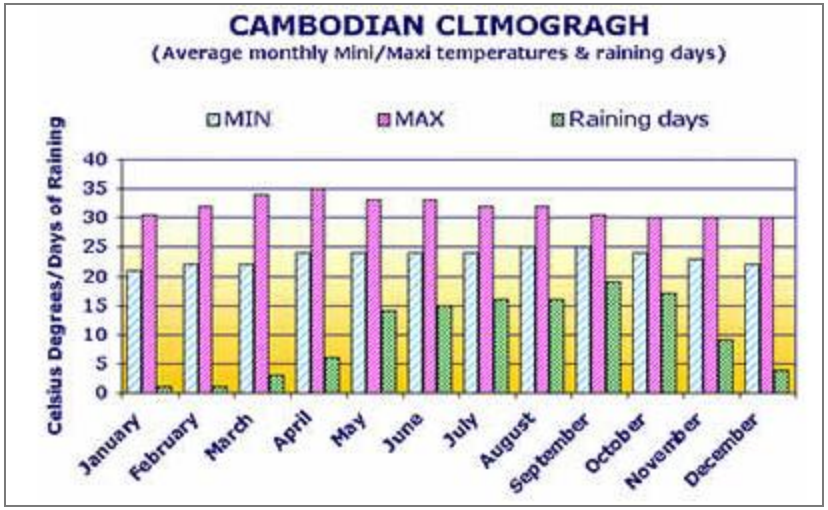
SOTELCO
(BEELINE CAMBODIA)
GREEN POWER
SOLUTIONS
(SOLAR-DG-CDC)



General Information: About Cambodia

Country Profile	
Name	Cambodia
Population	13,388,910
GDP	$13,001,000,000
Energy Consumption	0.07 Quadrillion Btu
2-letter ISO code	KH
3-letter ISO code	KHM
Numeric ISO code	116
UN Region[1]	South-Eastern Asia



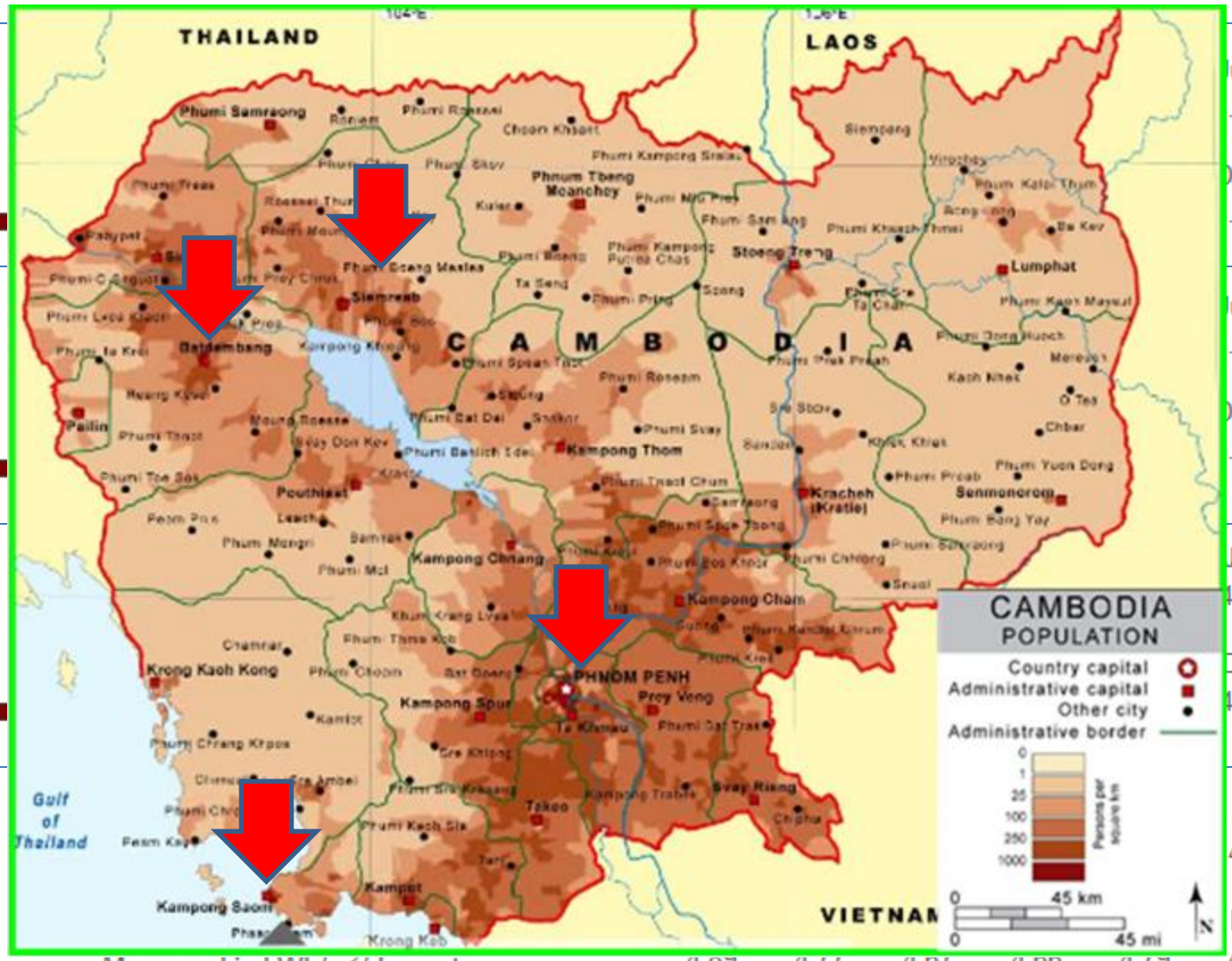
Energy Resources

Resource	Value	Units	Rank	Period	Source
Wind Potential	0	Area(km²) Class 3-7 Wind at 50m	91	1990	NREL
Solar Potential	545,084,675	MWh/year	83	2008	NREL
Coal Reserves	Unavailable	Million Short Tons	N/A	2008	EIA
Natural Gas Reserves	0	Cubic Meters (cu m)	196	2010	CIA World Factbook
Oil Reserves	0	Barrels (bbl)	195	2010	CIA World Factbook



Source - http://en.openei.org/wiki/Cambodia

General Information: Solar Potential



Measured in kWh/m²/day onto a horizontal surface:

Jun	Dec	Jun	Dec	Jun	Dec	Jun	Dec
.61	.91	.17	.23	4.99	4.85	4.99	4.85

Calculation Source: http://solarelectricityhandbook.com/solar-irradiance.html

Case Study: Considerations



72% of Sotelco sites are Green Field (GF) Sites
88% of the GF sites are Full Outdoor Sites
95% of GF sites are in Rural Areas



In Rural Areas, 61% are Off-Grid Sites



Case Study: Key Drivers



- Increasing Fuel Cost
- Low ARPU Sites
- Zero or Low Grid Visibility and/or Availability
- Access-Problem Sites
- High Power Consumption
- Market Condition for OpCos



Case Study: Cost Factors

➢ CapEx



- PV Panels (According to Load)
- CDC Batteries (According to Dimension)
- Solar Chargers (High Efficiency, enabled MPPT)
- Controllers and Monitors
- Foundation and Platforms (Customized Design)
- Diesel Generators (According to Load)
- Spares

➢ OpEx

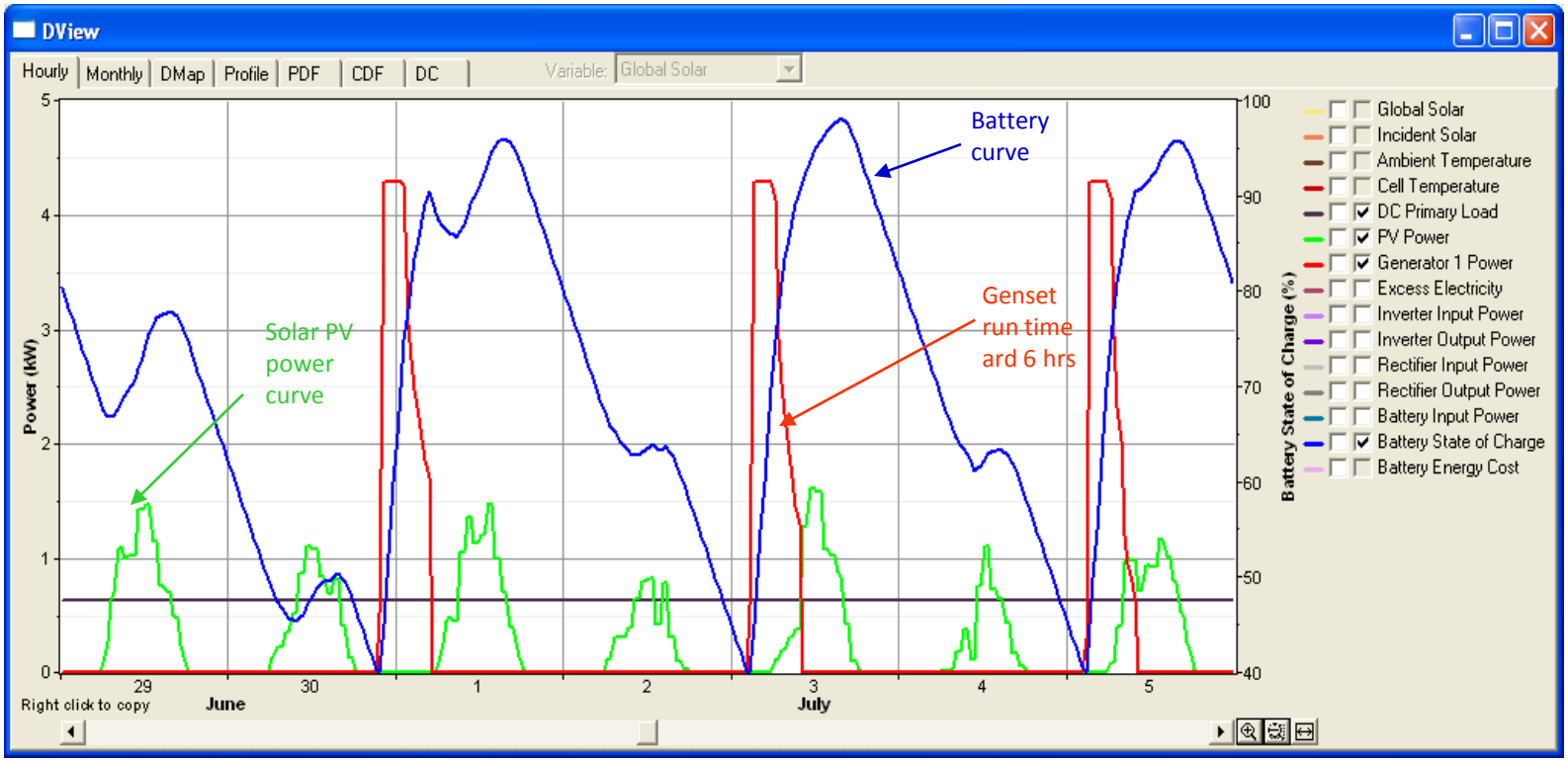


- Solar Maintenance
- DG Maintenance
- Battery Maintenance
- Fuel



Case Study: Trial - Simulation

Software Simulation Curve
Hybrid 1200W BTS site (simulate with 625W load from 29-June-11 to 5-July-11)

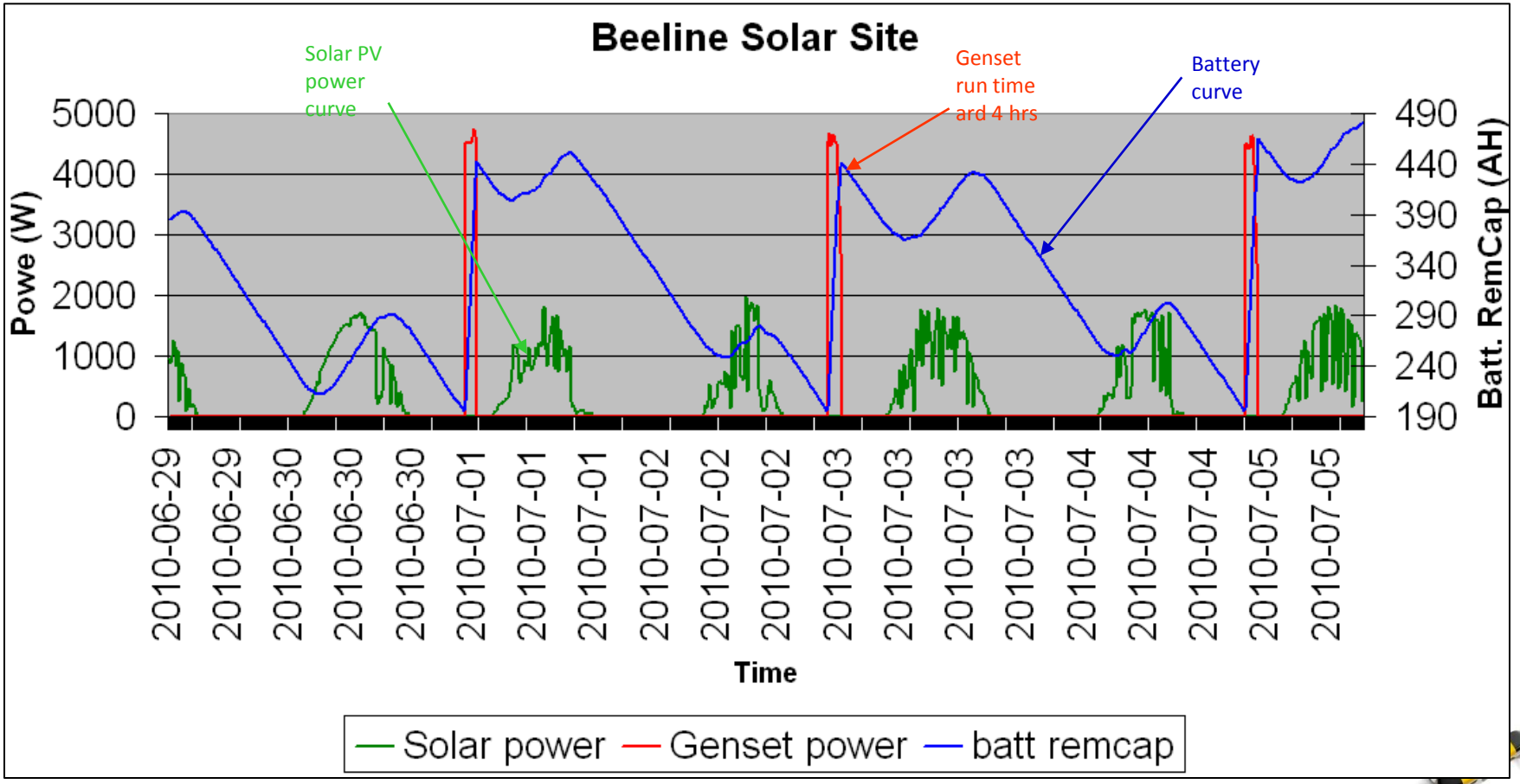


Genset Simulated Run Time = 6 hours



Case Study: Trial - Actual

Actual Running Curve
Hybrid 1200W BTS site (running at 640W load from 28th June to 5th July)

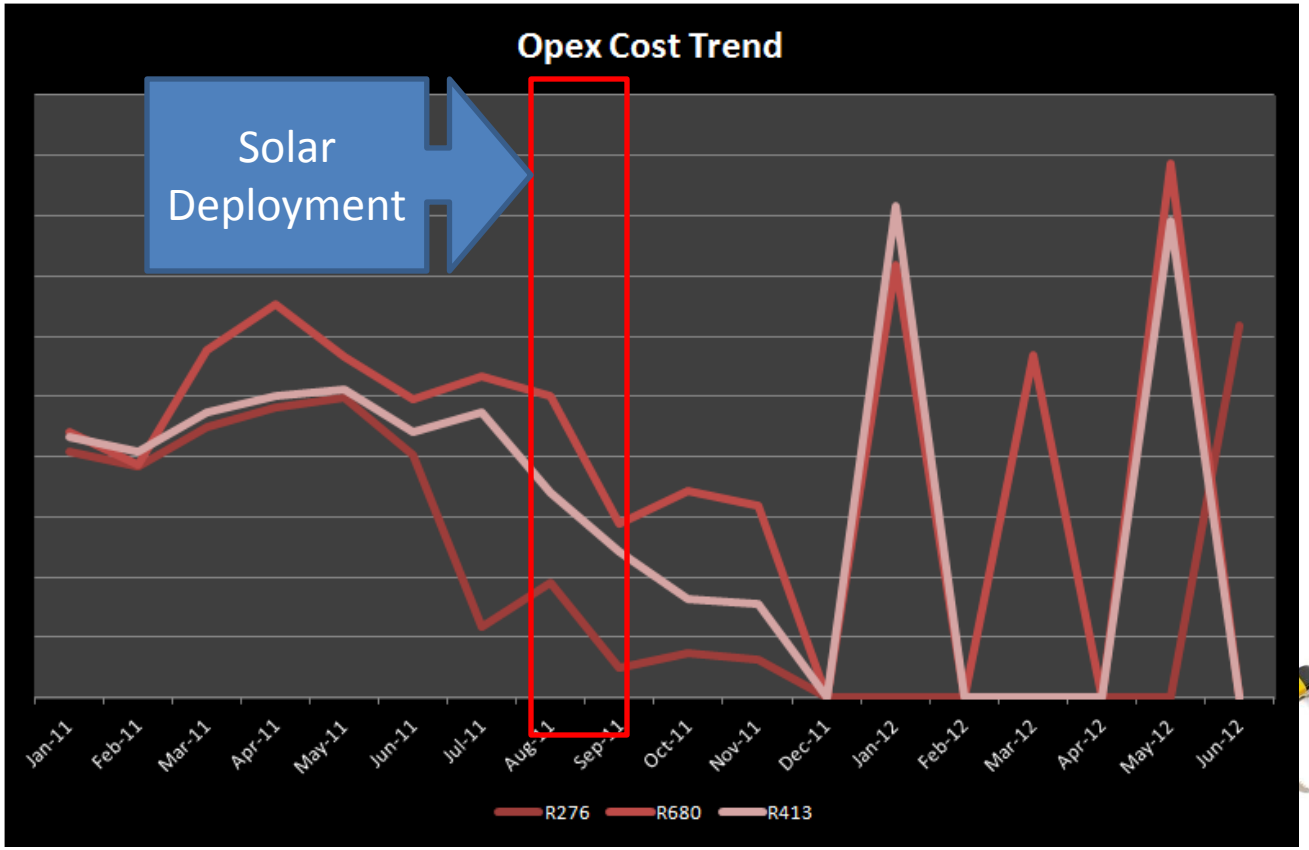


The actual data log collected is almost the same with the S/W simulation. The Actual Genset Run Time = 4 hours instead of 6 hrs.

Case Study: Deployment



- Completed 20 Solar Sites in 2011
- Completed 51 Solar Sites in 2012



Case Study: Challenges

Challenges against PV Panels



- Cost for PV panels
- Size of PV Panels (Dimensions)
- Efficiency of the PV panels and predictability of the Solution

Challenges in Deployment



- Geographical Orientation of the Site
- Vegetation of the area
- Flexibility of Frames and Foundations



Moving Forwards…



- Plan Ahead and Optimized Designs
- It is always best to go with “Try & Buy Scheme”
- During trial though, ensure to cover peak & off-peak seasons
- Factor in Telemetry systems and Keep Constant Monitoring



Thank you

By: Eric Castaneda

Head of O&M

