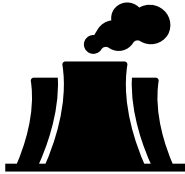


# UNLOCKING THE ENERGY TRANSITION

## GUIDELINES FOR PLANNING SOLAR-PLUS-STORAGE PROJECTS

# PROBLEM: A Perpetual Power Sector Poverty Trap

Deep dependency on (imported) fuel-based thermal generation



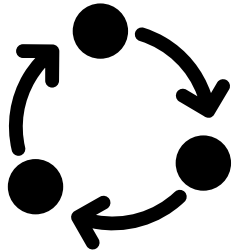
Energy market fluctuation and high subsidized leading to fiscal deficits



Expanding sovereign debt crisis



Perpetual vicious cycle of power sector poverty trap



Common issue in many developing countries

**Especially Sub Saharan Africa (SSA) and Small Island Developing States (SIDS)**

## SOLUTION: Combining Solar PV with Energy Storage | Hybrid Solar-plus-Storage Generation

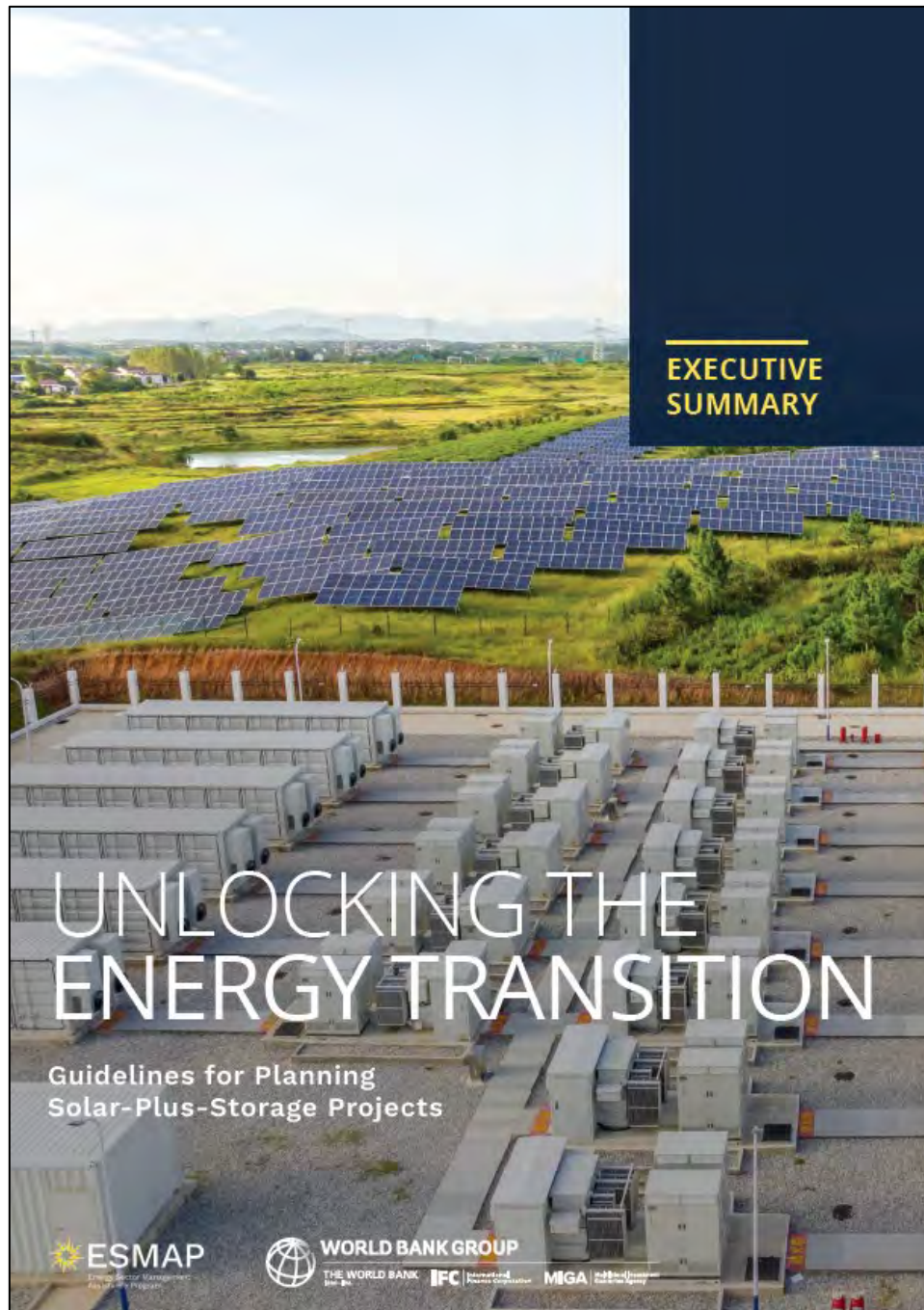
- **Solar-plus-storage is comparable** to thermal's technical characteristics in provision of firm and dispatchable sources of electricity.
- **Lower costs compared to thermal:** Costs of solar-plus-storage and tariffs achieved are much lower in many countries, compared to HFO, and fuel-based thermal generations.
- **Increasing adoption globally:** In advanced markets, solar-plus-storage is already being adopted, yet it is in early stages.

**Lack of planning framework:** Practitioners in many countries follow a piecemeal approach (if any), leading to high tariffs - mainly due absence of planning frameworks, best practices around PPAs and commercial models.



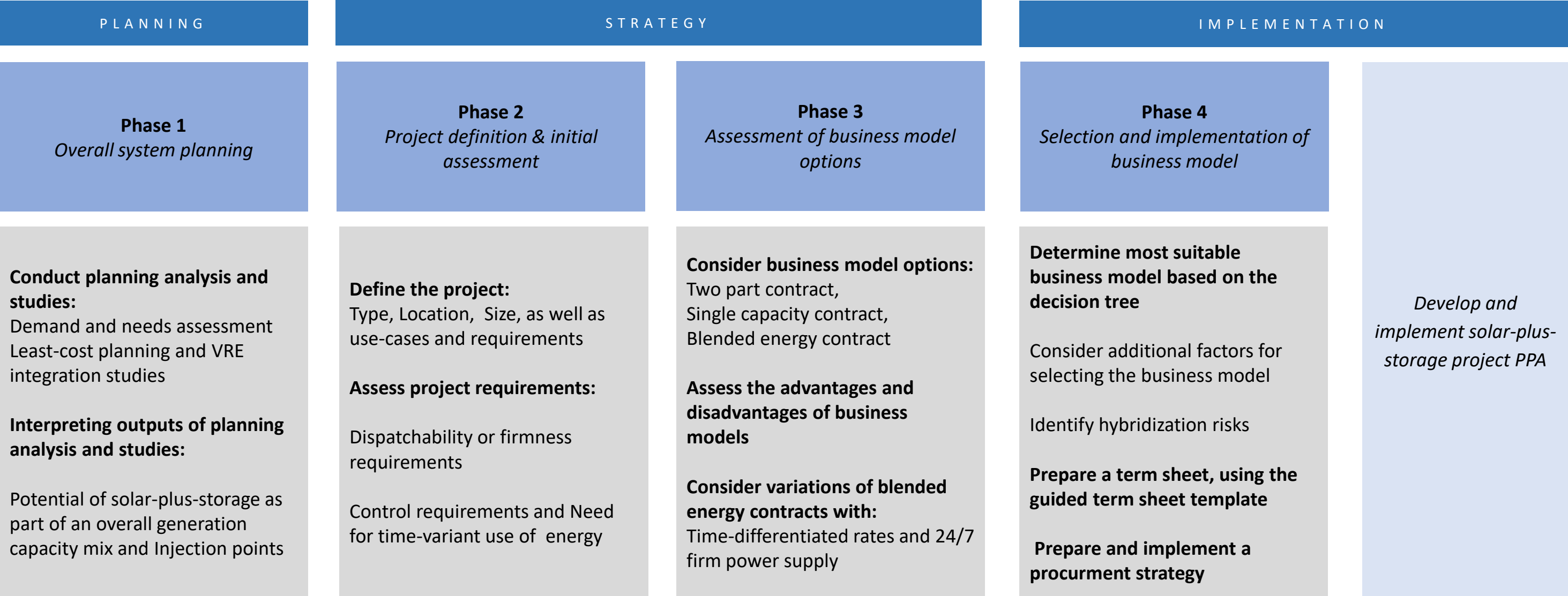
**The report** and associated knowledge resources **aim to address those challenges**

# REPORT: Unlocking the Energy Transitions | Guidelines for Planning Solar-Plus-Storage Projects

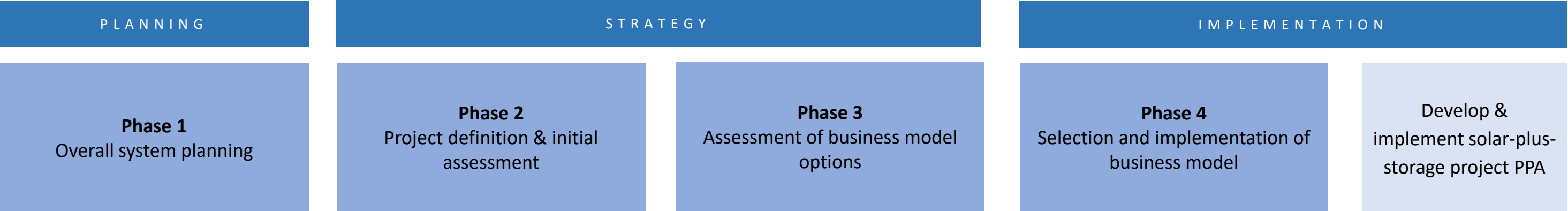


- **The report aims to** streamline the adoption of solar-plus-storage projects that leverages private investments in countries **where fuel-dependency is putting stress on limited public resources.**
- The business models outlined in this report may continue to evolve **as the solar-plus-storage contractual modalities are relatively in the early stages compared to solar-only PPAs.**
- Practitioners and decision makers are advised to engage relevant technical and transaction advisors **who can provide the necessary technical, legal, and commercial guidance on the planning and implementation of solar-plus-storage power projects.**

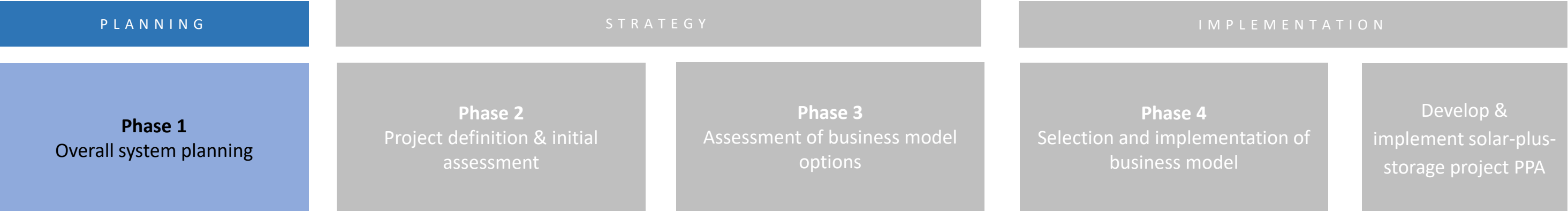
# STREAMLINED APPROACH: WBG's Planning & Implementation Framework



# STREAMLINED APPROACH: WBG's Planning & Implementation Framework



# STREAMLINED APPROACH: WBG's Planning & Implementation Framework



# PLANNING & ANALYSIS: Determining Needs and Long-Term Plans

## Overall System Planning includes (standard)

- Demands and Needs Assessments
- Least Cost Capacity Planning
- Grid Flexibility analysis
  - Dispatch Capability
  - VRE Integration
- High Level Locational Studies

Adequate and effective long term planning would help de-risk projects, **increase trust** by **investors and enhance bankability**.

The WBG's **SRMI framework** is a good reference (1).

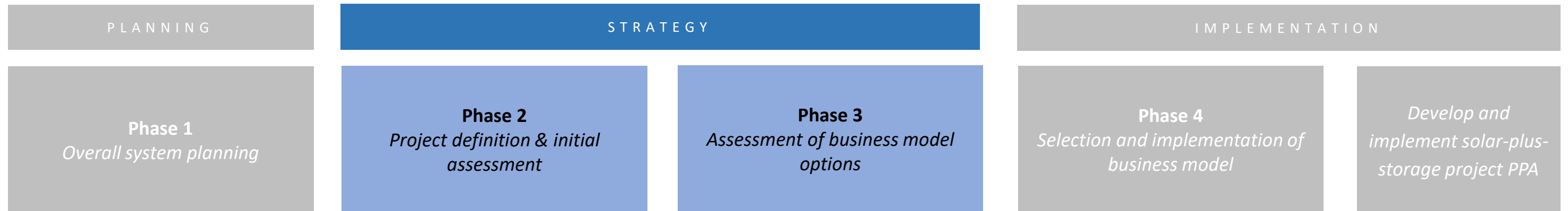


## Streamlined Techno-economic Feasibility Analysis

Expedited studies for specific pre-identified sites, to determine technical and economic feasibility for the solar-plus-storage project



# STREAMLINED APPROACH: WBG's Planning & Implementation Framework



# POSSIBILITIES: Global Experience around Three Business Models

Three primary business models explored in the report

## Two-Part Contract

Separate payments for energy (\$/MWh) and capacity (\$/MW/month) In a single contract

## Capacity Contract

Single payment for capacity only (\$/MW/month)

## Blended Contract (+ variations)

Single payment for energy only (\$/MWh)  
With variations depending on periods

**Overview** of the business models features

**Examples of actual projects** and tariffs

**Potential variations** of the business model

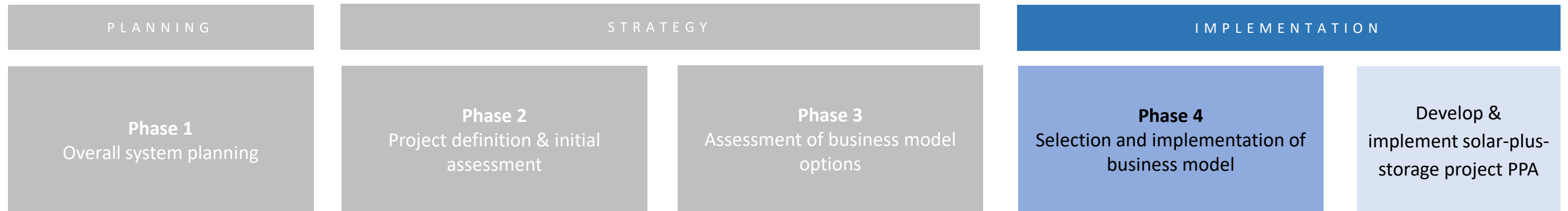
**Advantages and disadvantages** for each business model

**In-depth case study** for each model (context, payments, etc)

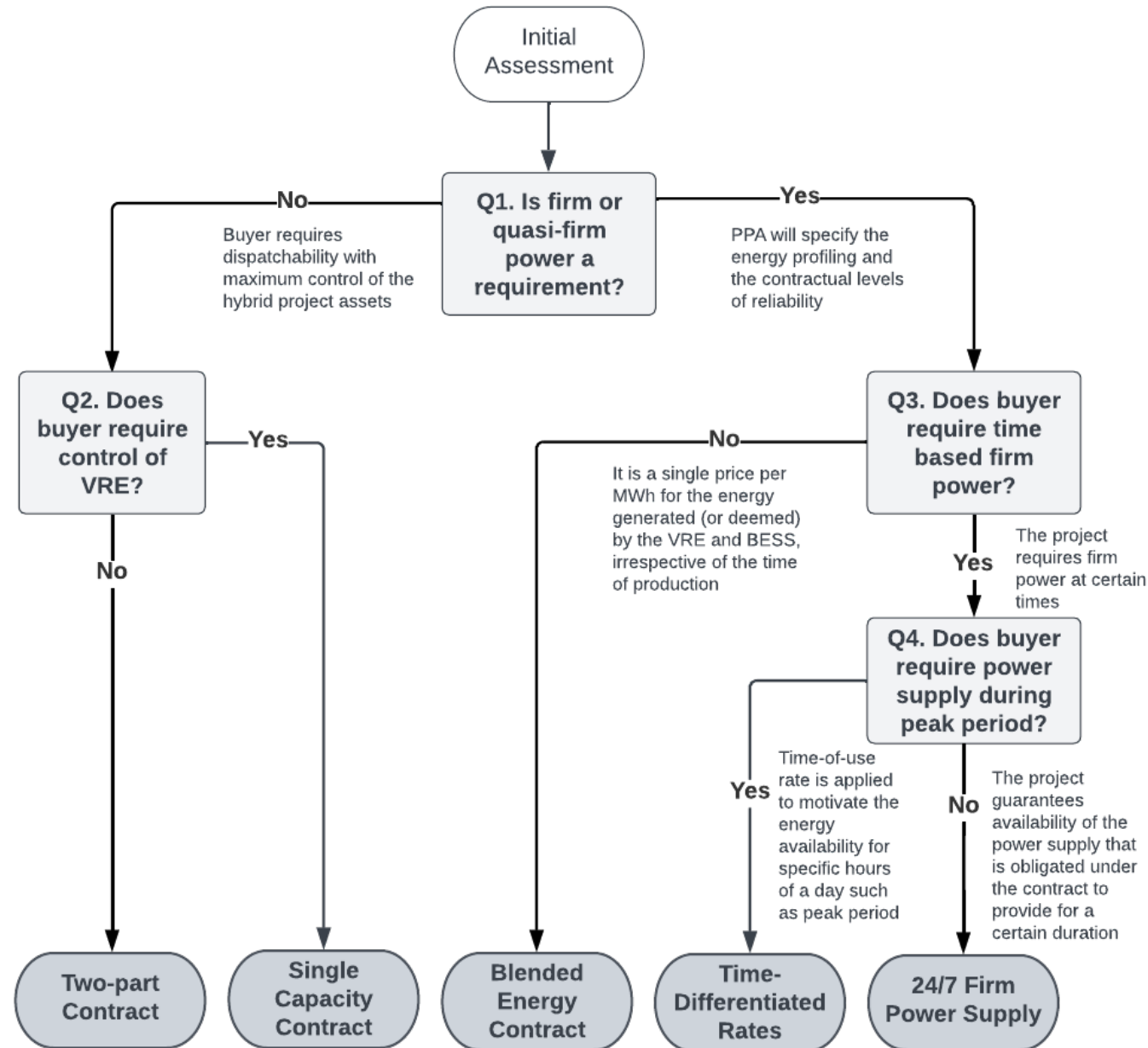
**Comparative review** with other business models

The report includes the following elements for each business model

# STREAMLINED APPROACH: WBG's Planning & Implementation Framework



# DECISION MODEL: What Matters in Selecting the Relevant Business Model



- **The decision model assists** practitioners in determining the suitable model.
- **Requirements for firmness, dispatchability, control of assets** are important to determine.
- **Other considerations includes:**
  - Electrical connectivity
  - Regulatory frameworks
  - Remuneration and bankability
  - Financing (sources and tools)
- **Determining risks is important** (curtailment, market, variability, etc)

# STANDARD DOCUMENTS: Term Sheet and PPA Template | Two-Part Contract (Example)

### Appendix B Term Sheet Template

The term sheet template presented in table B.1 provides a comprehensive (but nonexhaustive) framework for the PPA based on a two-part contract. It guides practitioners through the key elements that need to be considered when entering into a PPA. The term sheet should use technology-agnostic language, in order to ensure flexibility and adaptability to evolving technological trends. (The term renewable energy encompasses PV technology without compromising the broader project definition.) All of the terms included are suggestions and can be redefined based on a project's requirements.

Table B.1 Term sheet template

Category/subcategory	Terms
<b>General</b>	
Business model	Model: [ _____ ]
Purchaser details	Name: [ _____ ] Legal status: [ _____ ] Country of incorporation: [ _____ ] Address: [ _____ ] Email: [ _____ ]
Seller details	Name: [ _____ ] Legal status: [ _____ ] Country of incorporation: [ _____ ] Address: [ _____ ] Email: [ _____ ]
Name of project	[ _____ ]
Commercial operational date (The commercial operation date is the date on which the seller notifies the purchaser of the fact that the system [renewable energy plus storage] is mechanically and electrically complete and operational and providing PV output and storage output through the meter(s) to the delivery point.)	[ _____ ]
Metering (The seller shall, at its own expense, procure, install, test, and commission the main meter and a back-up meter at the delivery point, both at the renewable energy in relation to the production of net electrical output and at the storage in relation to it net electrical output and charging energy [grid].)	[ _____ ]
Evidence of insurance	Name of insurer: [ _____ ]
<b>Renewable energy</b>	
Contract term	[ _____ ] years
Location or site	[ _____ ]
Address of delivery point	[ _____ ]
Manufacturer and model	Manufacturer: [ _____ ] Model: [ _____ ] Certifications: [ _____ ] Comments: [ _____ ]
Inverter	Manufacturer: [ _____ ] Model: [ _____ ]

### World Bank Group (WBG): Template Documentation

Title:	POWER PURCHASE AGREEMENT (CO-LOCATED SOLAR PV + BESS)
Law:	ENGLISH
Date	APRIL 2023

NOTES:

- General Comments: This template Power Purchase Agreement (co-located Solar + BESS) (Power Purchase Agreement, PPA) has been prepared by the WBG team assuming that, in particular:
  - the project is a single-site, grid-connected solar photovoltaic power plant and battery energy storage system (BESS) likely awarded via a competitive tender;
  - the project use case is (A) to provide a certain number of hours of renewable energy storage (for example, between 1-4) on a fully dispatchable basis with a capacity-based tariff, so as to provide the maximum dispatch flexibility to the offtaker and maximise the value add of the BESS to allow use in peaking power periods and (B) to sell power generated from the PV Plant to the purchaser;
  - the Power Purchase Agreement follows recent international standard templates developed for single-site grid connected solar photovoltaic power plant except to the extent required to give effect to the use case described in paragraph (ii) and is intended for use together with the form of Government Support Agreement deployed in other WBG transactions;
  - the host country is not a country with an established IPP track record;
  - there is no legal or practical alternative to selling to the Government utility;
  - the Government is advised by qualified transaction advisor up to document execution;
  - the Government will tender the project to international developers specifying a pre-determined site provided or procured by the Government;
  - the project company will fund and build the interconnection facilities and then hand over the interconnection facilities to the Purchaser on or before the commencement of commercial operations;
  - the project will be limited recourse project financed, possibly by the WBG or other development finance institutions;
  - the project documentation (including this Power Purchase Agreement) will be competitively tendered to developers. It seeks to capture a balanced risk allocation and not an opening negotiating position: it is not intended as a first draft in a negotiated process;
  - although written as English law, in some countries local law will be adopted as the governing law, though this will add time and expense to the preparation process;

## PPA Template

- Can be the **basis for practitioner to adapt**, based on the project parameters and contextual requirements
- Legal and technical experts are to be engaged** in the process, for optimal results
- To follow consistent **procurement best practices**, to secure lowest possible tariffs

## PROCUREMENT GUIDELINES: Different Auctions Modalities and Considerations

### Important considerations:

- Leveraging existing solar PPA
- Maximizing participation and competition
- Mobilization of Private sector

Model	Auction type	Primary selection criterion
Two-part contract	Separate bids for energy and capacity (same auction)	Lowest levelized cost of energy (\$/MWh)
Single-capacity contract	Bid for given PV and storage capacity	Lowest bid (\$/MW/month) for joint capacity
Blended energy contract	Bid for price per MWh (for given firmness level)	Lowest bid (\$/MWh)
Blended energy contract with time-differentiated rates (variation 1)	Different bids (\$/MWh) for time blocks <i>(or a bid for peak hours and a fixed tariff for off-peak)</i>	Lowest cost for system or lowest (\$/MWh) or the lowest calculated tariff
Blended energy contract with 24/7 firm power supply (variation 2)	Typically technology-agnostic bid (given a firmness level)	Lowest levelized cost of energy (\$/MWh)

### The report provides:

- Primer into the business models used
- Overview of important applied case-studies
- Guide to determining requirements and planning
- Tool for selection of business model
- Template PPA and Term Sheet to adapt

**Goal:** Ultimately, **streamline and accelerate** the adoption, planning, and implementation of **solar-plus-storage** projects globally.

**Link:**

[www.esmap.org/unlocking\\_energy\\_transition](http://www.esmap.org/unlocking_energy_transition)

**THANK YOU.**

