Sun Shining in Madhya Pradesh, India

Pioneering large-scale renewable energy infrastructure through innovative public-private partnerships

RUMS
REWA ULTRA MEGA SOLAR LTD.

Rewa Ultra Mega Solar Limited

The Complete Project Lifecycle

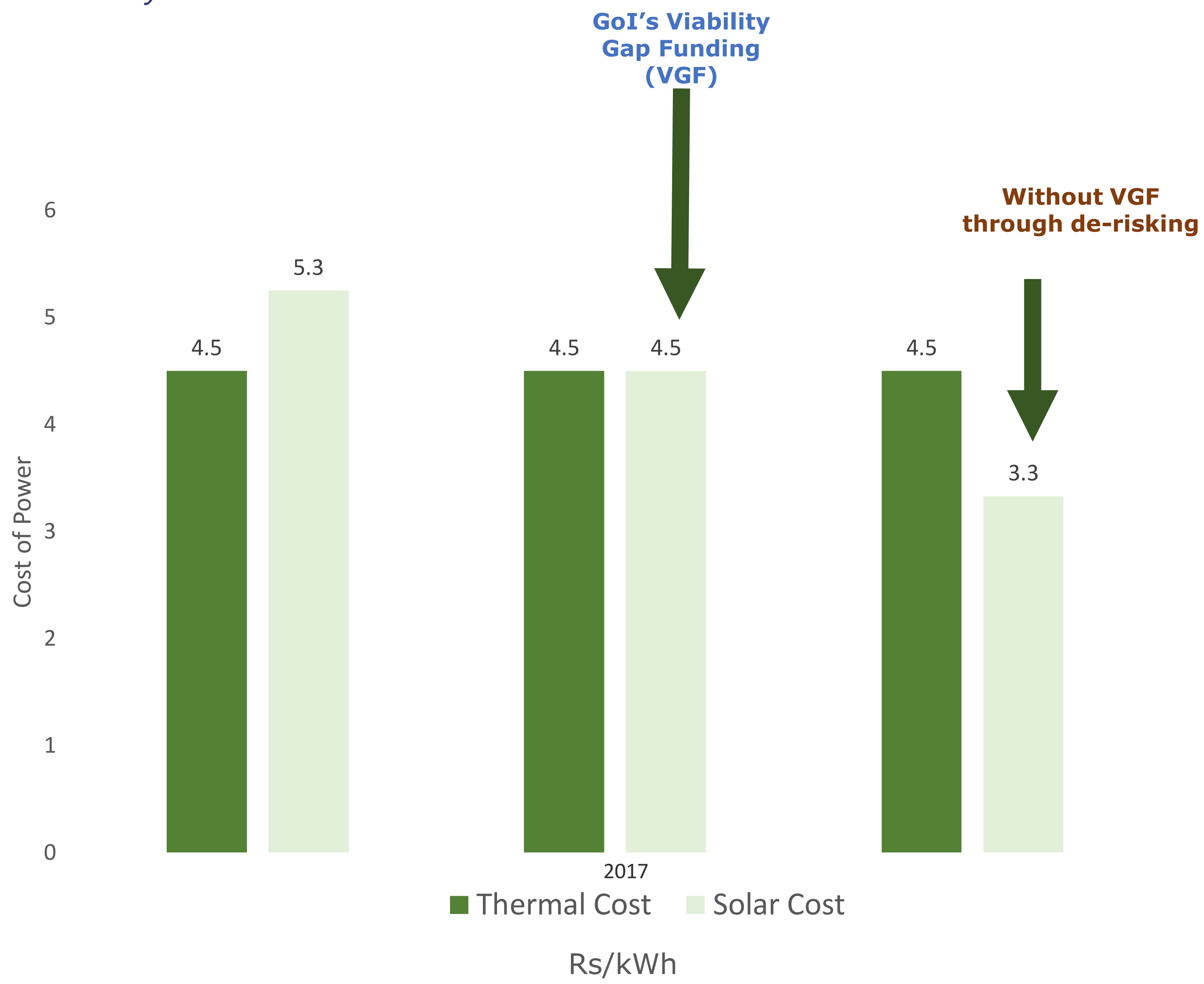
Federal organisations (SECI/ NTPC)	Park Developer: JV of SECI/NTPC & State Orgn.
Conceptualization Market consultations Financial and legal structuring Development of documents Identification of customer Bid process management Selecting the developer Agreements for 25-year project cycle	Arranging land Developing infrastructure

RUMSL: JV of SECI & MPUVN

RUMSL: The Entire Gamut

750 MW Rewa Solar project

Revolutionary Cost Reduction in 2017



Dramatic cost reduction achieved through innovative de-risking mechanisms:

- Balanced risk allocation
- Efficient project structuring
- Careful & detailed project documentation
- Plug and play solar park

Rewa Changed Solar Project Structuring in India

Immediate Impact

All SECI & NTPC tenders withdrawn for restructuring based on Rewa's proven framework

National Policy Shift

Government of India issued Standard Bidding Guidelines (August 2017) adopting Rewa's principles nationwide

Global Recognition

World Bank President's Award for Innovation and Excellence

Academic Excellence

Featured as case study at Harvard University demonstrating best practices

New Benchmarks for Structuring Solar Projects

Expanding Success Across Madhya Pradesh

Agar Shajapur Neemuch

1,500 MW total capacity across three solar parks

Record-low tariff: **Rs. 2.14/kWh**

Beyond Utilities

Delhi Metro powered by Rewa since 2018

Indian Railways supplied by Agar, Shajapur, Neemuch across 9 states

Omkareshwar Floating Solar

278 MW floating solar installation

Record tariff: **Rs. 3.21/kWh**

4,600 million units over 25 years

An unresolved question remains: what happens beyond solar hours?

Breaking the Barrier of Solar Hours

Ensuring supply when the sun is not shining

Morena Solar Park

India's lowest tariff benchmark

Rs. 2.70/kWh

440 MW Solar Park with 4 hours Storage

1. **Real-time solar generation** up to 440 MW during daylight hours
2. **2 hour Evening peak supply** (6-10pm) of 440MW with 95% annual availability
3. **2 hour Morning peak supply** (6-9am) of 440MW with 95% annual availability

Innovative derisking mechanisms

Developer Risk Mitigation

Comprehensive Framework for Project Success

Power Offtake Security

Risk: Long-term revenue uncertainty

Solution: 25-year Power Purchase Agreement (PPA). Fixed rates in Indian Rupees. Procurer pre-identified.

Land Availability

Risk: Delays in site readiness

Solution: 100% land provided within 15 days of PPA signing. Extension in Scheduled COD for any delay.

Evacuation Infrastructure

Risk: Grid connection bottlenecks

Solution: Authority's obligation—both external and internal infrastructure managed by single agency

Payment Safeguards

Payment Security Architecture

1. **1-month Letter of Credit** from procurer
2. **Payment Security Fund** providing 12-month liquidity support
3. **State Payment Guarantee** as ultimate backstop

PRAAPTI portal ensures transparent payment tracking

Dispute & Delay Protection

- **100% upfront payment** even during disputes
- Adjustments made post-resolution
- **Late Payment Surcharge** for delayed payments

Battery Storage Risk Mitigation

Innovative Solutions for Peak Power Delivery

Charging Power Availability

Risk: Charging power for morning peak

Solution: Utility supplies (85% RtE). At zero cost. Proportionate obligation reduction if supply is less, deemed payment at applicable tariff

Excess Solar Generation

Risk: Revenue loss from surplus generation

Solution: Same tariff pricing up to 440 MW, predetermined rate (2.4¢) for excess beyond 440 MW

Operational Flexibility

Risk: Morning peak timing conflicts with solar generation

Solution: Developer can discharge battery before/after peak at same tariff.

Early and Part Commissioning

Risk: All-or-nothing project activation

Solution: Allowed at 100% tariff without separate approval from Utility. Phased commissioning allowed with proportionate storage requirements.

Grid & Regulatory Risk Management

Developer Protections

Low Generation Periods

Allowed to source 5% energy from exchange to meet commitments

Grid Unavailability

Deemed supply at full tariff

Reduced Offtake

Deemed supply at full tariff

Flexibility & Innovation

- **Change in Law:** Risk borne by utility
- Day-to-day SCOD extensions for delay in filing application for tariff approval
- **Technology freedom:** Any technology allowed, changes permitted during 25-year term
- **Re-powering allowed** to upgrade systems
- **SPV partnerships:** Allowed with 51% equity retention
- **Termination protection:** Both for Procurer default and for Non-natural Force Majeure.
  Compensation starting at 4 years of tariff, reducing over time.

Utility Risk Mitigation

95% annual availability as sole metric—penalty of 2x tariff for shortfalls

Equal 440 MW during solar and peak periods, total CUF **capped at 35%** annually

880 MWhr available anytime during morning 06:00 hrs – 09:00 hrs or evening 18:00 hrs – 22:00 hrs, subject to maximum of 440 MW

Choice of Utility to provide charging power anytime from 22:00 hrs to 05:00 hrs.

Financial close of the project: Within six moths of signing PPA.

Developer Default: PBG retained up to 45 days post-COD; Delay LD applicable beyond Scheduled COD.

GST reduction included in the Reverse Bidding process, rather than a post-bid legal process

Mutual Benefits

Shared Efficiency Gains

Optimized Assets

Two daily cycles maximize battery utilization—solar + utility charging

Performance Incentives

Efficient batteries using <85% RtE earn Rs /unit bonus

Early Payment Discount

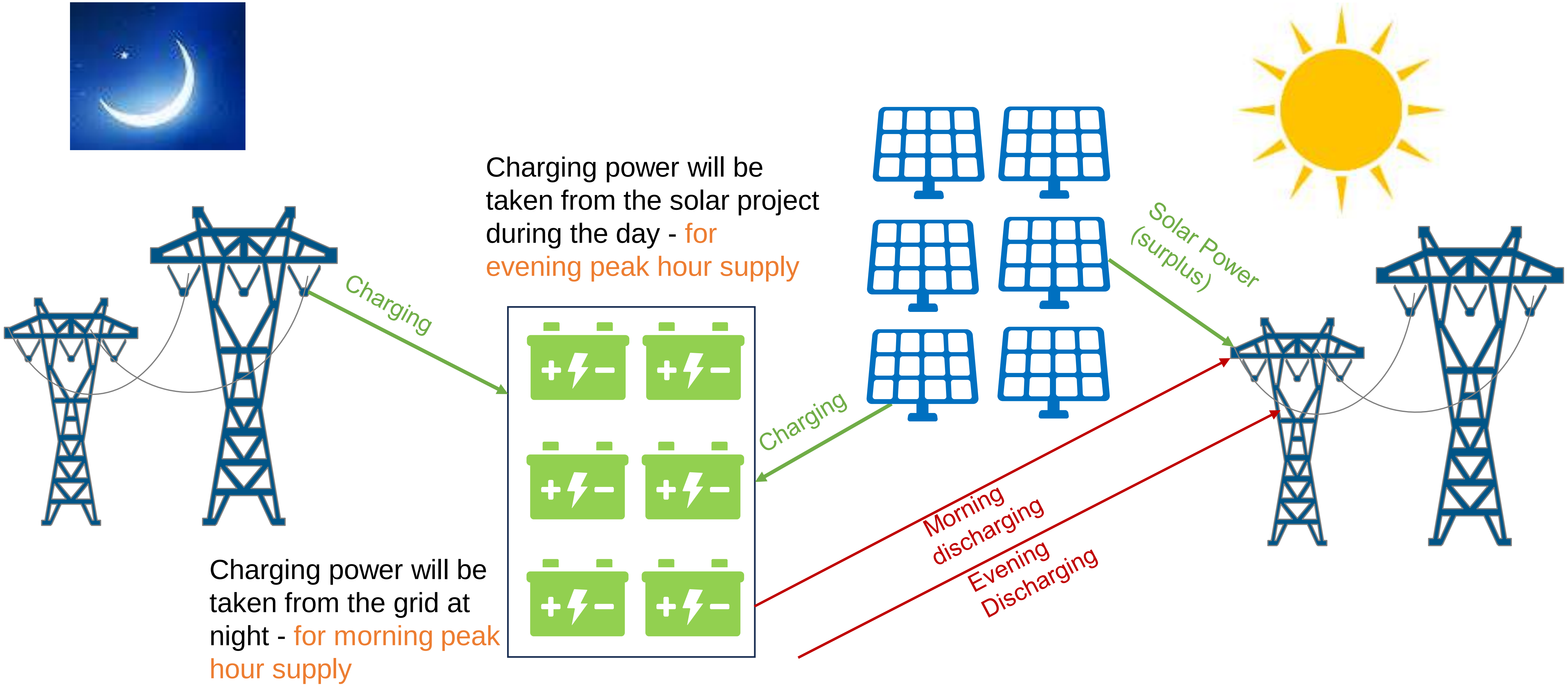
Financial benefits for prompt utility payments

Tariff reasonability

Morena Solar Project: Dual-Cycle Model

Cycle 2: Tolling Tariff-Based Model (Charging between 10 pm – 5 am; discharge during morning peak 6-9 am)

Cycle 1: Composite Tariff-Based Model (Solar period and evening peak 6 -10 PM)



Tariff reasonability

All tenders in India had peak supply from BESS at half the level of solar supply.

Bidding Agency	SECI	SECI	NHPC	SJVN	NHPC
Solar Capacity	1200	2000	1200	1200	1200
BESS Capacity	600	1000	600	600	600
Discharge hours	2	4	2	4	4
No. of cycles	1	1	1	1	1
Reverse Auction	Jul 2024	Dec 2024	Jan 2025	May 2025	Jul 2025

- If Cycle 1: Composite Tariff-Based Model is to be compared to any of the above tenders, 440 MW of supply for 2 hours needs to be converted to supplying 220 MW of storage power for 4 hours, since energy supply is same in both the cases.
- Further, Morena tender has a 95% Peak Hour Availability.

Tariff reasonability

Lowest Tariff Discovered in India for each of the two Cycles separately

Cycle 1: Composite Tariff-Based Model (Solar period and evening peak 6 -10 PM)

- SJVN (Solar+ESS01)
  - Level of Solar Supply (in MW): Solar Capacity:1200 MW
  - Level of Peak Supply from BESS (in MW): 600 MW
  - Storage Duration: 4 Hours
  - Bid Month: May 2025
  - Tariff achieved: Rs. 3.32/Unit

Cycle 2: Tolling Tariff-Based Model (Charging between 10 pm – 5 am; discharge during morning peak 6-9 am)

- RVUNL's Standalone BESS Tender
  - Level of Peak Supply from BESS (in MW): 1000 MW
  - Storage Duration: 2 Hours
  - Bid Month: October 2025
  - Tariff achieved: Rs. 1.77 Lakhs/MW/Month

Tariff reasonability

Savings in Morena Projects compared to lowest tariff discovered in India for each of the Cycle separately

Each Cycle operating separately

Cycle 1: Composite Tariff-Based Model (Solar period and evening peak 6 -10 PM)

- Annual Cost : 447.88 Cr.

Cycle 2: Tolling Tariff-Based Model (Charging between 10 pm – 5 am; discharge during morning peak 6-9 am)

- Annual Cost : Rs. 93.46 Cr.
- GST on 2nd Cycle: Rs. 16.82 Cr.

Total Annual Cost : 558.16 Cr.

Morena - Dual Cycle operation

Total Annual Cost : 455.98 Cr.

Annual Savings to MP Discoms = 102.18 Cr. OR 0.612 per kWh

Calculations

Principles for development of composite solar plus storage projects

Same supply level during peak and solar hours

- Would allow extension of storage period in upcoming tenders

- Useful for 24-hour flat block that would allow such projects to be a viable option to thermal projects

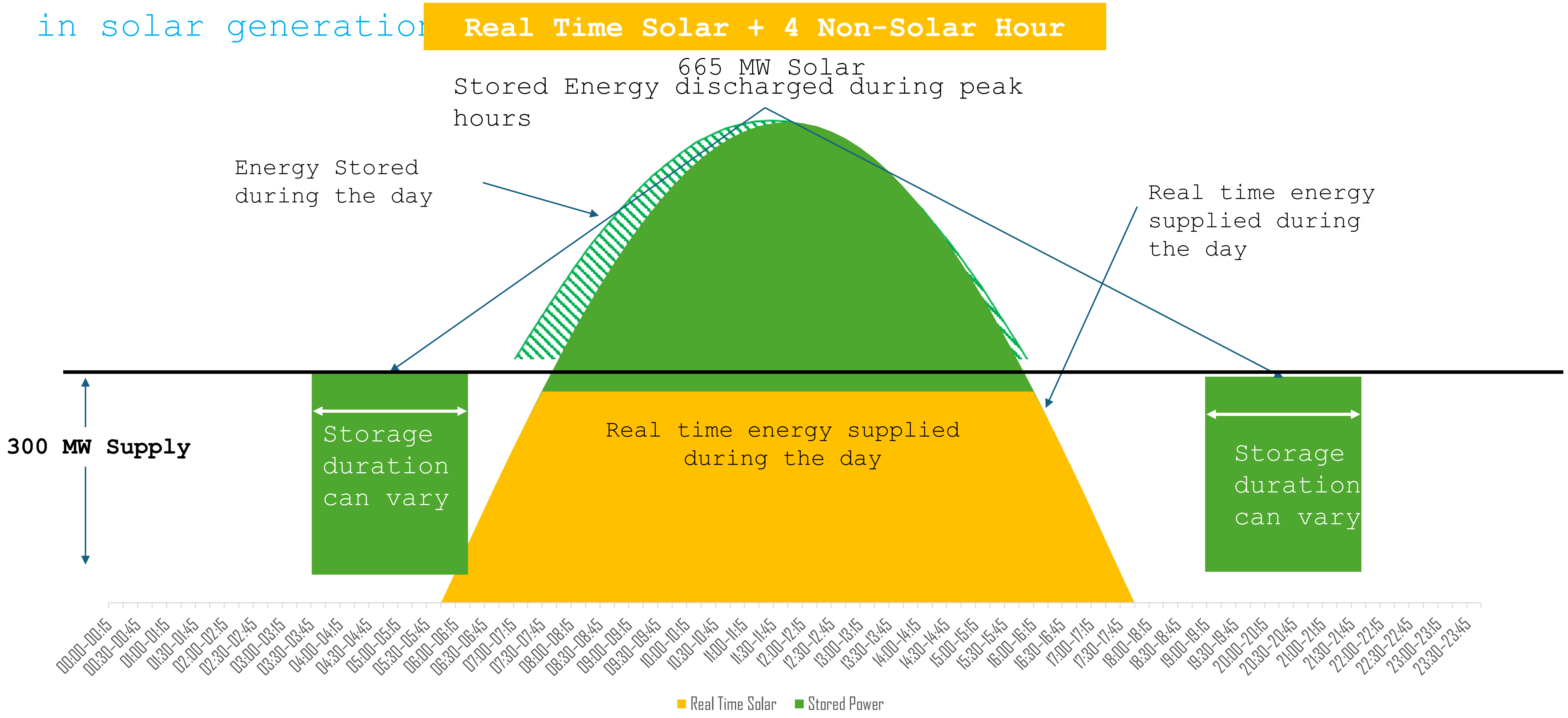
Optimized transmission capacity

- **Slightly higher transmission capacity than supply level** to avoid curtailment of excess solar
- **Excess solar procurement at a lower tariff** to avoid incentivizing the developer to oversize the solar project
- Tr

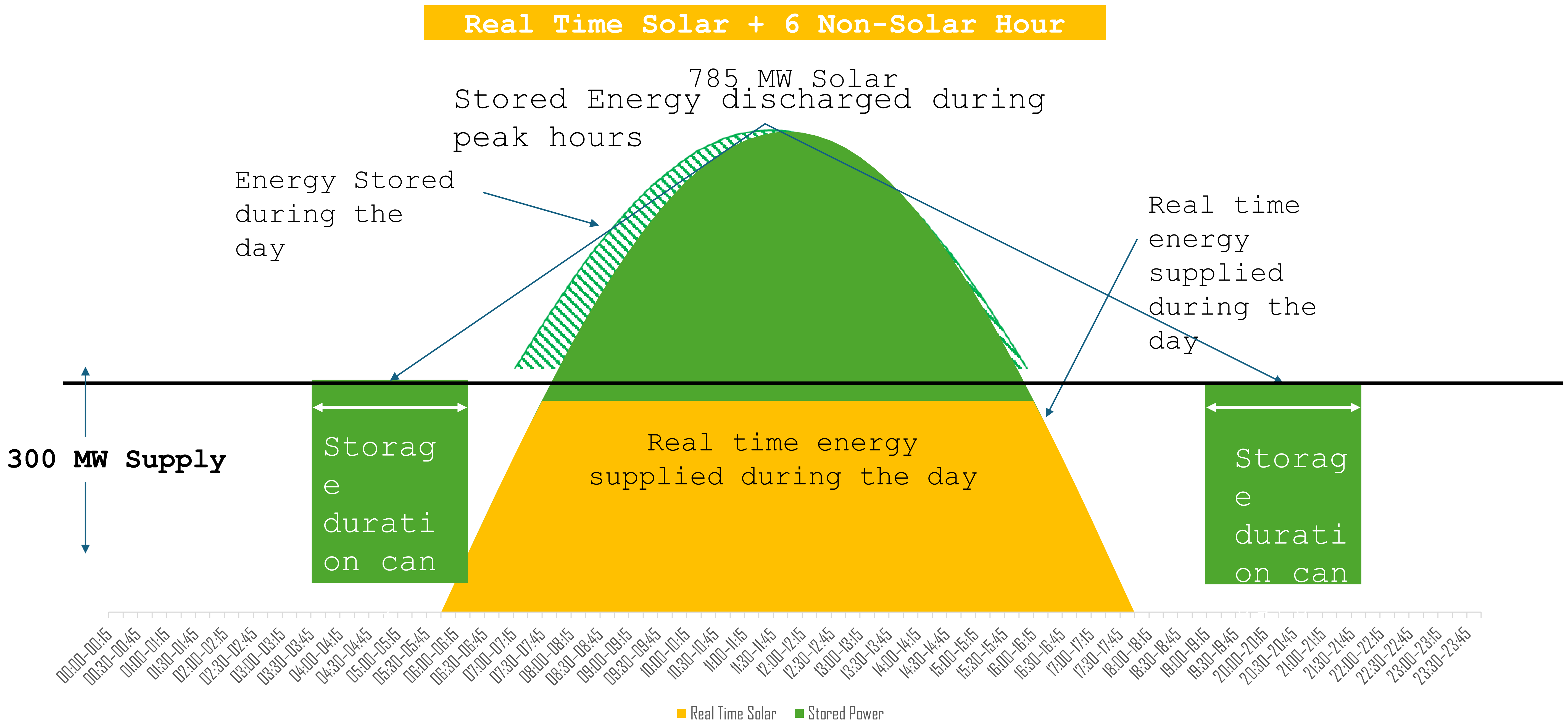
Transformer rating for 220 kV as per CEA (MVA)	Transmission Capacity/Connectivity (MW)	N-1 condition
100	Multiples of 100 MW	Additional 100 MW
125	Multiples of 125 MW	Additional 125 MW
160	Multiples of 160 MW	Additional 160 MW

Park Size Optimization

Develop the park size that should be able to supply both real time solar and energy to charge the storage as well as account for variation in solar generation



Park Size Optimization



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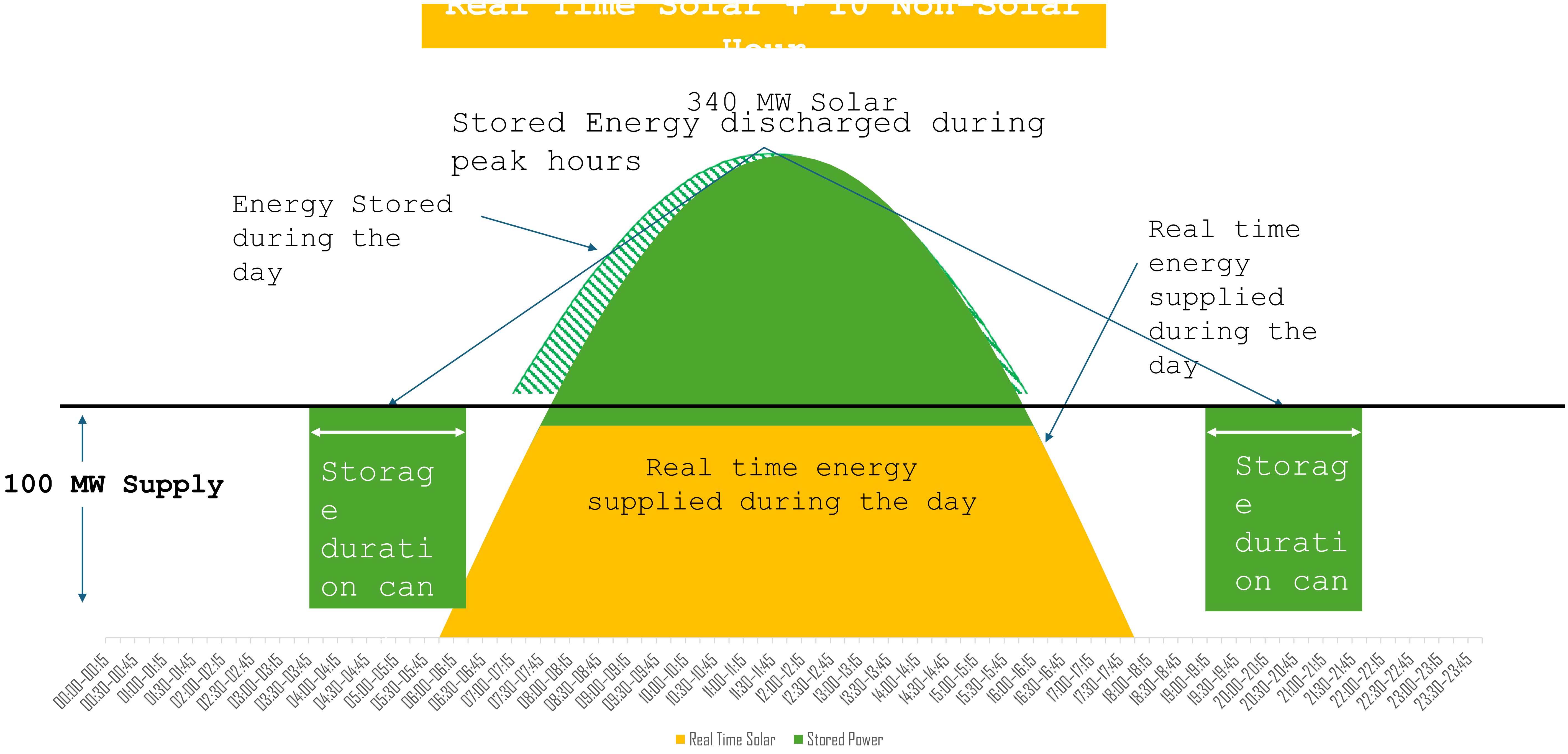
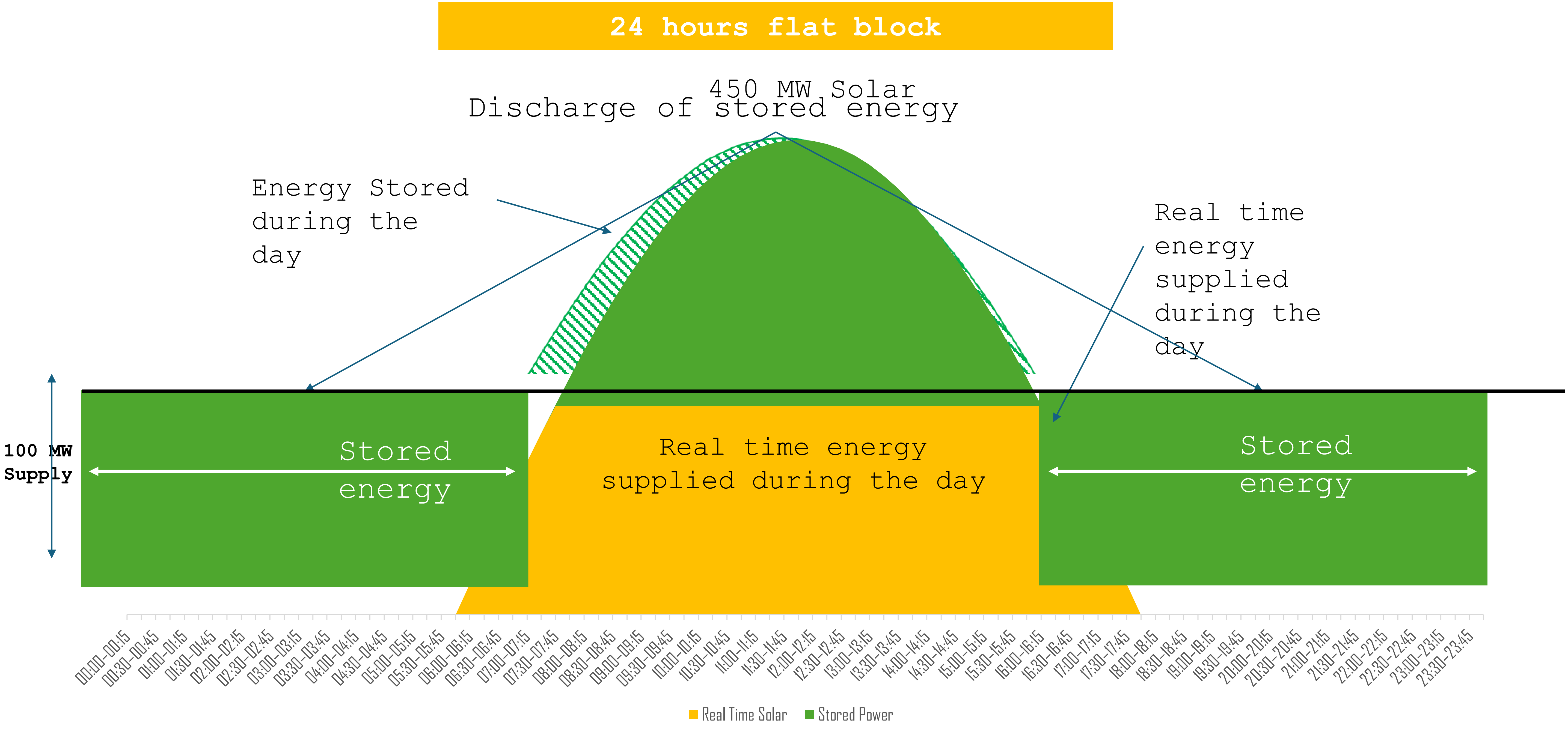


Park Size Optimization



Connectivity – CTU vs STU

- Gradual removal of ISTS charges waiver; STU projects have higher viability now
- Viability of STU projects to be assessed, based on:
  - Availability of transmission space in STU
  - Time taken to develop new STU infrastructure

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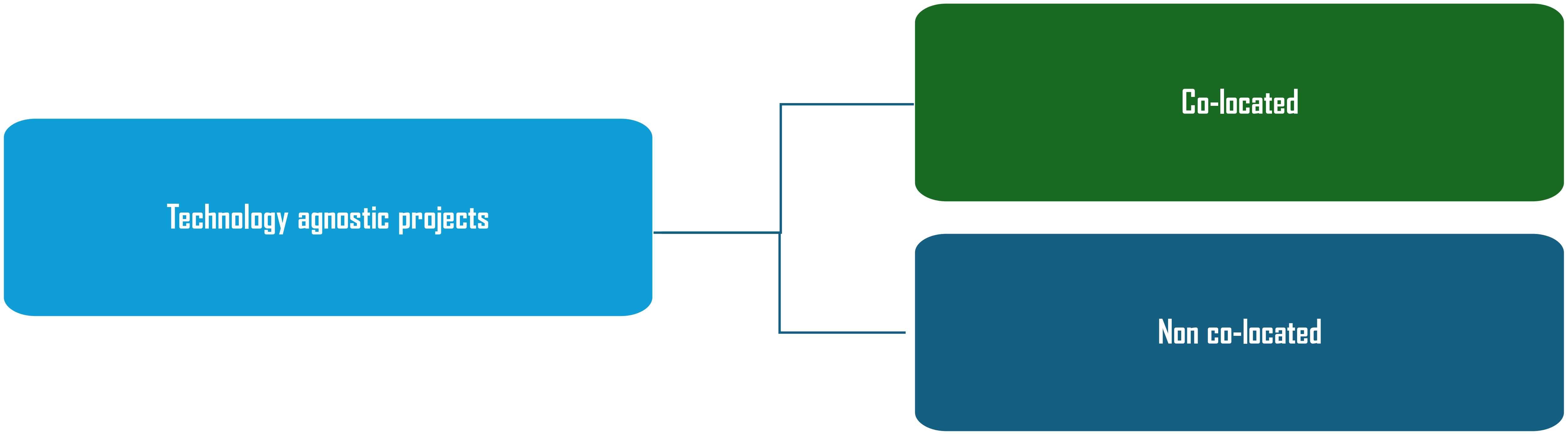
Encourage DC coupling to reduce losses

- DC coupling helps reduce losses due to conversion of DC energy from solar to AC and then from AC to DC for charging
- Project structuring, connectivity, regulations etc. to permit/encourage DC coupling
- Increasingly important as greater portion of solar generation is earmarked for storage

Technology agnostic projects



Challenges of non co-located projects
➢ Connectivity optimization is not possible as entire RE capacity (**oversized**) needs to be evacuated for charging the storage project ➢ ISTS charges and losses may be applicable on projects outside state, however, *within state STU waiver of transmission charges can be given*

Part & Early Commissioning

- Part commissioning can be allowed, provided the proportion between solar supply and peak supply is maintained with excess solar getting reduced tariff

- Early commissioning should be contractually allowed without need of an approval as Procurers need such projects

Let Us Make the Sun Shine

University of California, Berkeley Partnership

Research Center in Bhopal Supporting Innovation

Strategic collaboration bringing world-class research and technical expertise to Madhya Pradesh's solar initiatives

Technical Advisory

Advanced research in solar technology optimization and grid integration

Knowledge Transfer

Training programs and capacity building for local teams

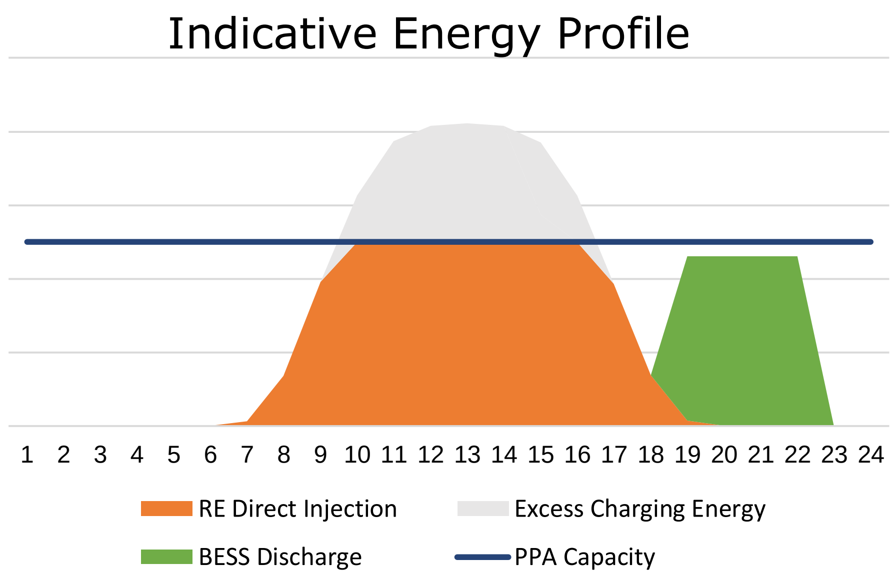
Innovation Pipeline

Next-generation storage and renewable energy solutions development

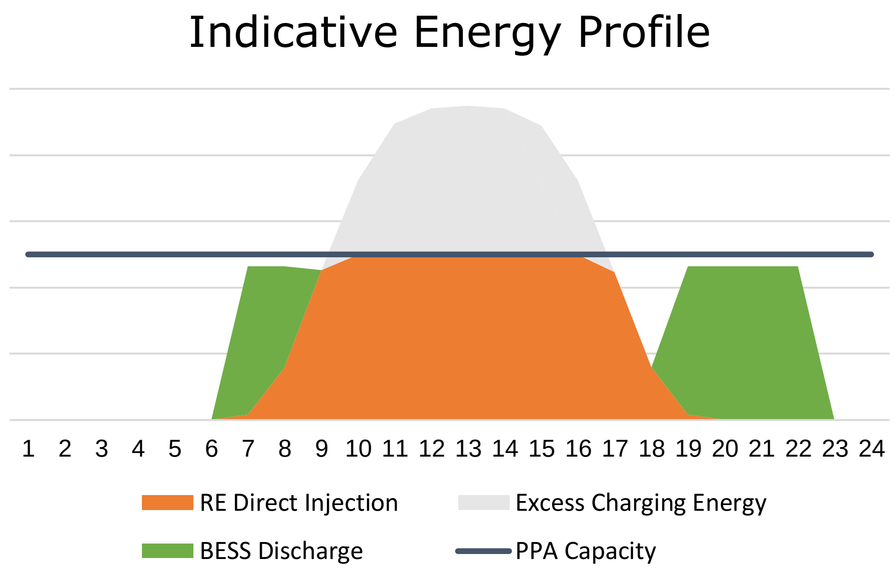
Proposed Storage Projects

Scaling Peak Power Solutions

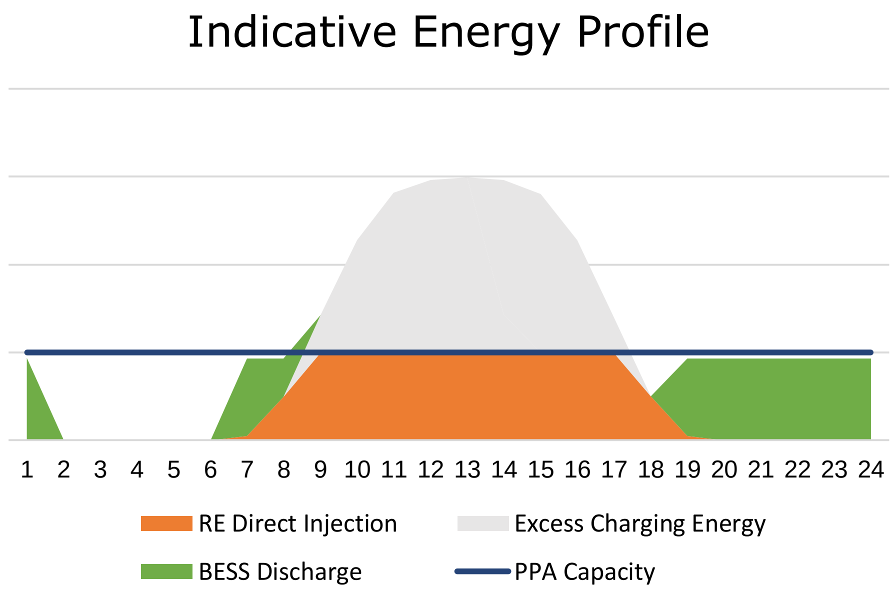
4 hours evening peak



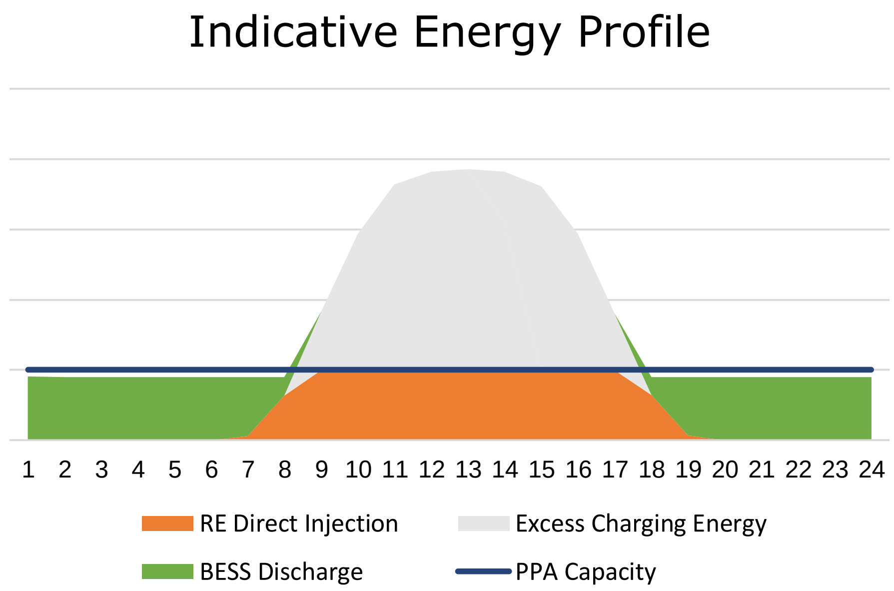
6-hour peak (2 hrs morning, 4 hrs evening)



10-hour peak (3 hrs morning, 7 hrs evening).



24 hours (round-the-clock) power



Calculations

Inputs

Sl.	Particular	Value	Unit
A	Contracted Solar Capacity	440	MW
B	Storage Capacity	440	MW
C	Discharge Duration - Morning	2	Hrs
D	Discharge Duration - Evening	2	Hrs
E	Annual CUF	35	%
F	Hours in a day	24	Hours
G	Days in a year	365	Days
H	RTE	85	%

Sl.	Particular	Value	Unit	Remarks
I	SJVN Tariff	3.32	Rs./kWh	Benchmark lowest tariff akin to Morena First Cycle operation
J	RUVNL Tariff	1.77	Lakhs/ MW/Month	Benchmark lowest tariff akin to Morena Second Cycle operation
K	Morena Tariff	2.73	Rs./kWh	Average tariff for two units
L	GST on Storage service	18	%	GST will be applicable on Tolling Tariff-Based Model

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Calculations

Annual Energy Calculation

Sl.	Particular	Formula	Value	Unit	Remarks
M	Solar Energy generated	M=A*F*G*E	13,49,040	MWHr	This includes energy supplied during solar hours and during evening peak hours
N	Night-time charging power supplied by MPPMCL	N= B*C*G/H	3,77,882	MWHr	
O	Total energy supplied under the PPA	O=M+(N*H)	1,67,0240	MWHr	
P	Morning Peak Supply	P=B*C*G	3,21,200	MWHr	
Q	Energy supplied under the first cycle	Q=O-P	13,49,040	MWHr	

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Calculations

Cost Calculation

Cost Calculation – Benchmark Tariff					
Sl.	Particular	Formula	Value	Unit	Remarks
R	Cost – First Cycle Operation	R=Q*I/10^4	447.88	Rs. Cr.	
S	Cost – Second Cycle Operation	S=J*B*12/ 10^2	93.46	Rs. Cr.	
T	GST on Second Cycle Operation	T=S*18%	16.82	Rs. Cr.	
U	Total Cost	U=R+S+T	558.16	Rs. Cr.	
Cost Calculation – Morena Tariff					
V	Cost to MPPMCL	V=O*K/10^4	455.98	Rs. Cr.	

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