Port Harcourt IA&RA Power Improvement Opportunities

Economically pursuing Net-Zero

Nigeria Real Estate
April 27 2023

Objectives

- To review Power System opportunities for Port Harcourt IA and RA with Solar and Grid significantly reducing Gas and Diesel.

- To obtain mandate to:
  - Review/ negotiate PPA with DayStar Power Ltd
  - Review/ negotiate PPA with TransAfam Power Ltd
  - Engage JV partners and other stakeholders on both initiatives

Why Now?

- Profitably achieving Shell's Net-Zero Ambition
- Current philosophy- Turbine as main and diesel generators as primary back up.
- Gas Supply- Sustained poor availability since divestment of OML 17 (2021) and worsened since OML 11 (2022). Heavy impact on cost, power availability, equipment health, safety (people and asset), environment (noise and emission) and reputation. No improvement in sight despite multiple effort.
- Economics- Up to 25% reduction in current unit cost of electricity within 5-years..
- Net-Zero journey- Up to 20% reduction in Scope 1 emission with Solar and Grid in the mix.
- Low-hanging fruits with respect to Cost-Benefits and timeline

Current vs. Target Power Supply Matrix

FROM: CURRENT POWER MATRIX

	PHC IA	PHC RA
PRIMARY SOURCE	Gas Turbine in the IA (27MW)	Gas Turbine (fed from the IA)
AUGMENTATION / PEAK-SHAVING	Diesel Generators	Diesel Generators
PRIMARY EMERGENCY BACKUP	Diesel Generators	Diesel Generators
SECONDARY BACKUP	Diesel Generators	Diesel Generators

TO: TARGET POWER MATRIX Q1 2024

	PHC IA	PHC RA
PRIMARY SOURCE	Gas Turbine in the IA (27MW)	Gas Turbine (fed from the IA)
AUGMENTATION / PEAK-SHAVING	Solar System	Solar System
PRIMARY EMERGENCY BACKUP	Grid Power	Grid Power
SECONDARY BACKUP	Diesel Generators	Diesel Generators

Key technical and commercial summary

Proposal to install Solar Power

Capacity	6,300 kWp - 11,560nos Solar 545Wp (all installed in PHC – IA synchronized with the turbine to feed both IA and RA)
Philosophy	Complements the turbines during the day. Only produces solar power when Gas Turbine is available and there is Sunlight. Scalable to include batteries and remove dependency on reference source.
Initial investment	Nil
Fixed Monthly Instalment	NGN 40,744,200 to cover installation and maintenance - (~10% of average monthly spend on diesel fuel and generators since 2022 to date)
Lease Term	15 years
Financial proposition	Generate a cost saving up to 25% of the current spend on diesel/ gas consumption depending on availability of sources.
Timeline	Phase 1- 0.999MW- 2 Months Phase 2. Licensing and 5.3MW - 6-12 Months
Reliability	Weather dependent but predictable- Fortunately, highest load coincides with highest sunshine.
Warranty	Run and maintain through out lease term

Proposal to connect to the grid

Capacity	Entire load - Minimum annual off-take to be negotiated
Philosophy	Dedicated 33kV feeder stepped down from the most reliable 132KV feeder from GenCo
Initial investment	Infrastructure CAPEX or OPEX options (<$2m mainly for cable + laying, transformer, splint, substation maintenance etc)
Tarrif	~N50 - N66 per KWhr (negotiable depending on infrastructure option)
Financial proposition	To become replace diesel as the primary backup while generators become secondary backup (currently @ ~N350/ KWhr)
Warranty	Pay per usage, 80-95% availability promised. Infraco to install and maintain transmission lines.
Timeline	1 to 2 Months

Key Benefits and Enablers

Upsides Daystar proposal

- Zero CAPEX- Fixed OPEX- inflation-proof.
- Savings in Operational and Fuel cost by up to 25%
- Reduction of Scope 1 emission by >10%
- Novel- Largest renewable investment in the ND
- Quick turnaround: 3-6 months completion
- Competitive pricing
- Adequate space and aesthetics
- Simple and Scalable solution
- Shell Company with reputation and track record
- Operate and Maintain by Daystar
- More capacity- Future revenue opportunities
- No regulatory requirement by Shell.

Downsides Daystar proposal

- Long-term commitment- 15years
- Only supplementary. Needs Turbine or grid to be available but:
  - Eliminates the need to supplement with diesel generators during low gas (daytime) hence fuel and maintenance cost.
  - Reduces gas consumption by turbines during the day.
  - Reduces consumption from grid during the day.

Upsides TransAfam proposal

- Competitive pricing- Lower price than disco (and still very negotiable) and additional reduction the need for diesel.
- Additional cost reduction- Diesel, Fuel Gas, Turbine and Generator run-hours
- Additional reduction of Scope 1 emission by >15%
- 33kV infrastructure already available
- 80-95% availability depending on infrastructure investment options.
- CAPEX and OPEX options available for infrastructure - Scope/ Price negotiable
- Suitable as Main, Back-up, Supplementary now and in the future
- Quick turnaround: 1-2 months completion
- Available Right of Way and proximity to Transmission Station
- Experience with such with reputation and track record
- Build, Operate and Maintain transmission line by Infrastructure Company- Optional but preferred by seller
- Minimal regulatory requirement by Shell

Downsides TransAfam proposal

- Minimum off-take - Negotiable
- Reliability- Quite reliable in the short term but can have long-term faults.
- Government policies can be unstable

Conclusion

- Both solutions are recommended to maximize economic, reliability and sustainability value.
- Solar requires gas availability, but allows the turbine to run at sub-optimal pressure. It is redundant at night and during zero gas pressure and cannot be used along side generator.
- While Grid is flexible and able to accommodate the entire load, solar is cleaner and helps to reduce the tariff cost during gas/turbine outage.
- Both complement each other in delivering greater value by reducing the need diesel operation by guaranteed over 50%.
- Both PPAs are easy to terminate should that be the best decision for future scenarios.

Q&A

Key Parameters

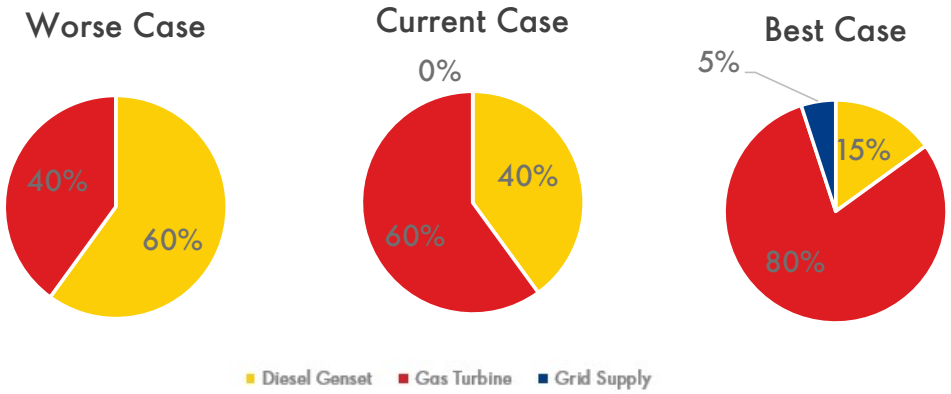
Solar provides savings across all three scenarios (Best, Current and Worst-case gas use) between 8% - 20% of savings with solar. Adding solar to the energy mix in IA and RA will provide a strong case for energy savings.

Power Source Utilization

- The ''conventional'' power supply mix uses gas, diesel and grid supply.
- Conventional power supply comparison with solar is made for 3 scenarios:

(i) Worse Case (ii) Current Case (iii) Best Case

- A blended tariff is calculated based on the ratio of power supply derived from individual tariff from each supply source
- Blended Tariff (N/kWh): Worse Case: 209.3 Current Case: 140.9 Best Case: 58.9



Key Data and Assumptions

- The model calculates savings from solar comparing two time periods
- Solar savings for daytime consumption
- Solar savings for full day – 24hrs

- Daytime Consumption per location
- IA daytime consumption: 70%
- RA daytime consumption: 40%

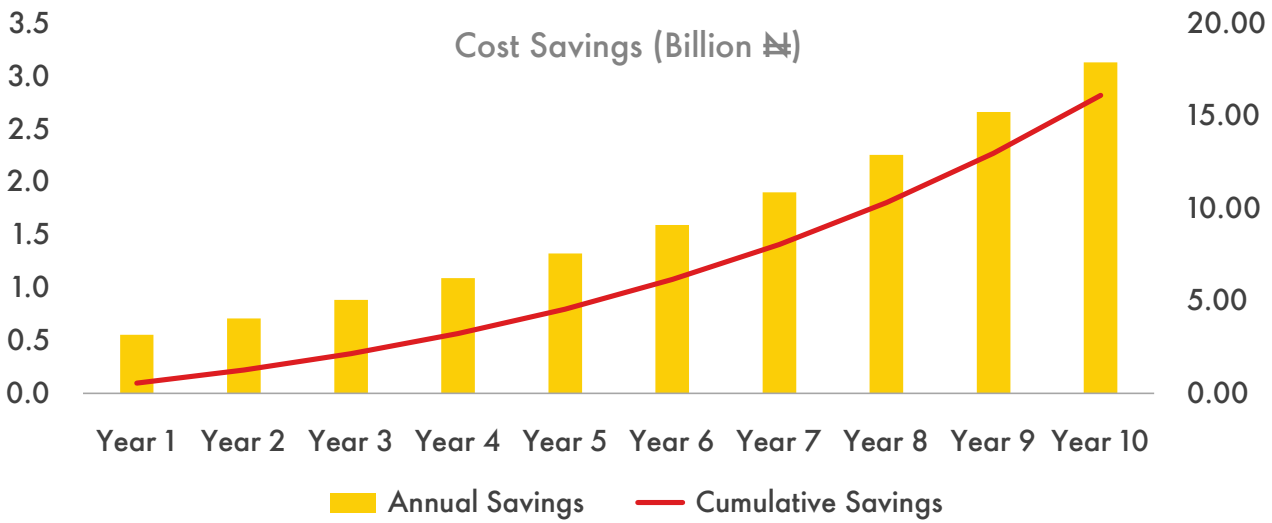
2022 Consumption Data:

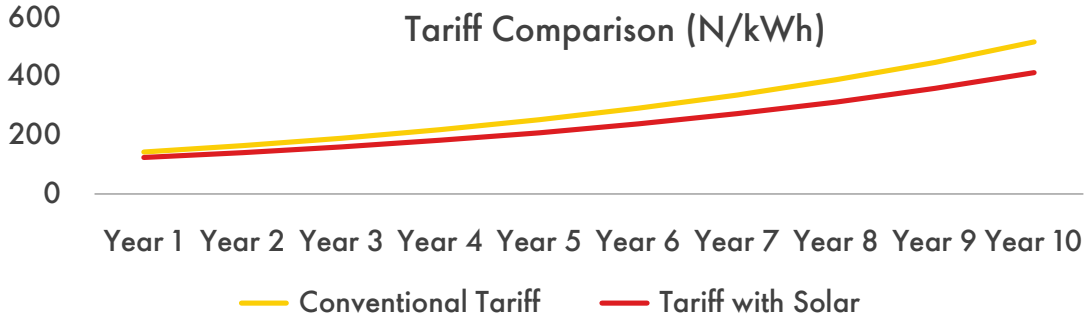
- IA: 29.9GWh
- RA: 22.5GWh

Fuel/Supply Prices

- Gas Price: $2.92/Mscf (based on current contracts)
- Diesel Price: $1.9/l (based on current contract price)
- Grid Price: N69.88/kWh (PHED MD2 Tariff)

Day time solar savings: current case scenario (gas: 60%, diesel: 40%, grid: 0%)

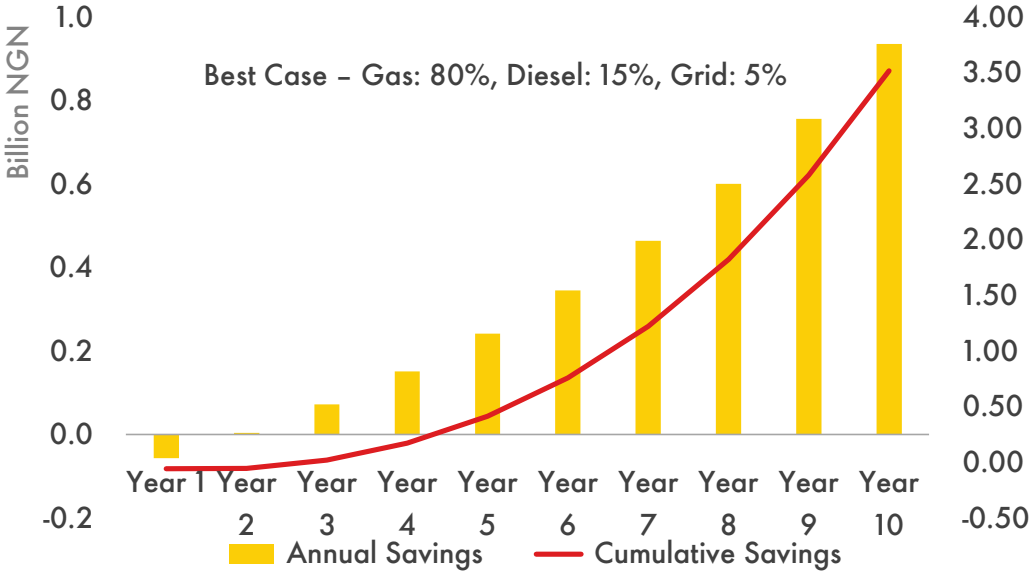


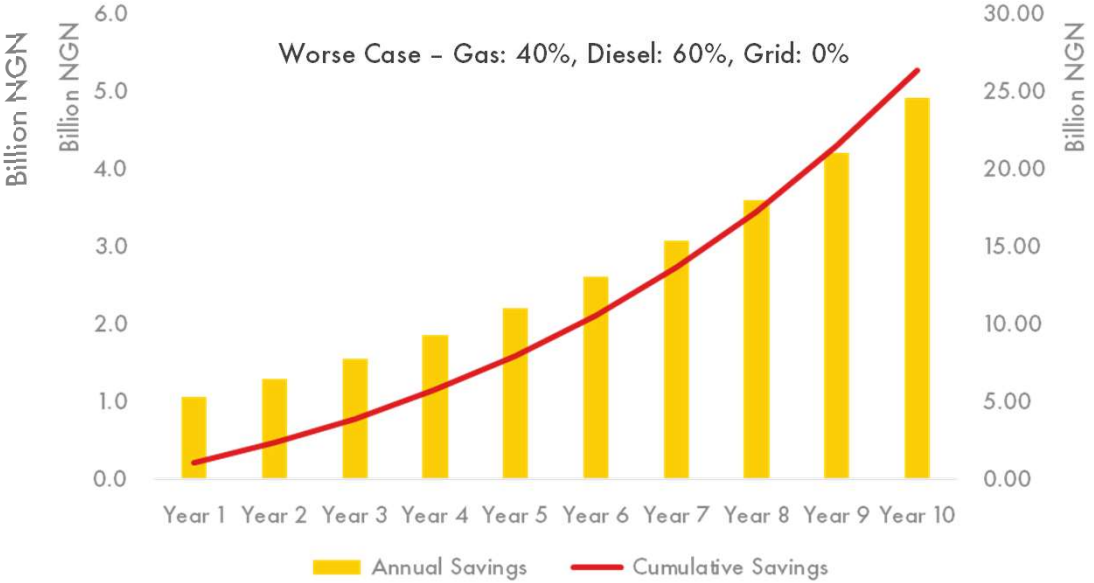


Power Supply Source	Tariff (N/KWh)
Diesel	350.0
Gas	4.4
Grid	69.9
Solar Only	66.5
Year 1 Conventional Tariff (without Solar)	142.6
Year 1 Tariff (with Solar)	124.1

Description	Figure
10 years Annual Avg. % Savings	17%
10 years Annual Avg. Cost Savings	₦ 1.6n
10 years Avg. Conventional Tariff (without Solar)	295.0 ₦/kWh
10 years Avg. Tariff (with Solar)	241.1 ₦/kWh

Day time solar savings: best & worst cases





Description	Figure
10 years Annual Avg. % Savings	8%
10 years Annual Avg. Cost Savings	₦ 0.4n
10 years Avg. Conventional Tariff (without Solar)	118.5 ₦/kWh
10 years Avg. Tariff (with Solar)	106.8 ₦/kWh

Description	Figure
10 years Annual Avg. % Savings	20%
10 years Annual Avg. Cost Savings	₦ 2.6n
10 years Avg. Conventional Tariff (without Solar)	439.4 ₦/kWh
10 years Avg. Tariff (with Solar)	351.0 ₦/kWh

Summary of PPA Terms

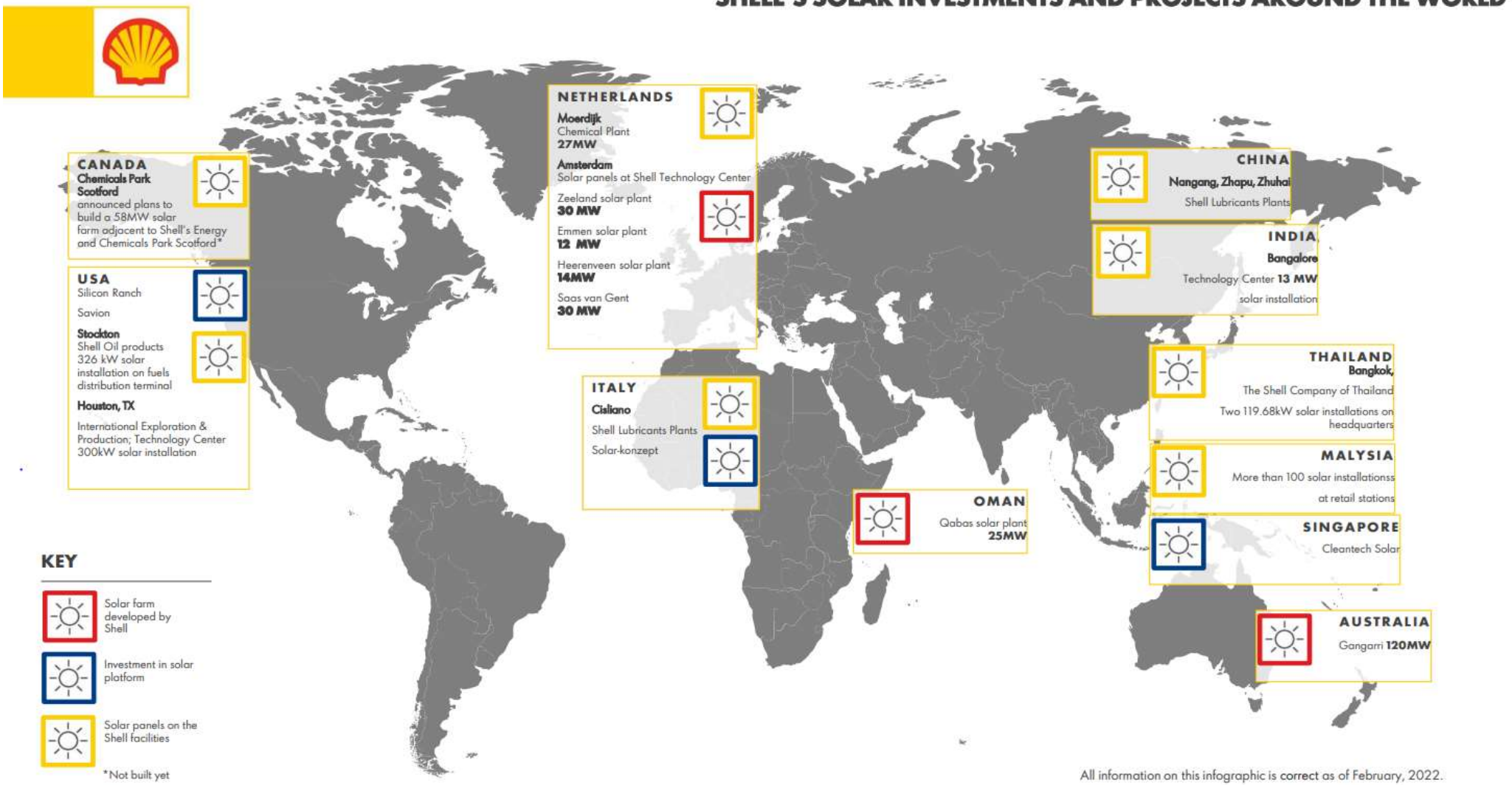
Table 1: Tariff breakdown based on Energy, Regulatory charges & Wheeling Infrastructure cost (All-inclusive / total package)

S/N	Description	Amount	Total Amount	Comment
1	Tariff NGN/KWH		66	Total Energy tariff billable to SPDC per KWH
	Makeup of the Tariff			
a	CAPEX Cost (N'bn)		1.23	Total CAPEX cost as a one-off investment which is not funded through external borrowing. No cost of capital incurred
b	CAPEX Cost (N'bn)		1.98	Total CAPEX cost as a one-off investment which is funded through external borrowing repayable on equal instalment for 5 years. Total cost comprises principal of N1.23bn and cost of borrowing of N746.8mn
c	Monthly Regulatory Costs: NGN/KWH			
	(a) TSP /Wheeling charge	6.74		
	(b) Market Operation	0.10		
	(c) System Operator			
	(d) Ancillary Services	0.85		These represent various regulatory costs per KWH
	(e) Eligible Customer Premium on TSP Charges	0.08		
	(f) NERC Charge on TCN Revenue (TSP + ISO)	0.30		
	Total Regulatory Costs	0.10	8.17	
d	Competition Transition Charge (CTC) NGN/KWH		5.00	

Table 2: Tariff based on Energy only (Regulatory charges & Wheeling Infrastructure cost removed)

S/N	Description	Amount	Total Amount	Comment
a	Tariff NGN/KWH Regulatory charges & Infrastructure cost removed	N56.07	N56.07	Makeup of the Tariff: Energy (Mw) cost only

SHELL'S SOLAR INVESTMENTS AND PROJECTS AROUND THE WORLD



All information on this infographic is correct as of February, 2022.