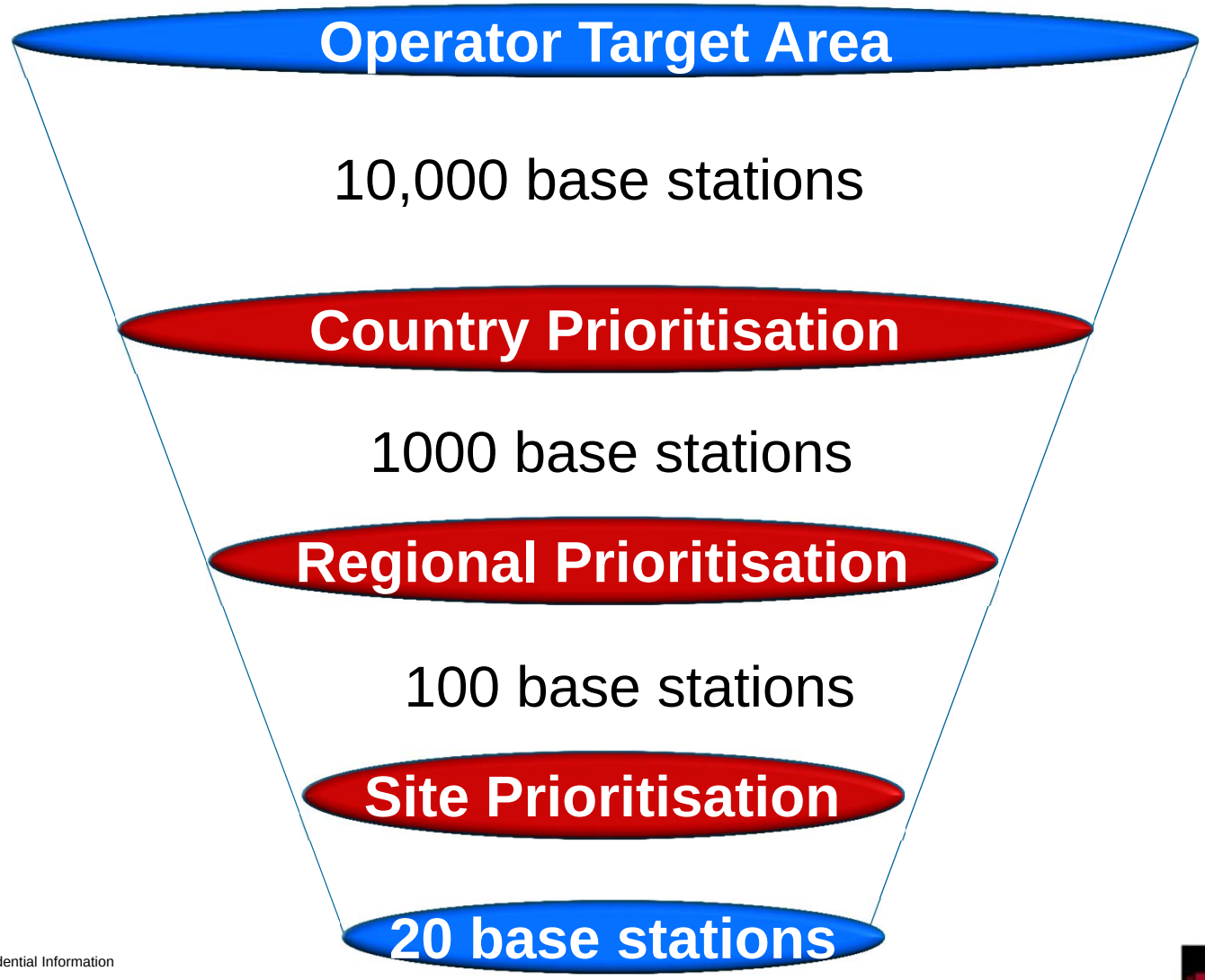
Develop Repeatable Implementation Plans

	% Complete	Owner	WBS	Task Name	Document Deliverable	Duration	Start	Finish	Predecessors	Resource Names
1	**9%**		**1**	**Scoping Phase**		**69 days?**	**Tue 03/02/09**	**Fri 08/05/09**		
2	**21%**		**1.1**	**Project Management**		**57 days?**	**Tue 03/02/09**	**Wed 22/04/09**		
3	80%	ramme Manager	1.1.1	Baseline Project Plan	Yes	4 days?	Tue 03/02/09	Fri 06/02/09		GSMA Programme Man
4	70%	ramme Manager	1.1.2	Scoping Phase Project Bud	Yes	4 days?	Tue 03/02/09	Fri 06/02/09		GSMA Programme Man
5	50%	ramme Manager	1.1.3	Establish Core Team	Yes	4 days?	Tue 03/02/09	Fri 06/02/09		GSMA PM,Operator PM
6	0%	GSMA PM	1.1.4	Setup Project Documentatio	Yes	5 days?	Mon 09/02/09	Fri 13/02/09		GSMA PM
7	0%	GSMA PM	1.1.5	Setup Project Document Re	No	5 days?	Mon 09/02/09	Fri 13/02/09		GSMA PM
8	80%	gramme Manage	1.1.6	Complete Project Definition I	Yes	4 days?	Tue 03/02/09	Fri 06/02/09		GSMA Programme Man
9	0%	GSMA PM	1.1.7	Establish KPIs	Yes	15 days?	Mon 09/02/09	Fri 27/02/09		GSMA PM,Operator PM
10	0%	GSMA PM	1.1.8	Complete Scoping Phase Ki	No	1 day?	Wed 04/03/09	Wed 04/03/09	14	All
11	0%	GSMA PM	1.1.9	Complete Scoping Phase Cl	No	1 day?	Wed 22/04/09	Wed 22/04/09		All
12	0%	GSMA PM	1.1.10	Implementation Phase Proje	Yes	10 days?	Mon 06/04/09	Fri 17/04/09		Operator PM,GSMA Tec
13	**0%**		**1.2**	**Solution Design**		**30 days?**	**Mon 23/02/09**	**Fri 03/04/09**		
14	0%	Technical Lead	1.2.1	Country Prioritisation	Yes	5 days?	Mon 23/02/09	Fri 27/02/09		GSMA Technical Lead
15	0%	Technical Lead	1.2.2	Regional Prioritisation	No	12 days?	Thu 05/03/09	Fri 20/03/09	10	GSMA Technical Lead,
16	0%	Technical Lead	1.2.3	Site Prioritisation	Yes	10 days?	Mon 23/03/09	Fri 03/04/09	15	GSMA Technical Lead
17	0%	Technical Lead	1.2.4	Site Dimensioning	Yes	10 days?	Mon 23/03/09	Fri 03/04/09		GSMA Technical Lead
18	0%	Technical Lead	1.2.5	Site Design	Yes	10 days?	Mon 23/03/09	Fri 03/04/09		GSMA Technical Lead
19	**0%**		**1.3**	**Communications and Mark**		**69 days?**	**Tue 03/02/09**	**Fri 08/05/09**		
20	0%	ger,Operator PM	1.3.1	External Press Release	Yes	10 days?	Mon 27/04/09	Fri 08/05/09		GSMA Programme Man
21	0%	ger,Operator PM	1.3.2	Complete Case Study	Yes	10 days?	Mon 27/04/09	Fri 08/05/09		GSMA Programme Man
22	0%	ger,Operator PM	1.3.3	Present at Industry Events	No	1 day?	Tue 03/02/09	Tue 03/02/09		GSMA Programme Man
23	**0%**		**2**	**Implementation Phase**		**1 day?**	**Tue 03/02/09**	**Tue 03/02/09**		
25	**0%**		**3**	**Monitoring and Evaluation Phas**		**1 day?**	**Tue 03/02/09**	**Tue 03/02/09**		

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Prioritise Countries then Regions then Sites

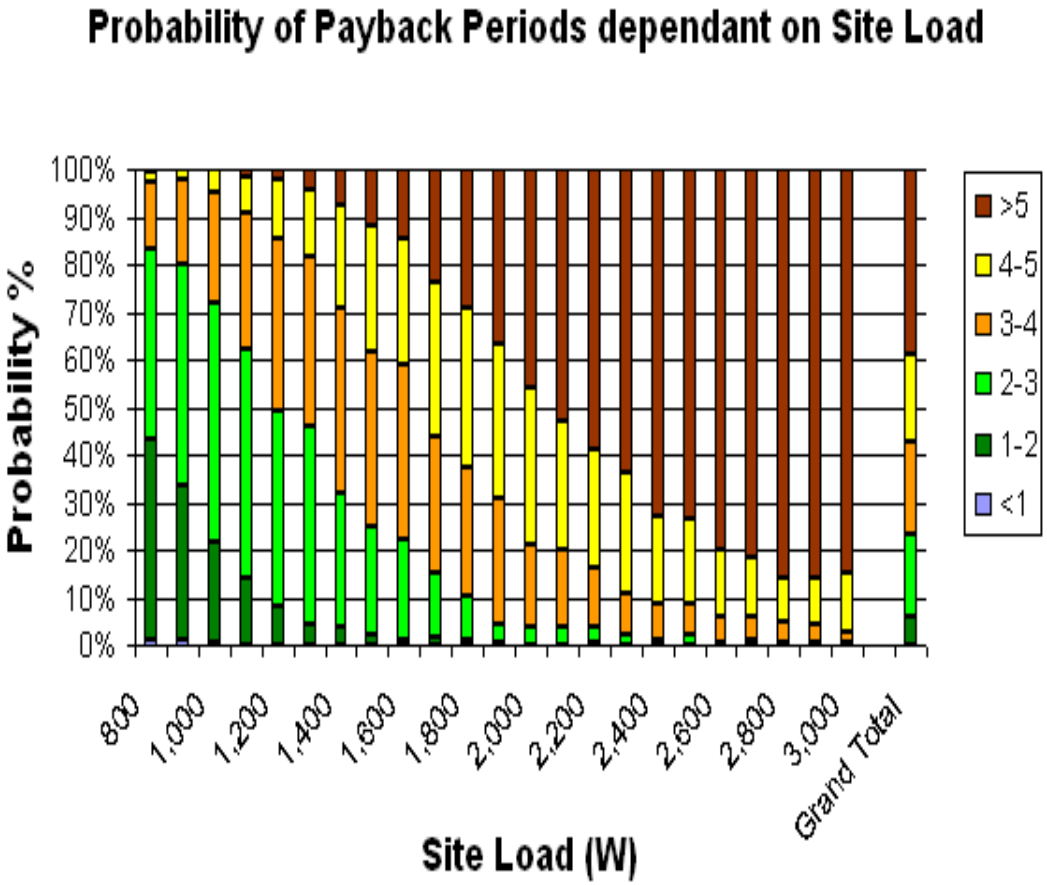


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Forecast Financial Viability at Country Level

Uganda Financial Viability



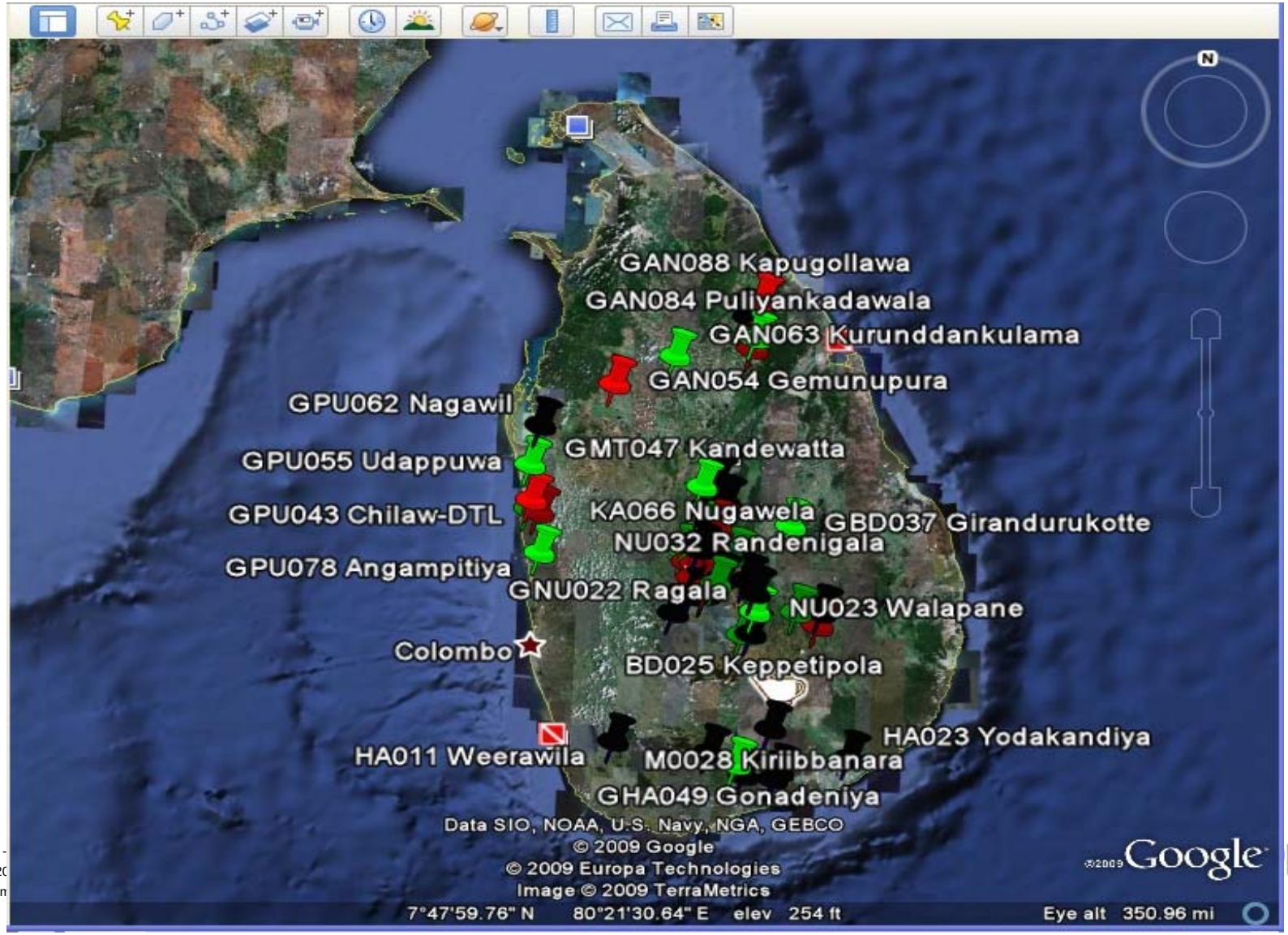
Retail price of diesel (US$) *	1.56
Probability of GP BTS payback within 3 years (%)	23.2
Probability of GP BTS payback within 5 years (%)	61.1

* Source: GSMA Member Operators

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Identify Geographic Locations of the Base Stations and Prioritise Regions



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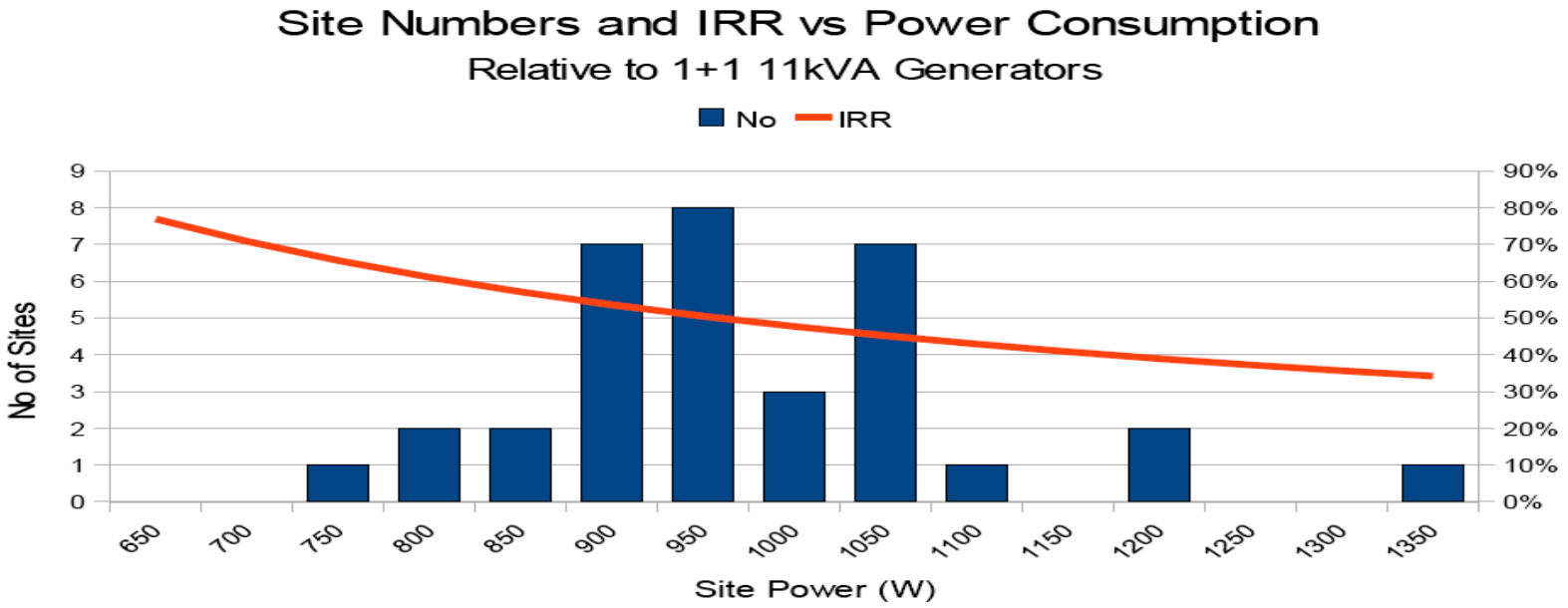
Cross Reference Priority Regions against Climate Data



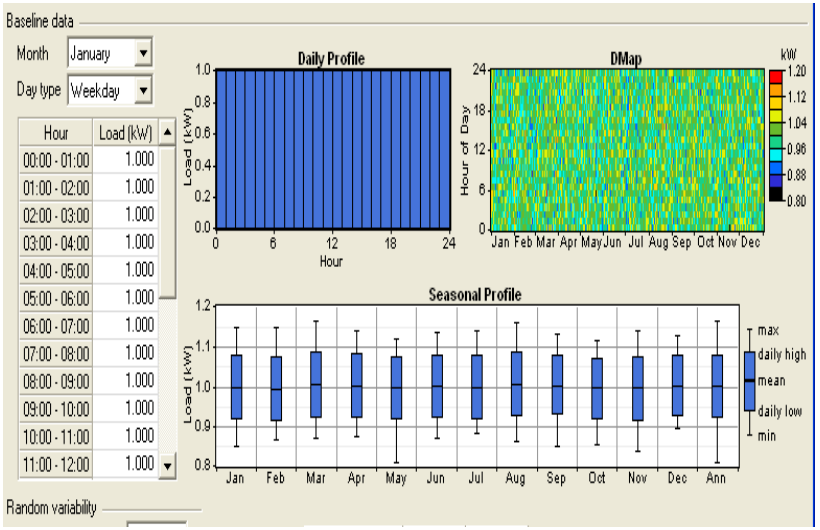
Prioritise Sites by Financial Viability

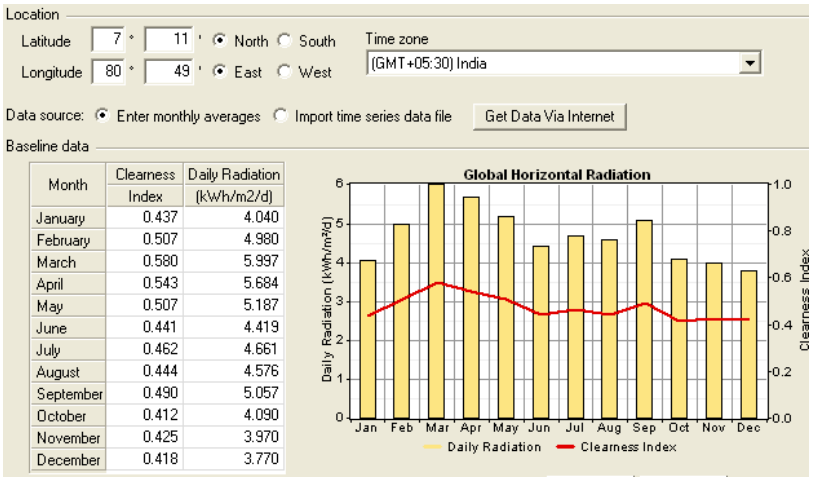
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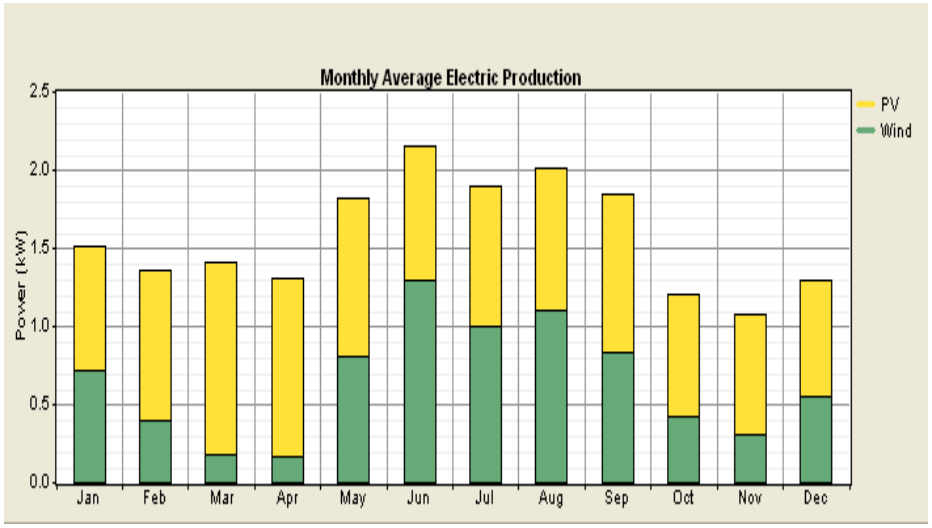
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Site ID	Site Name	elevation	Latitude	Longitude		Site Type	Current pov	Utility powe	Ease of acce	SGH Site notes	SGH google	wind assess	GSM
2	GHA028	Ridiyagama	70	6° 09' 50.18"	81° 00' 24.08	Hambanthota	Existing	Generator	Difficult	Manual delive	Flat by sea– coconut groves	ok	clear	2+4+2
3	GAN106	Welimuwapot	70	8° 34' 23.90"	80° 46' 54.80	Anuradhapur	Existing	Generator	Difficult	Possible by v	flat plains no sea	ok	clear	2+2+2
4	GPU062	Nagawil	60	7° 58' 01.26"	79° 49' 54.68	Puttlam	Existing	Generator	Possible	Manual delive	suburban site by sea	good	clear	3+2+3
5	MT007	Naula	70	7° 41' 51.22"	80° 39' 30.05	Mathale	Existing	Generator	Difficult	Possible by v	NS valley in hills (200m high 2km E a	ok	clear	3+3+4(GSM)/3+2+3(DCS)
6	MT022	Kawdupelella	70	7° 33' 58.35"	80° 37' 11.24	Mathale	Existing	Generator	Difficult	Manual delive	slight ridgeline	good	clouds close	4+4+3(GSM)/3+3+3(DCS)
7	NU023	Walapane	70	7° 06' 49.81"	80° 51' 35.76	Nuwaraeliya	Existing	Generator	Difficult	Manual delive	on top of hill – 200m higher hill 2km e	good	clear	2+2+2(GSM)/2+2+2(DCS)
8	KA079	Poojapitiya	60	7° 23' 12.59"	80° 35' 10.95	Kandy	Existing	Generator	Difficult	Manual delive	hilltop site in hilly area trees?	good	clear	2+2+2(GSM)/2+3+3

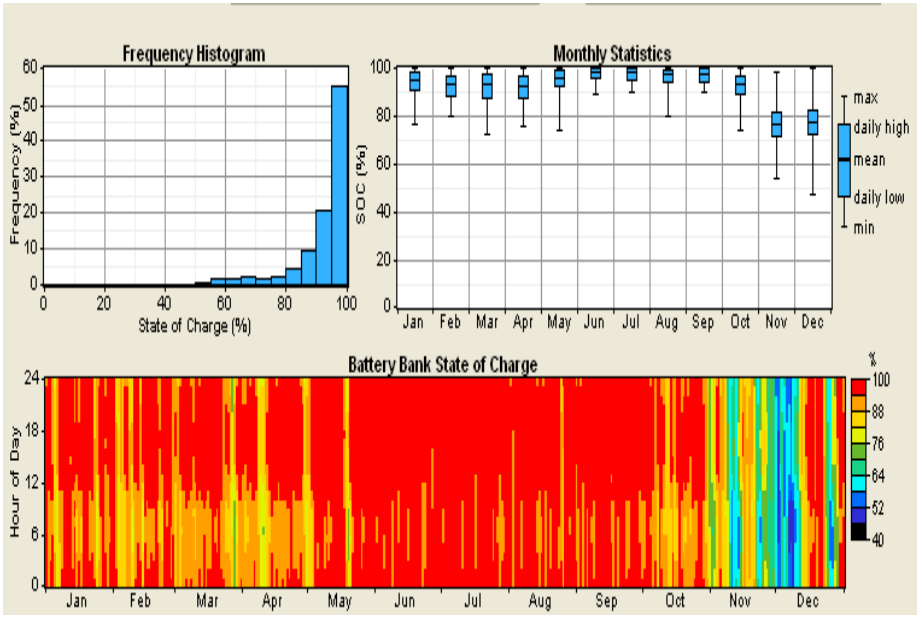


Use Software to Dimension the Renewable Energy Equipment









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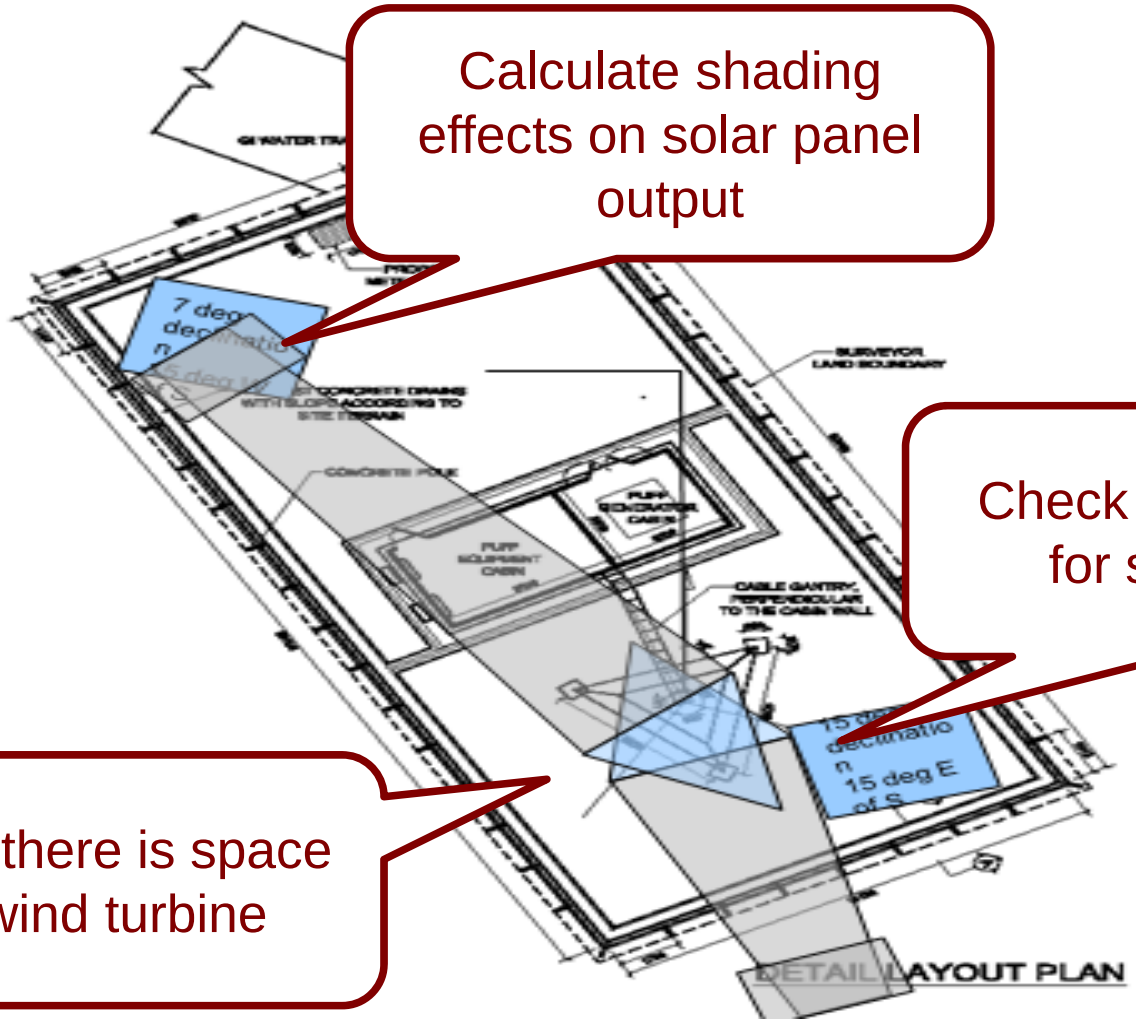
Generate Accurate Financial Forecasts of Solution Options

	Best Financial "green" solution	Proposal 1 (SWW)	Proposal 2 (Kestrel)
Kandewatta	0 PV 3kW SWW 7.5 kVA Gen 4.5 kW Con 500Ah 48V Batt SSC controller	2.5kW PV 3kW SWW 7.5 kVA Gen 4.5 kW Con 1000Ah 48V Batt SSC controller	3kW PV 1kW Kestrel 7.5 kVA Gen 4.5 kW Con 1000Ah 48V Batt SSC controller
Payback period	1.9 yr	2.73yr	2.84
ROI	52.60%	36.60%	35.20%
IRR	53.22%	37.50%	36.64%
NPV	$39,805	$30,375	$27,615
Autonomy	13.7 hr	27.4 hr	27.4
Renewable vs Generator/Grid	Wind 70% Gen 30%	PV 30% Wind 64% Gen 7%	PV 45% Wind 28% Gen26%
Capex	$32,080	$48,405	$47,340

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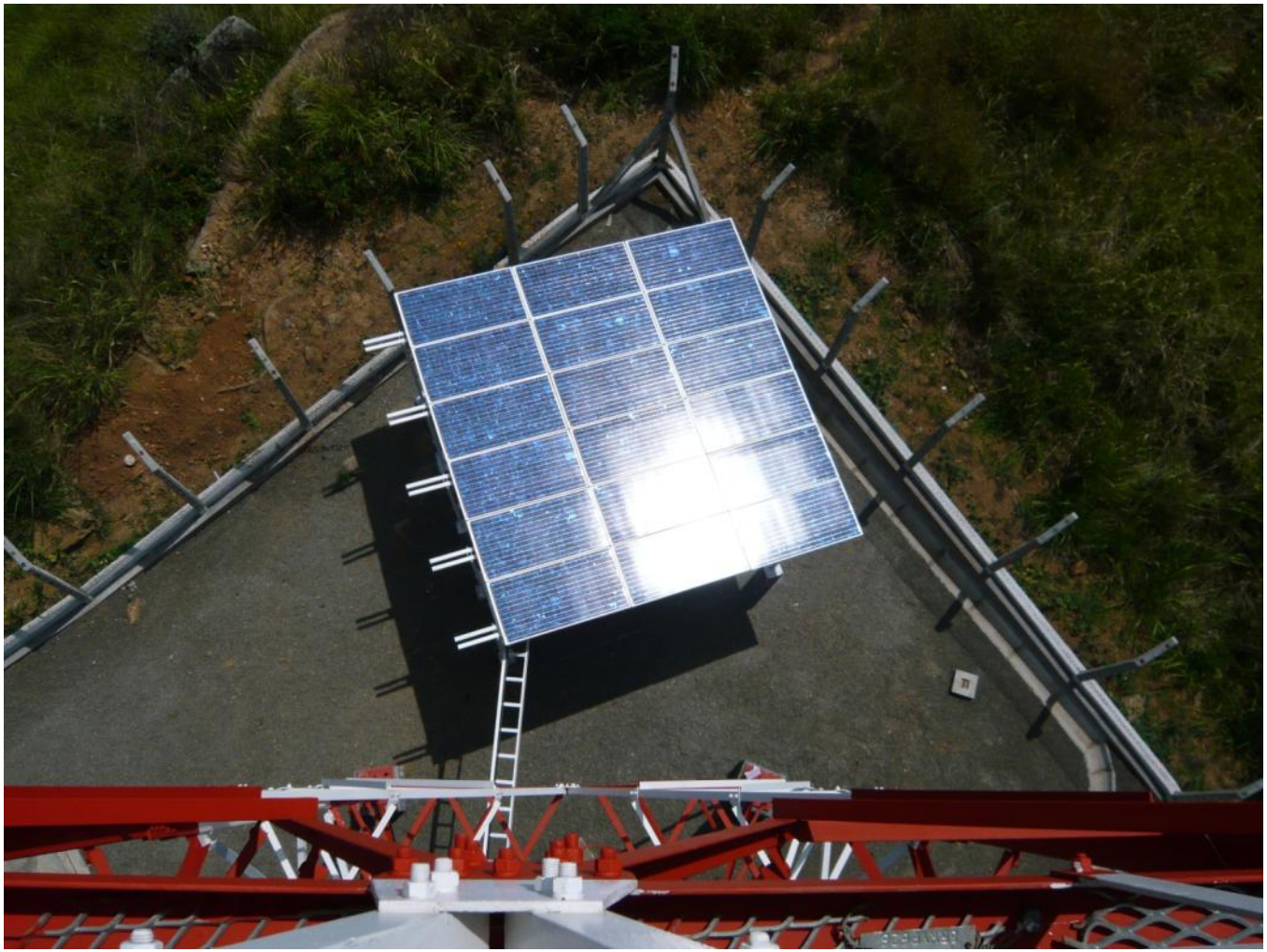
Complete Site Designs and Ensure Space Available for Renewable Energy Equipment



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Build Site with Operator Civil and Electrical Engineering Teams



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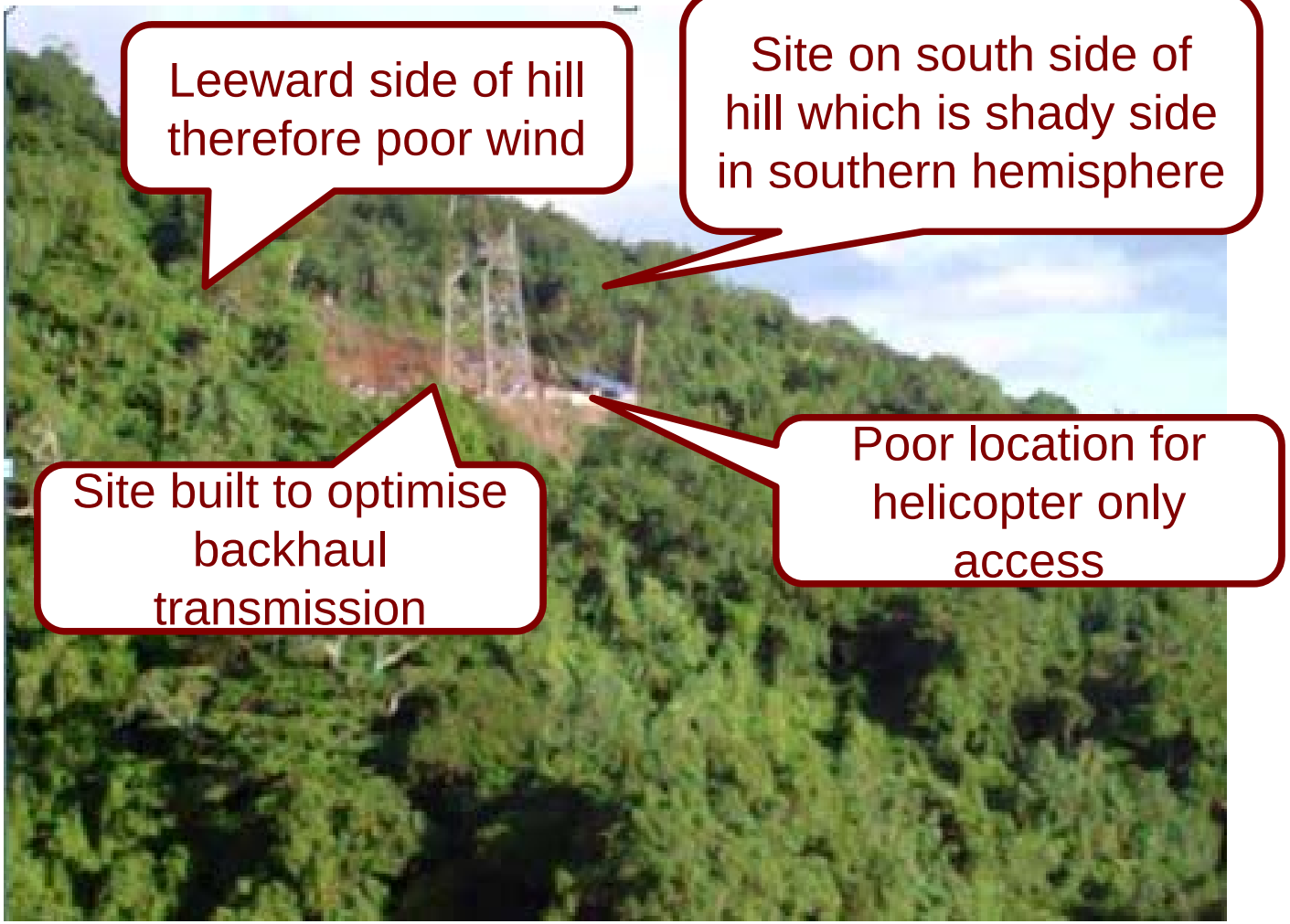
Commercial Scale Rollout of Solar/Wind Hybrid BTS in Vanuatu (25 sites) – Digicel



- Demonstrated the viability of wind and solar solutions in **commercial scale rollouts**
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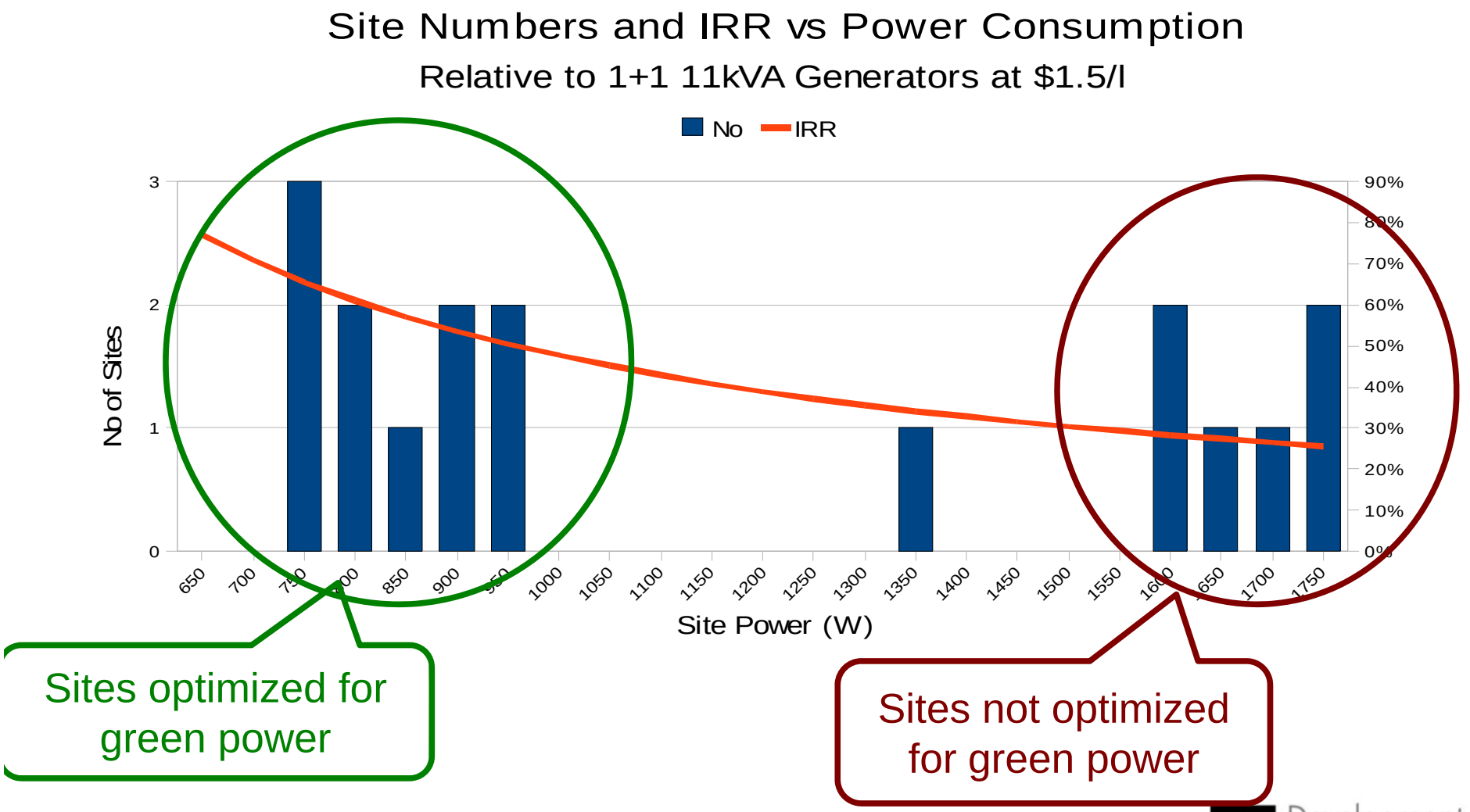
Consider Power as a Key Component of Network Planning



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Minimise Site Power Consumption



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Plan Remote Off-grid Sites for Wind and Solar

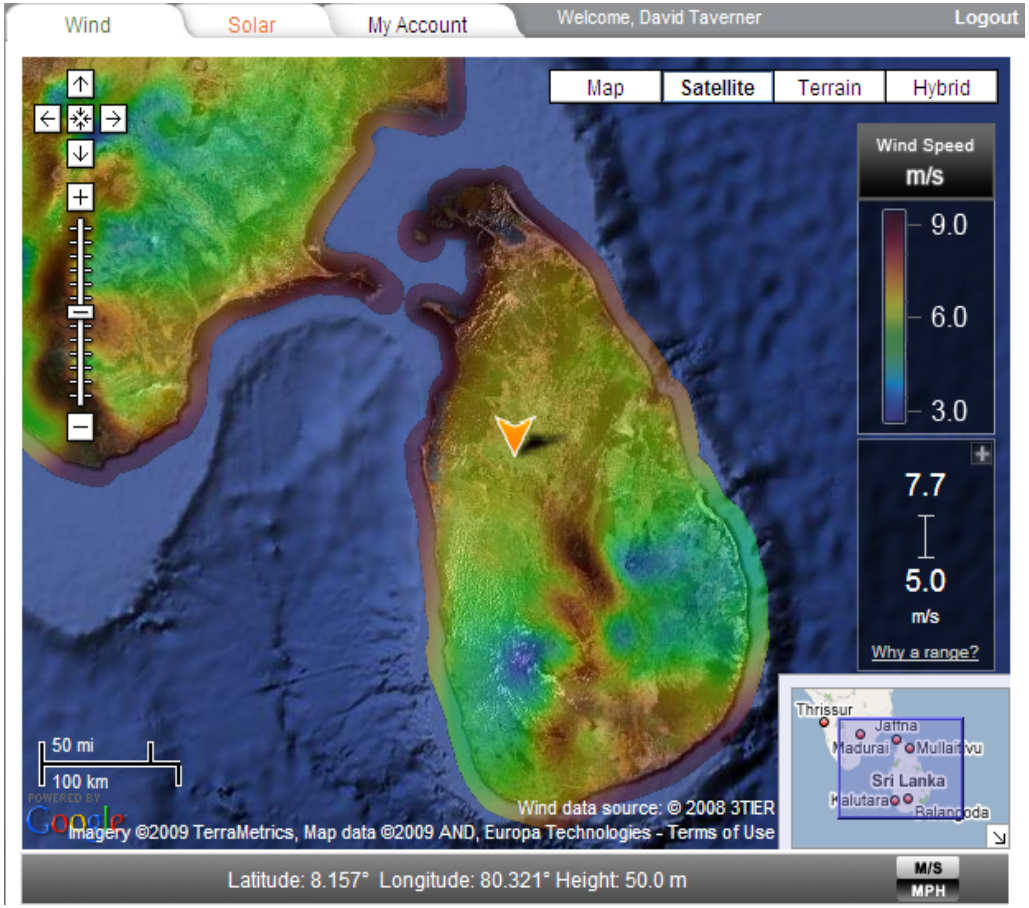


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Obtain Site Climate Data from Databases

ATMOSPHERIC SCIENCE DATA CENTER



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Confirm Climate Data with Local Micro-Climate Experts





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Use Mast-Head Wind Turbines Wherever Possible





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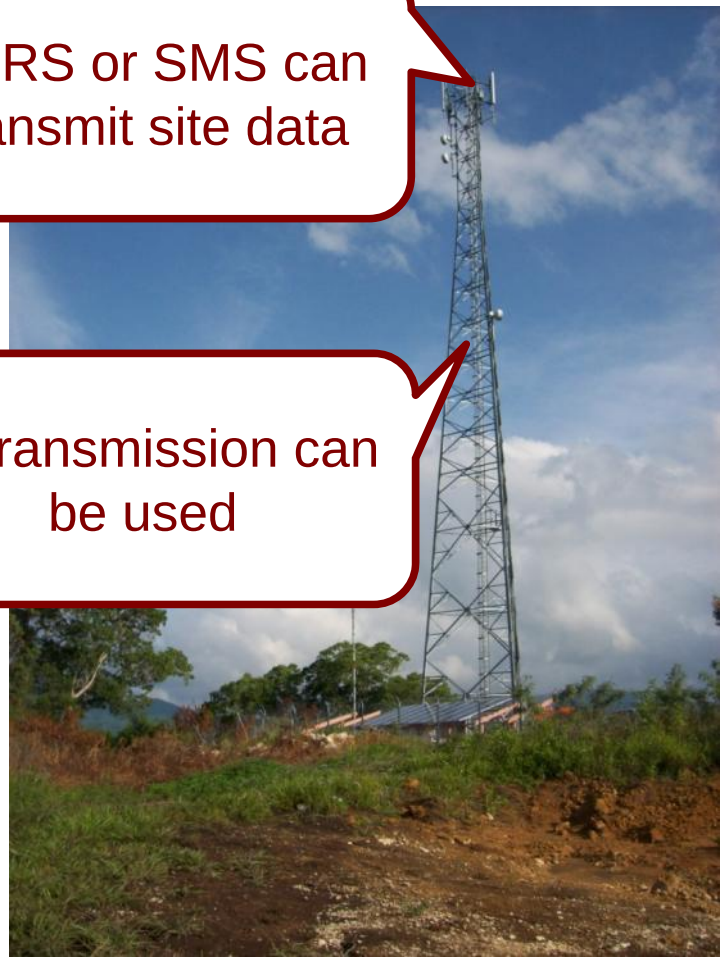
Remote Monitoring and Control of the Site is Critical

Advanced power controllers allow remote monitoring and control of site



GPRS or SMS can transmit site data

Or transmission can be used



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Presentation Objectives

- Present real life key learnings from green power implementations
- Highlighted that green power solutions are financially and technically viable
- Use of green power solutions is a complex process and operators are advised to seek external assistance until sufficiently skilled

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Contact

- Please contact dtaverner@gsm.org for further information and detailed project reports

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Operator Project Experience – MTC Namibia

Single site solar/wind hybrid BTS trial in Nambia

Situation:

In April 2007, the GSMA Development Fund, together with Mobile Telecommunications Limited (MTC) of Namibia and Motorola, commissioned a trial site for a wind and solar power solution to support the operator's remote GSM cellsites.

The purpose of the 90-day trial was to validate the use of wind and solar power as a feasible and cost-effective alternative to using fuel generators at sites where the main grid connection is not available, too costly to run, or would take months, even years, to connect.

Project Approach:

Phase 1 (Feb 07 – April 07)

- Defining renewable power system KPIs
- Stakeholder management of operator and vendor to ensure solution design for base station site complete
- Installation of solar/wind hybrid site

Phase 1 (May 07 – Sept 07)

- Site monitoring to capture live KPI data
- Calculation of business case for solar/wind solution against grid and diesel options
- Monitoring and evaluation of system performance
- Documented project results and lessons learnt

Results:

- Technical viability of wind & solar base stations demonstrated by 90-day evaluation and monitoring confirming that ouput was sufficient to reliably power the 1400W- 1800W, 6-carrier base station
- Financial viability demonstrated with a forecast payback period of three years

Albertus Aochamub, Corporate Services General Manager, MTC Namibia quoted:

"With the implementation of cell sites into more remote areas the Motorola solution provides us with an efficient and reliable alternative to the often costly roll-out of mains grid electricity. It is a commitment to our customers to provide the essential communication services needed in the region."

Further Materials:

- Case Study
- Press Release

Operator Project Experience – Idea India

Multi site biodiesel BTS trial in India

Situation:

Local Operator IDEA Cellular, Ericsson and the GSMA's Development Fund teamed up to develop biodiesel as a power source for wireless networks in rural India. In a pilot project, biodiesel will be used to power mobile base stations located in Pune, Maharastra, where mains electricity is highly unreliable.

Project Approach:

Phase 1 (Technical Testing)
- Technical test of biodiesel B100 in new diesel generator
- Technical test of HSD in new diesel generator for benchmarking purposes
- Quality test of biodiesel produced by supplier to ensure it meets standard EN21214

Phase 2 (Rollout Scheduling and Management)
Definition of following:
- Base stations details
- Map of locations
- Storage of biodiesel
- Process for refuelling
- Performance monitoring

Phase 3 (Socio-economic Workshop)
- Initial report from NGO BAIF detailing estimates of costs involved in workshop delivery and ongoing operational cost
- Final report detailing delivery, ownership and costs involved. Also involves metrics for performance monitoring.

Results:

The original scope to power between 20 – 40 base stations by mid 2007 in the Maharashtra region has been significantly expanded with 100's of sites in the network now powered by biodiesel.

Sanjeev Aga, Managing Director of IDEA Cellular quotes:

"Almost three-quarters of India's population lives in rural areas that often lack a reliable power supply," said Sanjeev Aga, Chairman of IDEA Cellular. "Biofuels will help us further extend mobile coverage into these areas bringing major economic and social benefits to rural communities."

Further Materials:

- Case Study
- Press Release

Operator Project Experience – Digicel Vanuatu

Commercial scale rollout of solar/wind hybrid BTS in Vanuatu (25 sites)

Situation:
Digicel Vanuatu and GSMA have partnered to deploy wind and solar energy solutions to 25 base stations on the Pacific archipelago of Vanuatu. By Feb 2009 it is expected that 33 green powered sites (including 8 low power RF repeaters) will have been deployed. This will bring Digicel's network to approximately 65% green powered.

Project Approach:

Phase 1 (May 08 – October 08)

- Defining renewable power system KPIs
- Reviewing site power consumption on all off-grid sites
- Preparing business case calculations for green energy on off-grid sites
- Site visits to ascertain site suitability for green energy
- Preparing a short-list of suitable sites for green energy for agreement with Digicel
- Dimensioning agreed sites and preparing BoMs for green energy materials to be shipped to each site

Phase 2 (October 08 – April 09)

- Dimension agreed sites (8 GSM sites plus 1 MW repeater site) and prepare BoM of green energy materials to be shipped to each site
- Design and dimensioning of RF repeater renewable power systems
- Advising on renewable equipment purchases, including upgrades to existing sites
- Documented rollout methodology, key learnings and project results

Results:

- The Digicel Vanuatu project is being used as a template approach for rolling out renewable energy across Digicel Group's networks around the world . Tanya Menzies, CEO of Digicel Vanuatu quotes:

"The work we are doing in Vanuatu is particularly important to the Digicel Group, as it's serving as a model for alternative power deployments for other Digicel networks around the world"

- Digicel Vanuatu now carries more than 60% of its network traffic on base stations powered by renewable energy sources
- The total number of renewable energy powered base stations is currently 25 and is expected to expand to 33
- A payback period of less than 3 years has been forecast for the majority of sites

Further Materials:

- Press Release

Operator Project Experience – Dialog Sri Lanka

Commercial scale, multi-vendor rollout of solar/wind hybrid BTS in Sri Lanka (10 sites)

Situation:

Dialog Telekom and GSMA have partnered to deploy ten solar and wind-powered base stations in Sri Lanka. This will save up to 109,000 litres of diesel per annum and cut carbon emission by up to 294 tonnes per annum.

The trial will assess the plethora of renewable energy providers in the marketplace today by deploying equipment from eight top-tier vendors.

Project Approach:

Phase 1 (October 2008 to February 2009):

- Defining renewable power system KPIs
- Prioritising target 10 sites from an on-grid and off-grid network shortlist of 51 sites
- Site visits to ascertain site suitability for green power & reviewing site power consumption on all target sites
- Preparing business case calculations for green power on off-grid sites
- Dimensioning agreed sites and preparing BoMs for green energy materials to be shipped to each site
- Identification of top-tier equipment vendors
- Implementation of 2 sites

Phase 2 (February 2009 to July 2009):

- Preparing business case calculations for remaining 8 sites
- Dimensioning remaining 8 sites and preparing BoMs for green energy materials to be shipped to each site
- Implementation of 8 sites
- Documented rollout methodology, key learnings and project results

Results:

Project is incomplete. Results to be confirmed in future.

Further Materials:

- Press Release