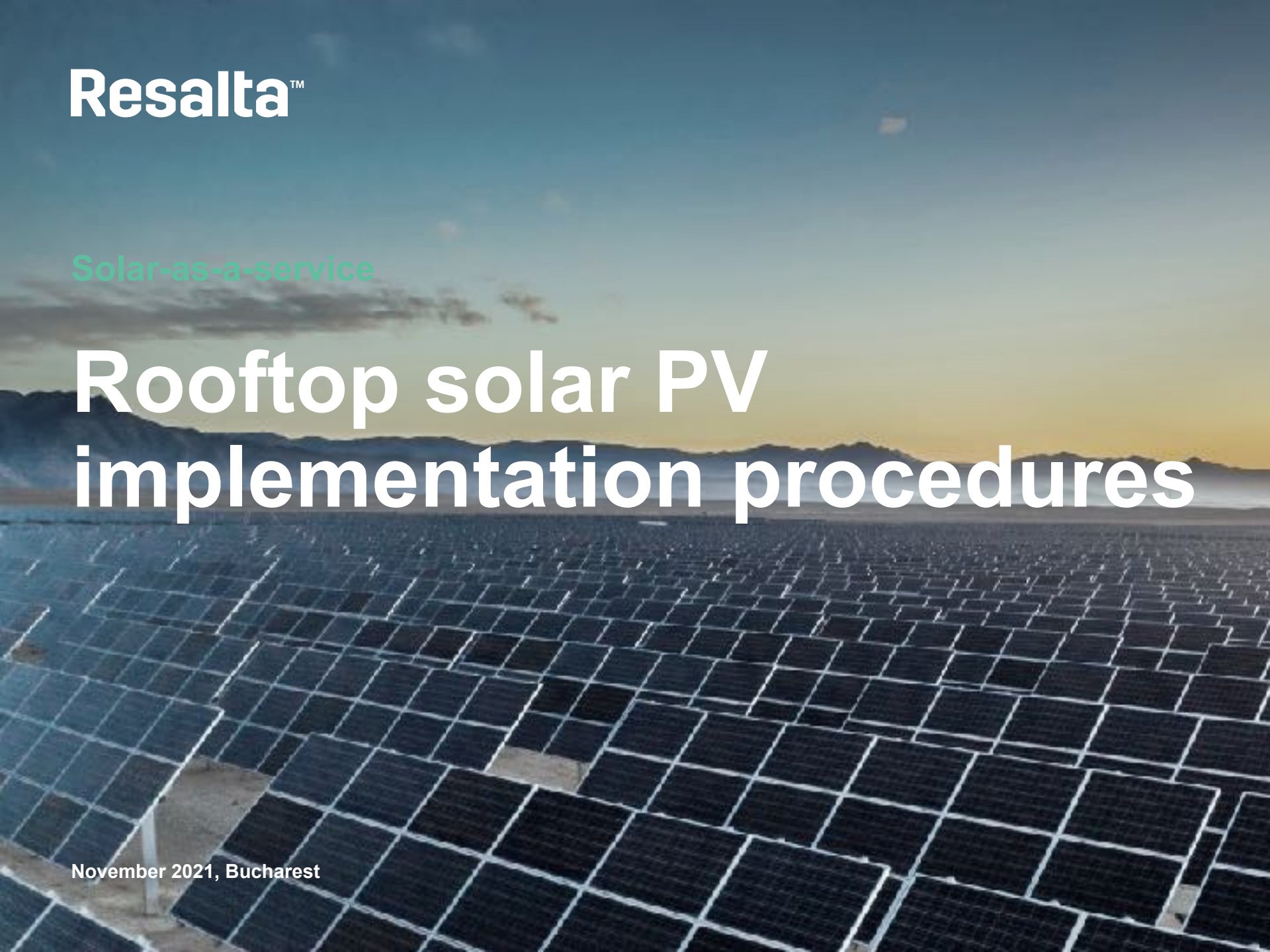
Resalta™

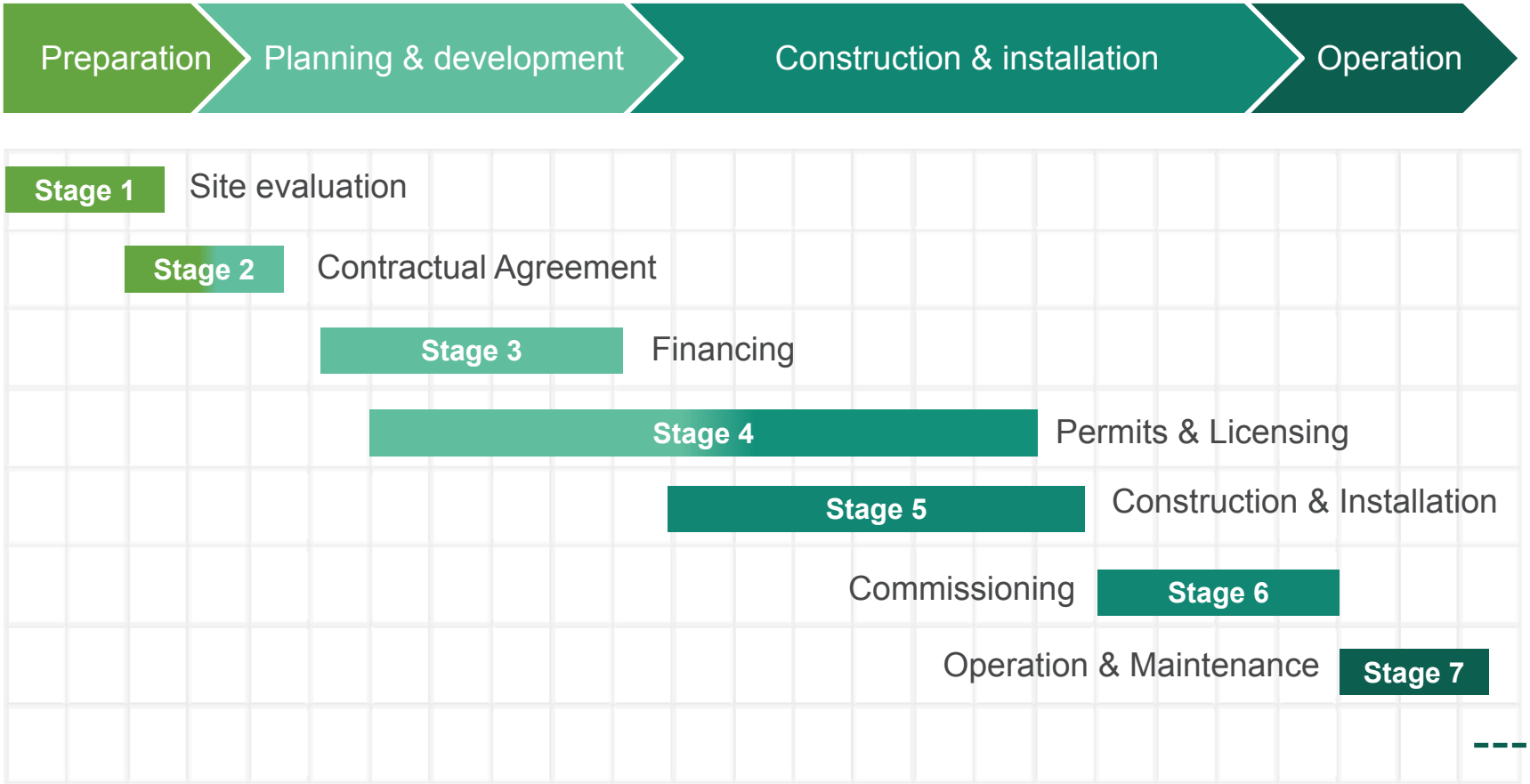
Solar-as-a-service

Rooftop solar PV implementation procedures



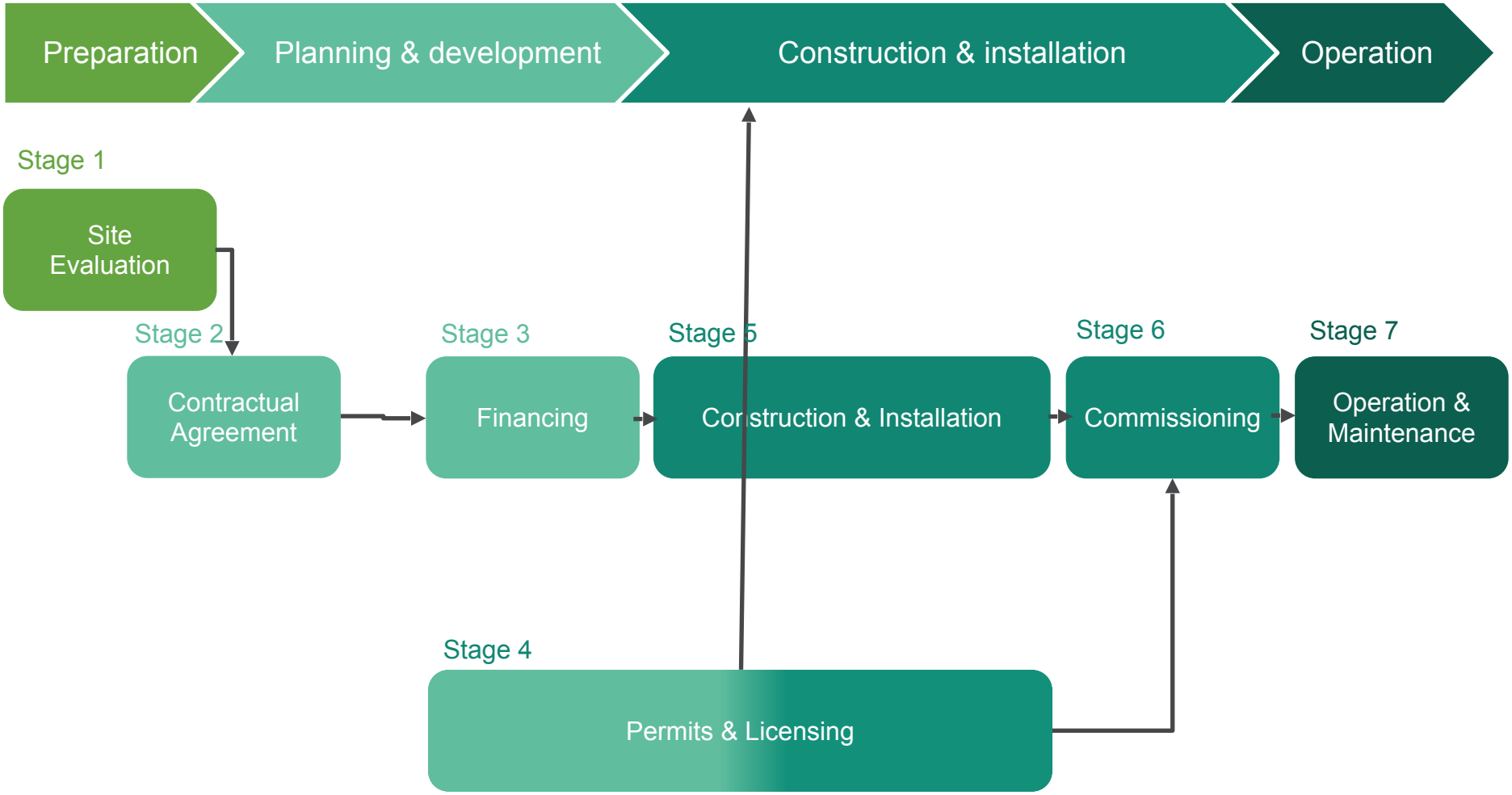
November 2021, Bucharest

Step by step procedures



Resalta

Step by step procedures



Resalta

Procedures for developing rooftop Solar PV

The process for the development of rooftop solar PV projects can be divided into four phase: (1) Project Preparation, (2) Planning and Development, (3) Construction and Installation, (4) Operation. The interfaces between these phases are marked by three major milestones of project development.

Project Preparation

Project Preparation Phase describes the evaluation of the suitability of the project location, checking the project feasibility and determining the suitable business model and implementation pathways. This phase consists of two stages:

Site Evaluation

Site Evaluation (Stage 1): in this stage, suitability of the roof shall be assessed and the business model for project implementation chosen.

Contractual Agreement

Contractual Agreement (Stage 2): in this stage, the Client negotiates and makes a contract with relevant parties to implement the project. This sets the frame for further project development.

Planning & development

Milestone 1: Signed Contracts

Resalta

Procedures for developing rooftop Solar PV

Project Preparation

Planning & development

Construction & Installation

Development Phase describes the process after the contract with the implementing party is signed and before the actual construction/installation begins. It covers securing necessary financing, obtaining applicable incentives and supporting mechanisms, and applying for necessary licenses or permits.
This phase consists of 2 stages:

Financing

Financing (Stage 3): in this stage, the project developer will secure necessary financing for procurement and installation of the system.

Permits & Licensing

Permits & Licensing (Stage 4): several licenses or permits are necessary for solar PV rooftop projects (depending on the installed capacity). The project developer must secure all relevant licenses during this stage.

Milestone 2: Financial close / Pre-construction licenses obtained

Resalta

Procedures for developing rooftop Solar PV

Planning & development

Construction & Installation

Operation

Construction / Installation Phase describes the physical construction and installation of the system. Usually, this phase is the most capital and manpower-intensive.
This phase consists of 2 stages:

Construction & installation

Construction & Installation (Stage 5): physical construction of rooftop solar PV system including installation of all components.

Commissioning

Commissioning (Stage 6): secure permission from relevant power utility providers and conduct commissioning of the system.

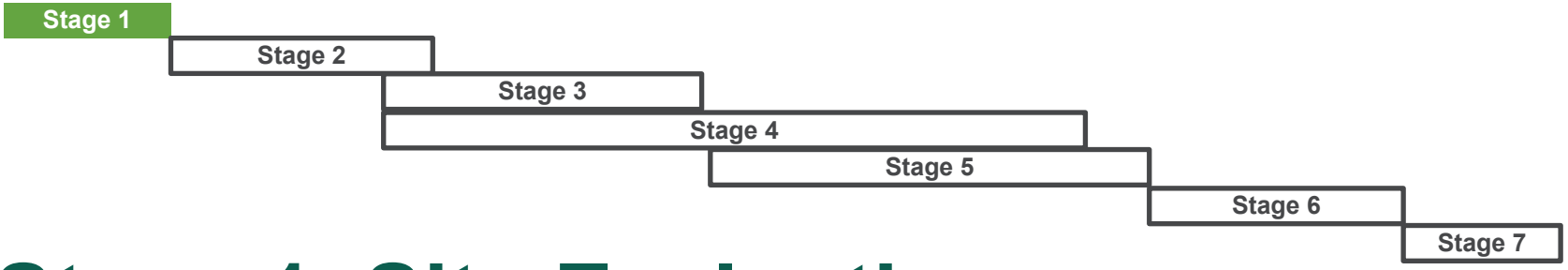
Milestone 3: Commercial Operation Date (COD)

Operation Phase describes the process after the system reaches the commercial operation date (COD). This is the phase at which the solar PV system produces electricity to reduce grid electricity consumption by the facility. This phase consists of only one stage. However, it is the longest phase, lasting until the end of the installation's lifetime.

Operation & maintenance

Operation & Maintenance (Stage 7): Operation and maintenance of the rooftop solar PV powerplant until the end of the system's lifetime.

Resalta



Stage 1. Site Evaluation

Step 1.1 Decision-making flow chart

Step 1.2 Business model approval

Step 1.3 Information checklist

Step 1.4 Site survey

Step 1.5 Technical design & financial offer

Step 1.6 Investment feasibility

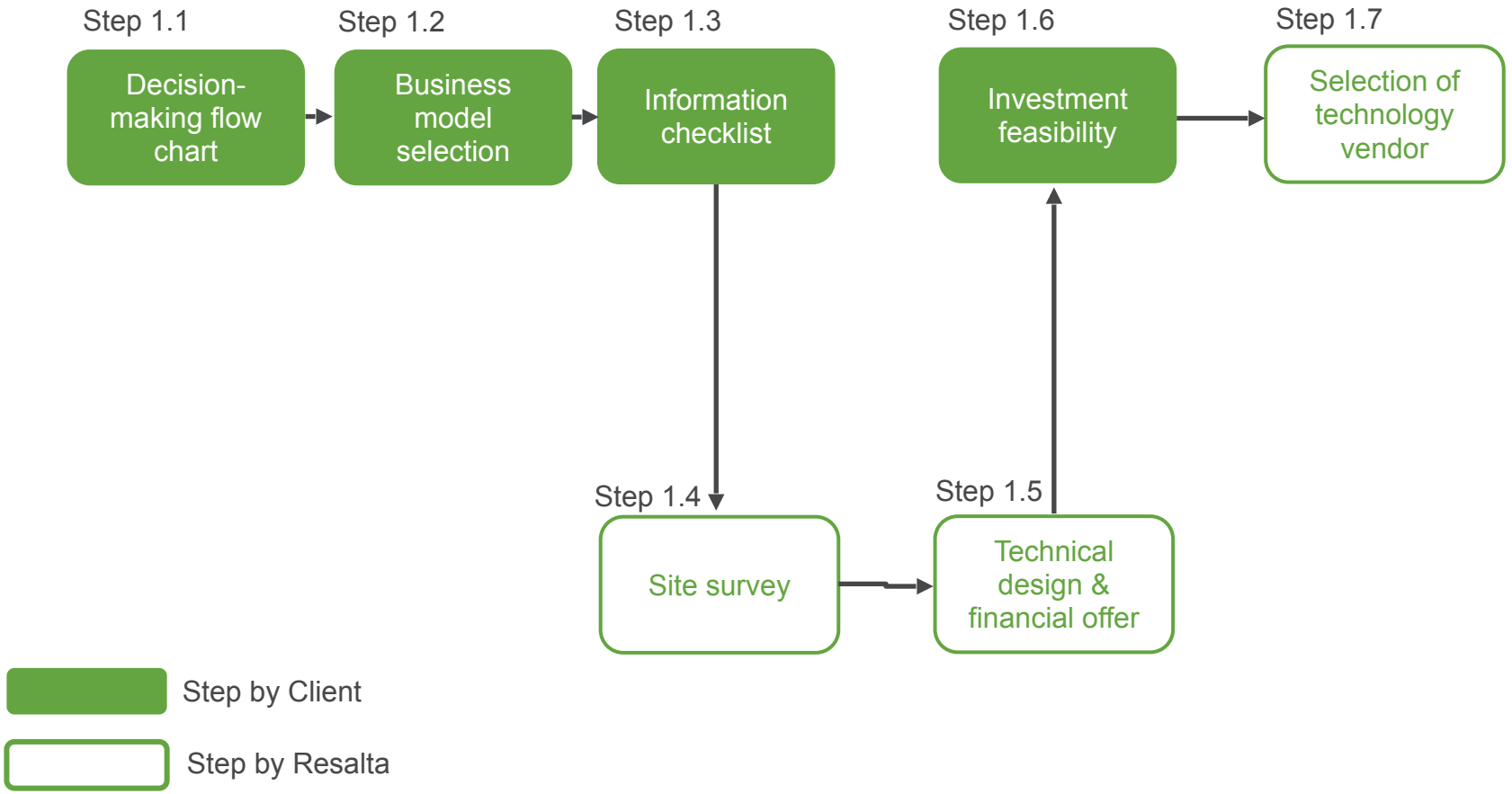
Step 1.7 Selection of the technology vendor

Step by Client

Step by Resalta

Resalta

Stage 1. Site Evaluation



Resalta

Stage 1: Site Evaluation

Stage Description

The Site Evaluation stage aims to assess whether a facility (i.e. commercial building, factory, etc.) is technically and financially suited for rooftop solar PV system development. Throughout this stage, the Client is the decision-maker. Several tools are provided as part of this guide to assist Clients in making effective decisions on the project.

First, the Client goes through the **decision-making flowchart** (Step 1.1) to get an initial assessment of whether it is suitable for them to install the system. The flowchart helps determine which **business model** (1.2) is suitable, taking into consideration the Client's investment capability and need/ requirements.

The Client uses the **Information Checklist** (1.3) to self collect all required information/data. Using this data Resalta undertakes a preliminary feasibility analysis and cost benefit analysis, then conducts a **site visit** (1.4). This allows Resalta to further collect necessary information/data in more detail, which is crucial for **drafting the technical and financial offer** (1.5) to submit to the Client for consideration.

With the offers at hand, the Client performs financial assessments using a **financial model** (1.6) provided in these guidelines and with Resalta's help, checking the project's financial feasibility including ROI, payback periods, etc. Based on the financial analysis, Resalta determined the **most suitable technology vendor** (1.7) for the project. This is the last step of the Site Evaluation stage.

Step 1.1. Decision-Making Flow Chart

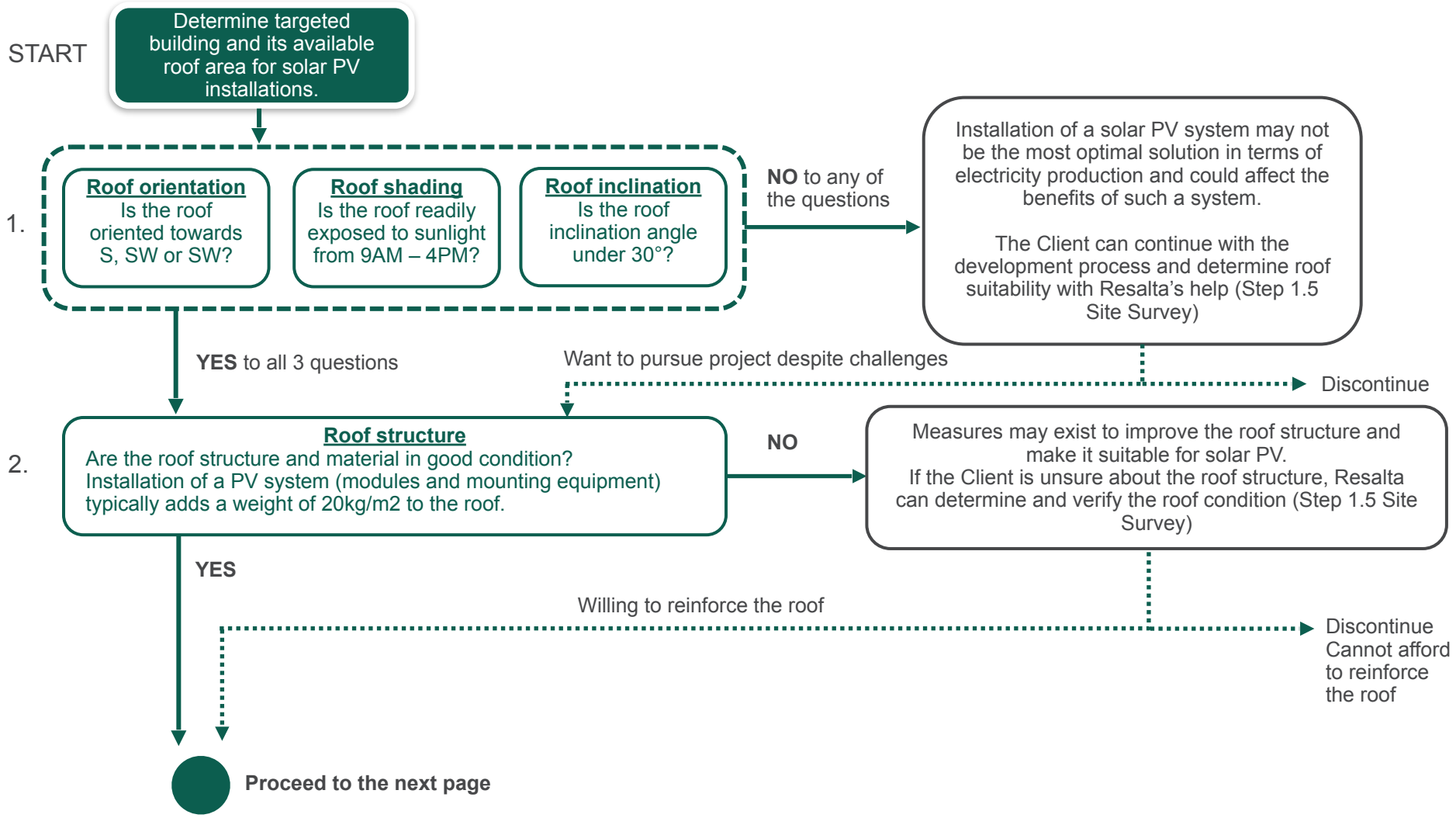
Tool: Decision-making flow chart

Many building or factory owners want to install a solar PV rooftop system at their facility. One main barrier is the lack of information. They may not know where to start or are unsure whether their roof is suitable for installing solar PV systems from a technical, structural and financial perspective.

As the first step, these guidelines provide a decision-making flow chart for the Client. They can go through the flow chart themselves to gain greater understanding of key considerations when developing a rooftop solar PV project. At the end, they will know if installing a rooftop solar PV system is a good option for them. If yes, there are several viable business models they can adopt.

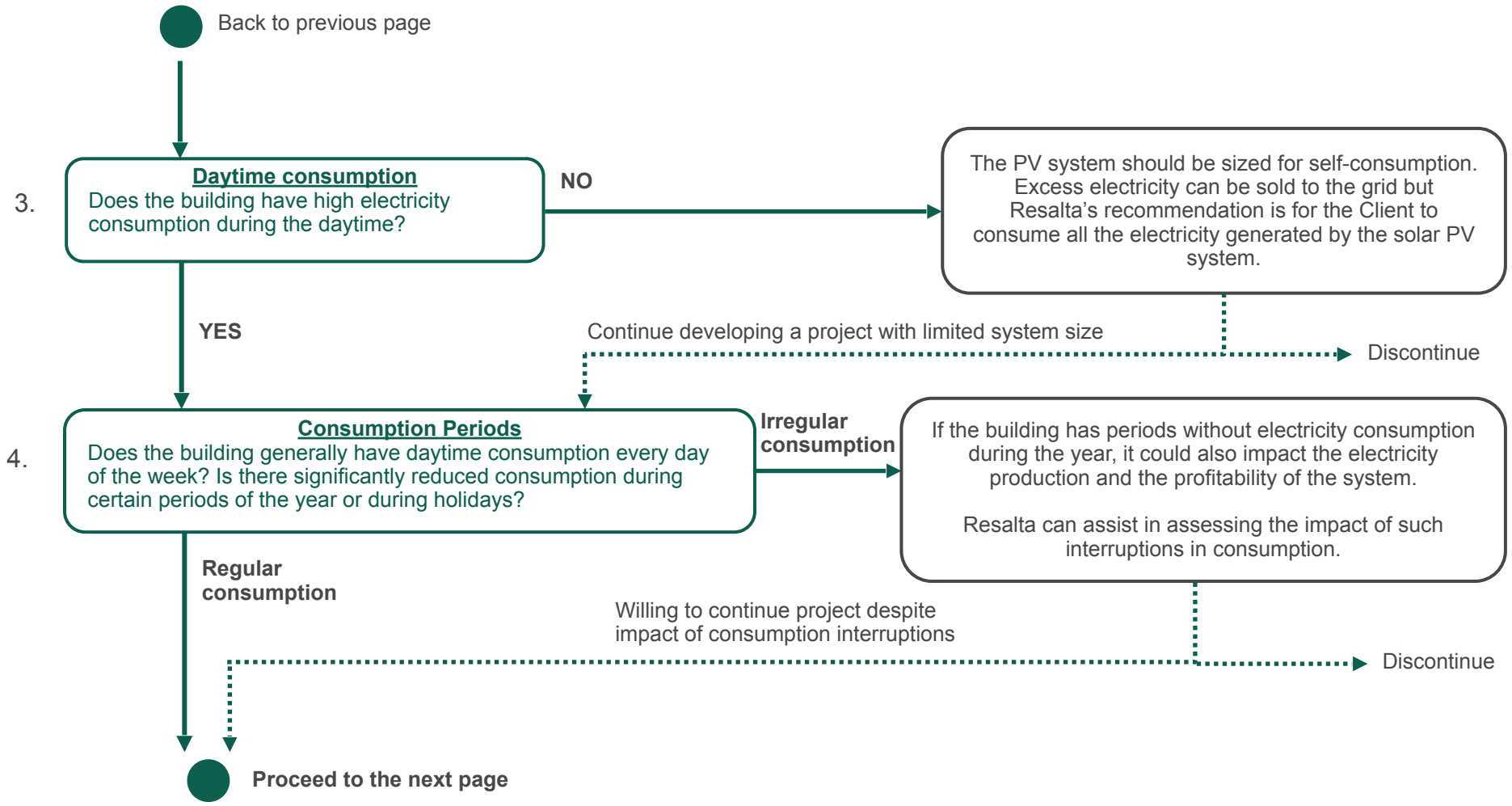
Step 1.1. Decision Making Flow Chart

1/3



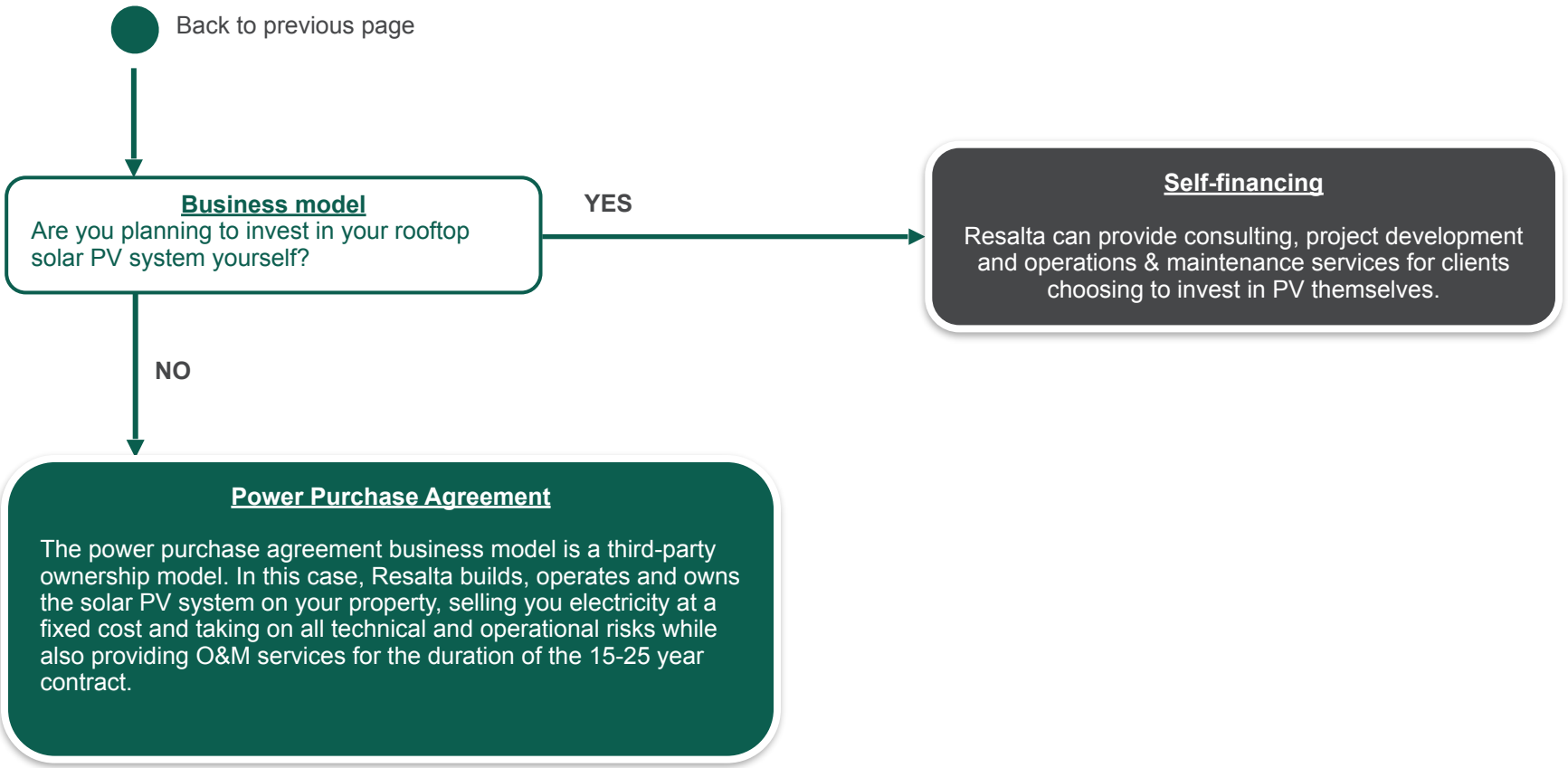
Step 1.1. Decision Making Flow Chart

2/3



Step 1.1. Decision Making Flow Chart

3/3



Step 1.1. Business model selection

By using the decision-making flow chart (1.1), the Client has a good idea of the suitability of their roof for a solar PV system installation. These guidelines are created to present the “Solar as a Rent” (SaaR) business model that is best suited for companies in Romania to develop solar power with no upfront investment, technical or operational risks. The other option is self-financing. The table below compares the PPA model to a self-financing model.

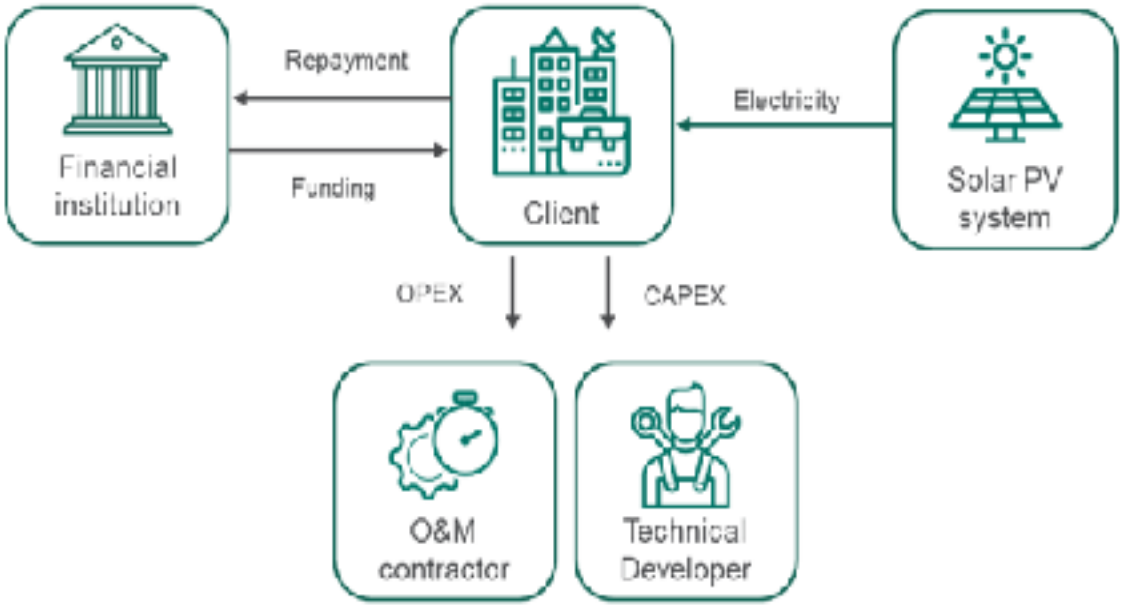
	Solar as a Rent	Self-financing
Description	Resalta builds, owns, operates the PV system and sells electricity to the Client at a fixed price for the contract duration (20-25 years)	Client buys the system. Full investment cost is to be paid upfront to the developer once the system is installed (year 0).
Investment cost	None	Wholly on Client, depends on system size
Electricity savings	Dependent on rising grid electricity prices	Dependent on rising grid electricity prices & support schemes/subventions – client sole beneficiary
Ownership	Resalta	Client
O&M	Provided by Resalta for the contract duration	Responsibility of the Client
Benefits	- Limited investment & O&M costs - Guaranteed fixed cost for 25 years - Buy-back option to switch to self-finance model available	- Full potential savings benefits - Fixed electricity cost for 25 years - Fully in control of the system - No long term contract

Step 1.2. Business model selection

Self-financing model

Under the self-financed model, the Client purchases the system with their own capital. This can be either through equity financing or debt financing (or a combination of both).

The Client contracts Resalta to design and construct the PV system. The ownership of the system remains with the Client.



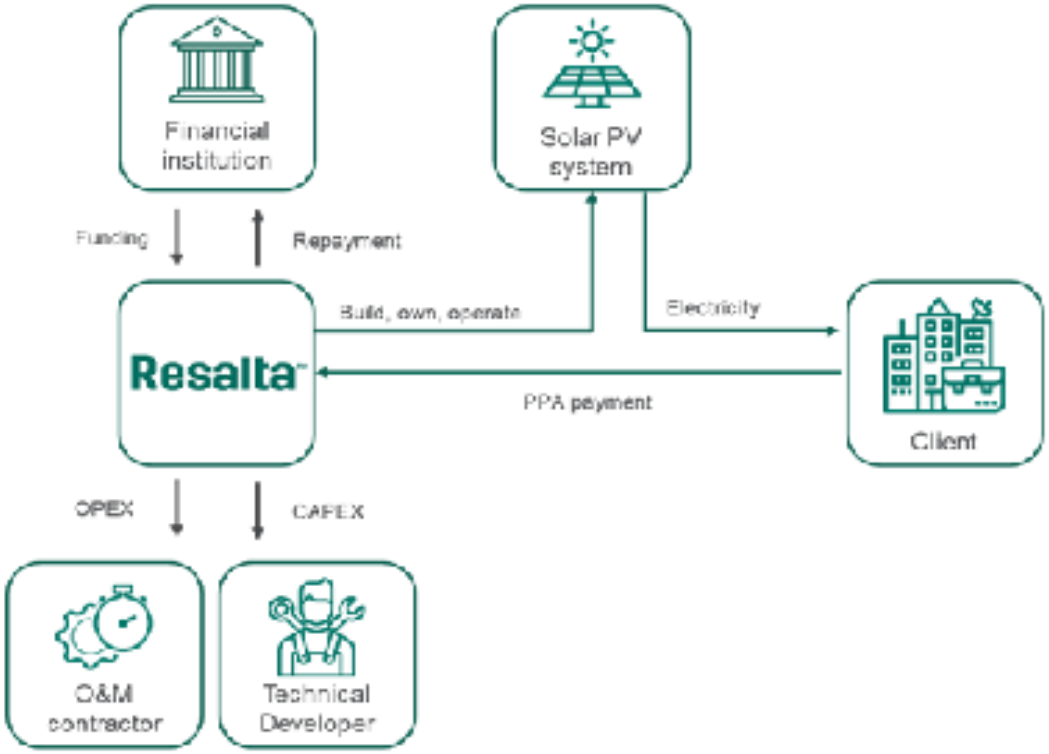
Step 1.2. Business model selection

Solar as a Rent (SaaR) model

Under the SaaR model, all investment is done by Resalta, thus eliminating any upfront investment from the Client's end.

A SaaR is a contractual arrangement of selling power between a solar service provider and the Client. In this case, Resalta invests and installs a solar PV system on the Client's roof. Resalta does not sell the solar plant itself to the Client, instead if builds, owns and operates the system on behalf of the Client.

Resalta receives revenue from selling electricity generated by the solar PV system to the Client at an agreed rate, lower than the local utility rate, but covering the cost of electricity production.



Step 1.3. Information Checklist

Once the business model is chosen (Step 1.2), the Client collects key data necessary for the solar PV project development. This collected data/information (Step 1.3) facilitates an effective discussion and exchange with Resalta's engineers and potential technical contractors.

The data included in the information checklist tool will allow Resalta to pre-determine roof suitability and system size, providing a preliminary feasibility analysis and preliminary cost benefit analysis. Further technical designs follow a site survey (Step 1.4).

Step 1.3. Information Checklist

	Item	How to obtain it
	Site Location ○ Address and GPS Coordinates	Use of Google maps or other available maps application
	Building Plans ○ Floor Plan ○ Roof Plan ○ Roof Usable Area (in square meters) ○ Building Electrical Plan (single line diagram)	This information can be obtained from engineering documents. Consult your engineering/building department.
	Electricity Consumption and Cost ○ Monthly electricity consumption (kWh), customer type, monthly electricity cost (EUR)	Copies of electricity bills from utilities (past 6-12 months) showing consumption and costs.
	Load Profiles ○ Site load profile for at least 1 full week	Commercial/Industrial Clients may have their own load profile data or can check with the utility
	Photos of Site and Chosen Roof Area ○ For a preliminary assessment of the roof construction & structure	If safe access to the roof is possible, please provide pictures from the roof. If not, drone photos or map application photos are suitable.

Step 1.4. Site Survey

The site survey will be conducted by Resalta's engineers, possibly in the presence of a technical developer staff member, upon agreement with the Client. There are several key pieces of information that must be collected during the visit:

- Roof direction & inclination angle
- Roofing material
- Roof structural condition
- Roof shading
- Location of main distribution board (MDB)
- Inverter housing location
- Cable routing
- Other necessary information for design

The Client must ensure that site surveys are effectively conducted, since this is the last step before the technical design and financial proposals from Resalta (Step 1.6). The Client should ensure that the person in charge of the facility's electrical system is present during the site survey.

Step 1.5. Technical Design & Financial Offer

Following the site survey (step 1.5), Resalta should possess sufficient information for the sizing of the system. Resalta will prepare and submit a technical design proposal to the Client for consideration. There are several key components Resalta takes into consideration when designing the system:

- Choice of type and power of photovoltaic module
- Selection of substructure according to the type of roofing and calculation of static loads according to wind forces and snow pressure load
- Inverter type selection
- Design and dimensioning of arrays of photovoltaic modules
- Choice of control system
- Dimensioning of cross-sections of connecting cables
- Design and dimensioning of the electrical connection of the solar power plant to the distribution network
- Determination of measuring sets
- Design and dimensioning of lightning installations
- Sizing of overvoltage protection

Step 1.5. Technical Design & Financial Offer

Applicable regulation & permit requirements

The following elements have to be obtained either from the network operator or the power market operator. They are explained at length at stage 5 (permits & licensing).

1. Consent for connection
2. Connection agreement
3. Payment of the connection contract
4. Supply contract
5. Application for connection and use of the system
6. Device statement
7. Measurements
8. Statement of protection
9. System use agreement
10. Unipolar scheme and operating instructions

Step 1.5. Technical Design & Financial Offer

Relevant documentation

The technical design of the solar powerplant must include the following steps:

1. Conceptual project design
2. Static assessment of the project
3. Project documentation for implementation
4. Project documentation of completed works
5. Operating instructions for the solar powerplant
6. Fire safety study

In order to be fully compliant with local regulations and meet the criteria set by network and power market operators, the project must specify and include the following points:

1. Appropriate meter (remote control) + circuit breaker + button
2. External measuring point on the facade or freestanding cabinet or TR station
3. Contactor behind the meter or circuit breaker with automatic restart
4. Measuring point arranged according to requirements (sealing base, suitable cabinet, etc.)

Step 1.6. Investment Feasibility

Self-financed model

Once the Client receives proposals and offers from Resalta, they will have sufficient information to assess the investment feasibility of installing a solar PV system.

The guidelines provided in this document provide basic assumptions that are generally used and can help guide the investment decision. Resalta can also undertake the analysis on behalf of the Client with a few further inputs such as CAPEX, yield, etc.

Solar as a Rent

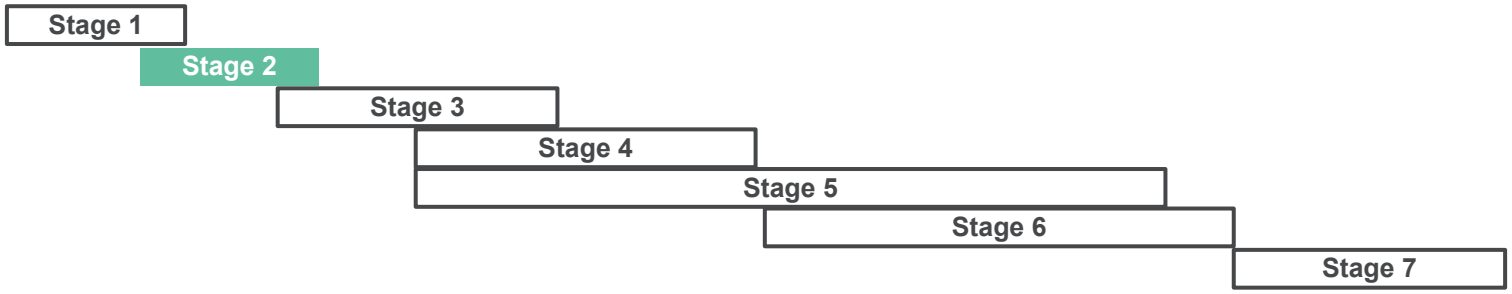
Once the Client receives the proposal from Resalta, they can assess the project feasibility and its financial value to the company.

Step 1.7. Selection of technical subcontractor/developer

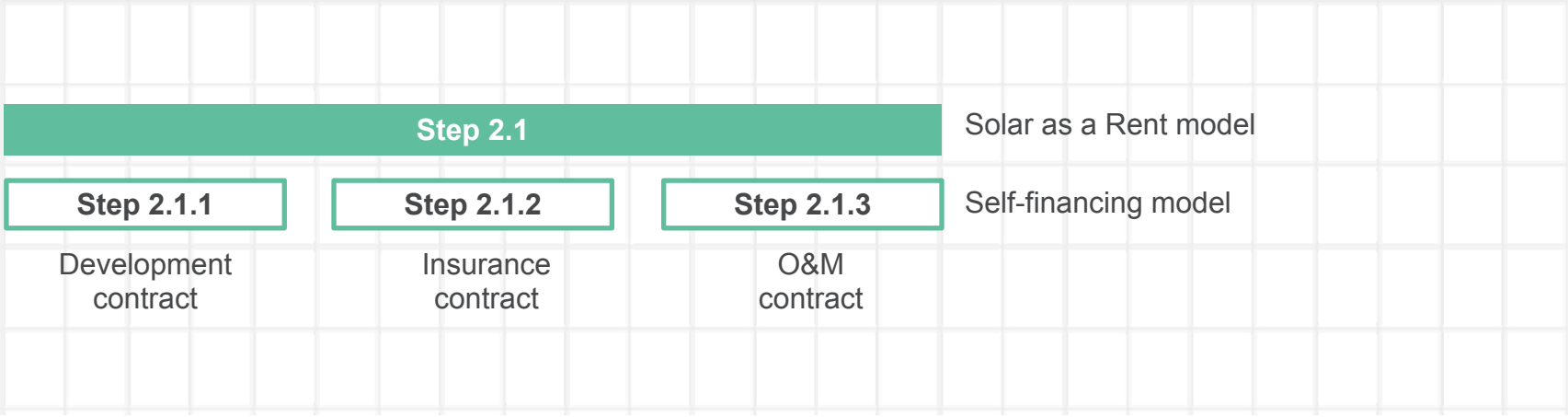
Based on the results of the investment feasibility (Step 1.6) and the Client's decision on which business model to choose, Resalta chooses a subcontractor/project developer to carry out installations and O&M services. The selection moves the project onto the next stage (Stage 2: Contractual Agreement).

The following aspects are considered depending in the choice of developer, whether the chosen business model is self-financing or SaaR:

- Technical offer
- Track record/credibility/ESG & CSR standards
- Price of the system offer
- Electricity yield
- Yield guarantee



Stage 2: Contractual Agreement



Solar as a Rent contract

Different contracts under self-financing model

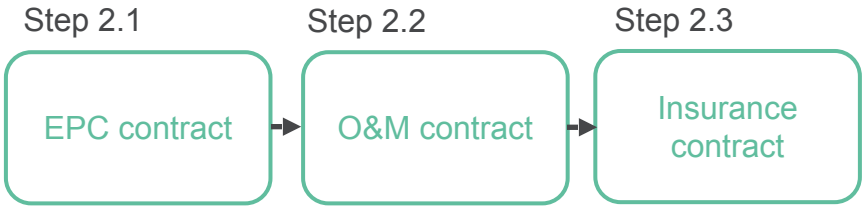
Resalta

Stage 2: Contractual Agreement

Solar as a Rent model

Step 2.1

Self-financing model



Steps handled by Resalta

Steps handled by the Client

Resalta

Stage 2: Contractual Agreement

During the Site Evaluation stage, the Client has chosen a business model for project development (self-financed or SaaR). This leads to different contractual implications and therefore has to be negotiated differently between the concerned parties.

Solar as a Rent model

A long-term SaaR contract is made between Resalta and the Client (Step 2.3). The SaaR contract stipulates terms and conditions on which the Client pays electricity from Resalta. As this contract is long-term (15-25 years), it is important that the SaaR is comprehensive and covers all conditions and eventualities.
Under this model, Resalta is responsible for construction, operation and maintenance of the system and must take care of the **EPC Contract** (Step 2.1), **O&M Contract** (2.2) and **Insurance Contract** (2.4).

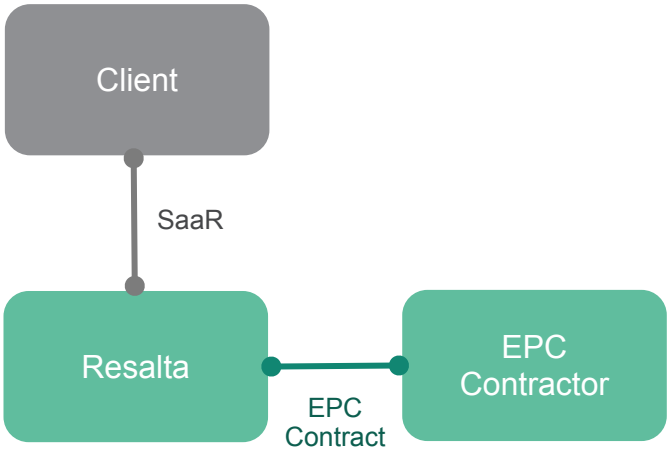
Self-financing model

Under the self-financing model, the Client contracts the EPC contractor to provide a turnkey service in installing a solar PV system. Two contracts are crucial for this model. The Client and the contractor must agree on the terms and conditions of the **EPC Contract** (Step 2.1). The EPC contractor usually provides operations and maintenance (O&M) services for a certain duration of time after the completion of system installation. After that point, the client is responsible for O&M activities. Some Clients choose to use their own staff for carrying out O&M, but usually an external party is hired to handle O&M activities through an **O&M Contract** (Step 2.2).

Step 2.1. EPC contract

An EPC contract is a contract that governs two parties on the design, engineering, procurement, construction and installation of solar PV rooftop systems. The EPC contract is the same regardless of the model chosen (SaaR or self-financing), the only difference being that a different party contracts it (Resalta or the Client).

Solar as a Rent model



Self-financing model

Under the self-financing model, Resalta guides the client through the process, providing support on project development, contracts, and O&M.

Step 2.1. EPC contract

Terms & Conditions

Payment conditions	
Cost of EPC	The cost cover the design, engineering, procurement, construction and installation of solar PV rooftop system.
Payment Schedule	Usually several payments are required, for instance 10% after design phase, 60% advance payment for the equipment, 30% after test run and hand over protocol.
Warranty	
Equipment Warranty	Warranty is regulated by manufacturer's warranty for different parts of PV rooftop system (Panels 12 years, inverters 5-12 years). There is a possibility to buy extended warranty.

Step 2.1. EPC contract

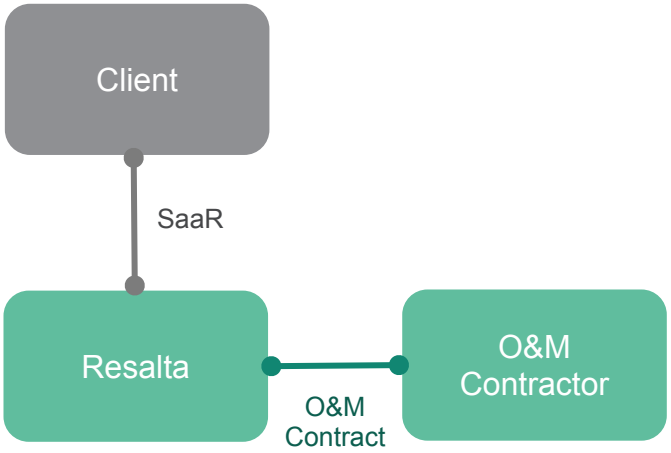
Terms & Conditions

Warranty	
System performance rate guarantee	System performance guarantee given on component level – performance given on level of the installed equipment only (i.e. panel degradation, inverter efficiency). Burden of proof on the investor.
System yield guarantee	Usually no explicit guarantee included. Only informational data on expected yields.
EPC workmanship warranty	Usually from 2 to 5 years. For some works there are 10 year warranty available – i.e. leakage.
O&M period	Can be a part of EPC or a separate contract. Period usually lasts up to the lowest warranty period of the installed equipment.

Step 2.2. O&M contract

An operation & maintenance (O&M) contract is a contractual document governing all operation & maintenance activities on the installed rooftop solar PV system. Details of this step are the same regardless of the chosen business model, the difference is only between the players involved in the O&M contract.

Solar as a Rent model



Self-financing model

Usually, the EPC contractor who constructs and installs the system covers O&M activities for a few years after commissioning. After that point, the Client or Resalta must either do their own O&M or contract a third party for O&M services. Most EPC contractors offer O&M services.

Resalta

Step 2.2. O&M contract

General Scope of O&M Contract

Scope of PV Operation & Maintenance	
Monitoring & reporting	▪ Remote monitoring (alarms) ▪ Daily/monthly/yearly reports ▪ Routine inspection reports
Preventative Maintenance	▪ Annually: cleaning of PV modules, inspection of roof condition, PV modules, mounting structures, combiner boxes, protection equipment, etc. ▪ Annually: inverter preventive maintenance ▪ Annually: inspection and testing of systems ▪ Annually: meter calibration
Corrective Maintenance	▪ Error diagnosis ▪ Handling equipment & product warranty claims for Client ▪ Repair work ▪ Stocking of modules and inverter spare parts

Step 2.2. O&M contract

SaaR O&M Contract

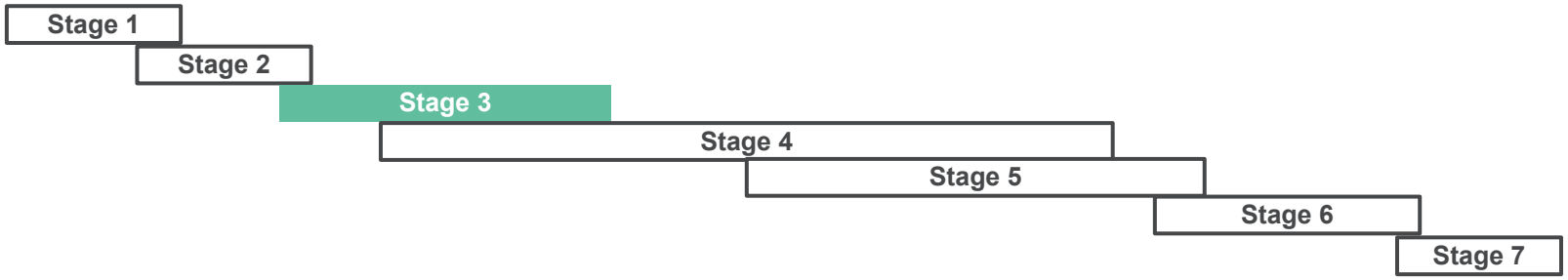
If the Client chooses to conclude a SaaR with Resalta, key terms and conditions that should be considered to be part of a SaaR contract are summarized in the following table.

Terms	Description
Contract term	Typically 15-25 years
SaaR price structure	Client will pay a rent for the right to use the solar power plant with the purpose to produce electricity for self-consumption. The rent is calculated based on the annual production of the solar power plant and the electricity price. Whilst the production of the solar power plant is variable depending on irradiation during a year, the electricity price will be fixed for the length of the contract. The rent will be fixed on monthly basis and will be an annual settlement in relation to actual production (thus variable payments based on production).
Investment & financing	Covered by Resalta
Yield guarantee	Will Resalta guarantee yield performance of the solar rooftop system?
Transfer of ownership	▪ Is the system transferred to the Client at the end of the contract? Are there any payments on the Client's end for the transfer? ▪ Is there a buyback option for the Client to buy the system before the PPA contract expires?
Emissions reduction	▪ Will future possible emission reduction certificates belong to Resalta or the Client?

Step 2.3. Insurance Contract

Resalta incurs certain risks under the SaaR model, as the solar PV system which is an asset of Resalta is located on the Client's roof. Resalta may seek an insurance contract to cover risks that may arise during the system's lifetime. The insurance should cover all risks deemed necessary from Resalta's perspective.

Insurance cost varies on coverage but is usually 0.5 – 1.0 % of total CAPEX per year.



Stage 3: Financing

Step 3.1	Resalta obtains financing for the entire project
Step 3.1	Client invests in project or obtains financing independently

Power purchase agreement model

Self-financing model

Resalta

Stage 3: Financing

Stage Description – self-financing

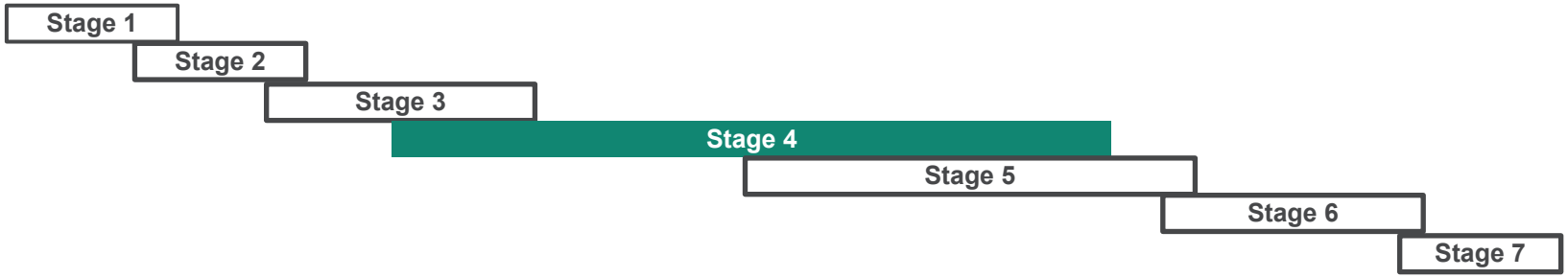
In the financing stage, the Client choosing to self-finance a solar PV installation may opt to utilize own equity, or to apply for bank financing.
The optimal financing option will depend on a variety of criteria such as the size of the project, the type of financing available, credit worthiness and cash flow, and more. The Client needs to make a decision based on its own needs, requirements and abilities.

Despite the declining cost of solar PV modules, the upfront investment in a solar PV system can be considerable. When 100% equity investment in a solar PV rooftop project is not feasible, the Client must secure a bank loan. Different banks will have different criteria for evaluating solar PV projects, and some will require that the Client channel some of their own equity for the project before approving a loan. Finding a bank with financial instruments tailored specifically for renewable projects is recommended where possible.

Stage 3: Financing

Stage Description – Solar as a Rent

Alternately, a SaaR model places the burden of financing entirely on Resalta who funds the entire project with 0 investment on part of the Client. This business model is meant to remove entry barriers for clients to install solar PV systems and facilitate the switch to renewables. While ownership of the plant remains with Resalta, so do all technical and operation risks and the financing responsibilities.



Stage 4: Permits & Licensing

Construction & installation

Step 4.1 Location information

Step 4.2 Project documentation preparation

Step 4.3 Project approval

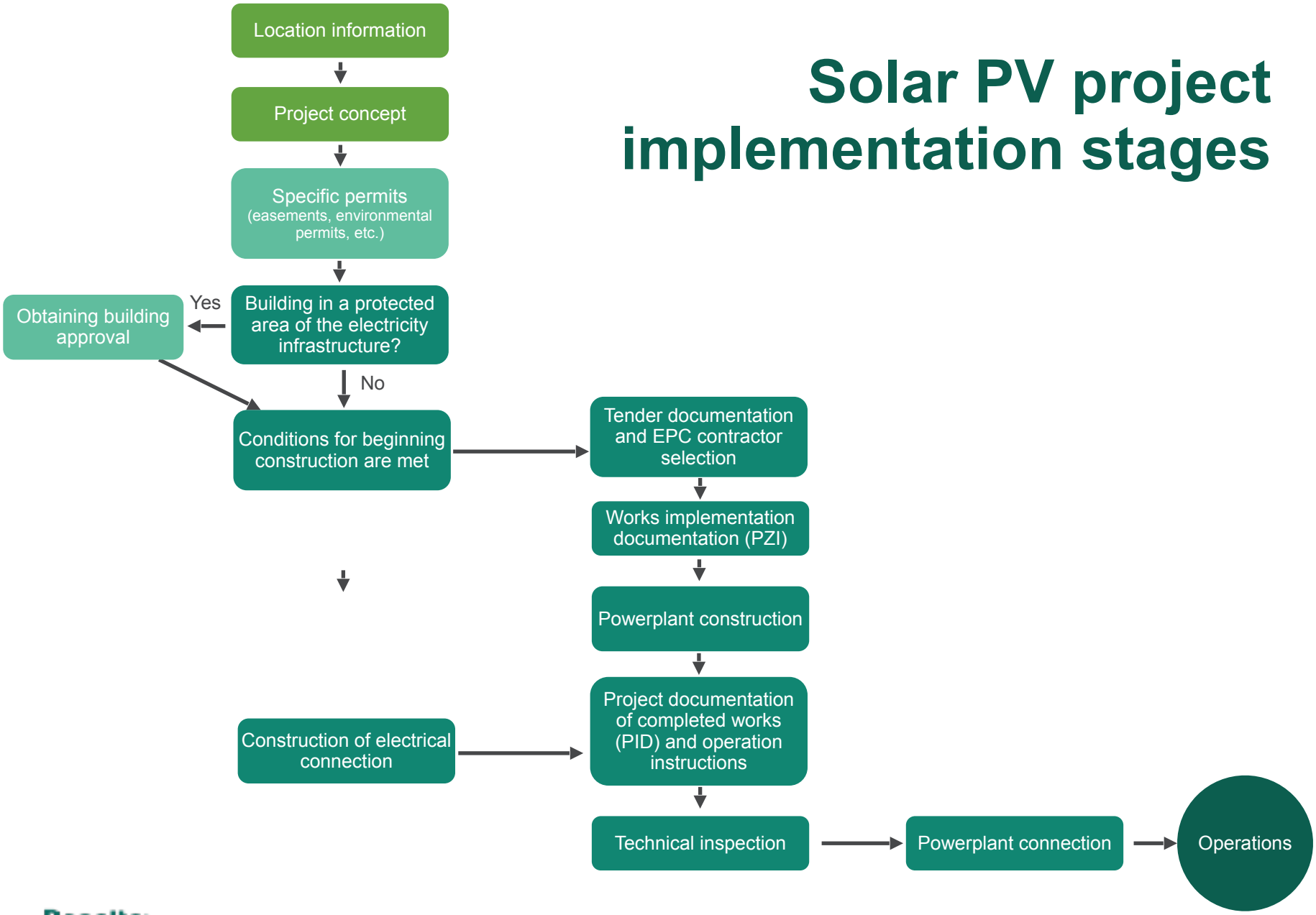
Step 4.4 Measurements & performance test

Step 4. 5 Technical inspection

Final handover & connection to the measuring point **Step 4.6**

These steps are covered by stage 6: commissioning

Solar PV project implementation stages



Resalta

Stage 4: Permits & Licensing

Stage description

The permits and licensing stage outlines key permits and licenses which are required for solar PV rooftop projects. Different permits and licenses are required depending on the installed capacity of the system (DC capacity). In Romania, there is one process for powerplants under 1,000 kWp and a second one for powerplants over 1,000 kWp.

The larger the system size the more permits and licenses are required, so a powerplant above 1,000 kWp requires building and energy permits that smaller powerplants do not.

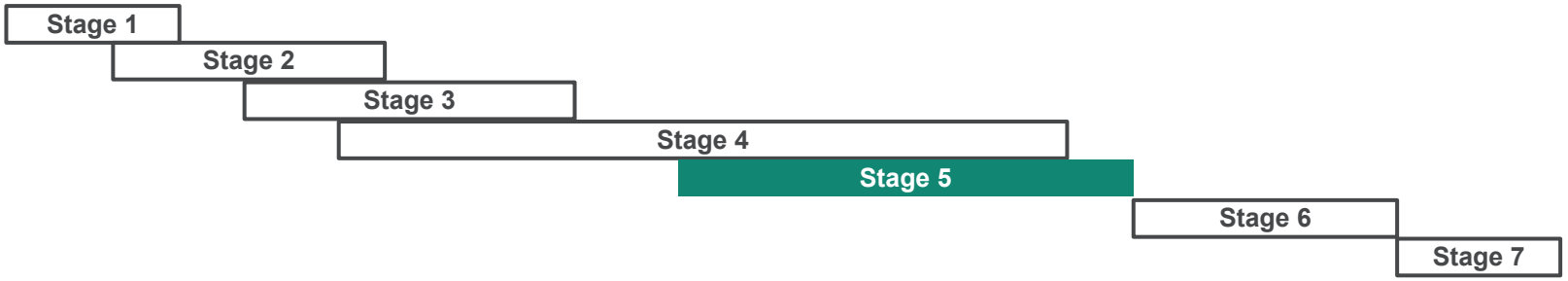
This document outlines the permits and licensing procedure for solar powerplants with an installed capacity **under 1,000 kWp**.

All permits and licenses have to be obtained from system operator of the distribution network or power market operator. Resalta obtains the permits and licenses with the authorization of the Client.

Stage 4: Permits & Licensing

Solar powerplant <1.000 kWp connection procedure and required documentation

1. Obtaining location information
2. Project documentation preparation
3. Project approval
4. Solar power plant installation
5. Measurements and performance test
6. Technical inspection of the facility (performed by the electricity network manager)
7. Final handover and connection to the measuring point (performed by the electricity network manager)



Stage 5: Procurement & Construction

Resalta responsibility

Resalta

Stage 5: Procurement & Construction

Stage description

The Procurement & Construction Stage describes the process of equipment/system procurement in line with project documentation, site preparation and related agreements, construction and installation of solar powerplants. Most tasks are performed by the EPC contractor but control and inspection of the overall development to ensure quality of deliverables remains a responsibility of Resalta (under the SaaR model) or the Client (under the self-financing model).

This stage consists of two steps: **Site Preparation (5.1)** and **Construction & Installation (5.2)**.

Step 5.1. Site Preparation

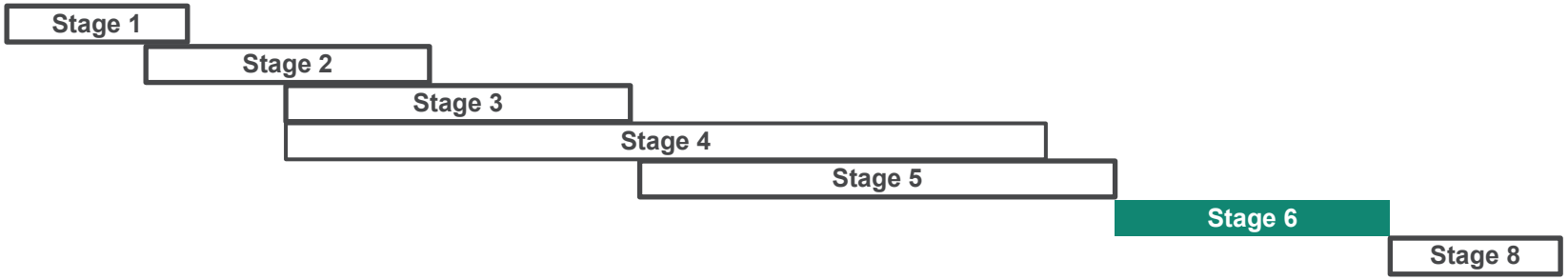
Before beginning construction of the solar powerplant, it is necessary to have all the right conditions ready. The owner of the facility is always responsible for this. Access to the site must be ensured, as well as the use of necessary resources such as electricity, water, equipment storage facilities, as well as to define and specific safety conditions, etc.

After all the arrangements have been made, the EPC contractor or subcontractor will access the site to **construct and install the system (Step 5.2)**. During this step, project owners must oversee the overall work to check progress and ensure quality of workmanship.

Step 5.2. Construction & Installation

Once all the necessary conditions are met and the implementation documentation is in place, the process for building and putting the solar powerplant into operation can begin. Depending on the selected business model, the EPC contractor or Resalta takes the initiative and takes care of the procurement process. The Client assumes a minor role in overseeing compliance with the contractual provisions.

Under the self-financing model, the EPC contractor/technology vendor is the one responsible for the procurement of all components, construction and installation of the solar PV rooftop system. Resalta can act as an owner engineer to oversee and supervise the construction. This is to ensure that all procured components meet with technical requirements and comply with standard or good engineering practices. This will also ensure that the system is properly installed.



Stage 6: Commissioning

Commercial Operation Date (COD)

Step 6.1 Measurements & performance test

Step 6.2 Technical inspection

Step 6.3 Final handover & connection to the grid

Resalta

Step 6.1. Measurements & performance test

Internal testing

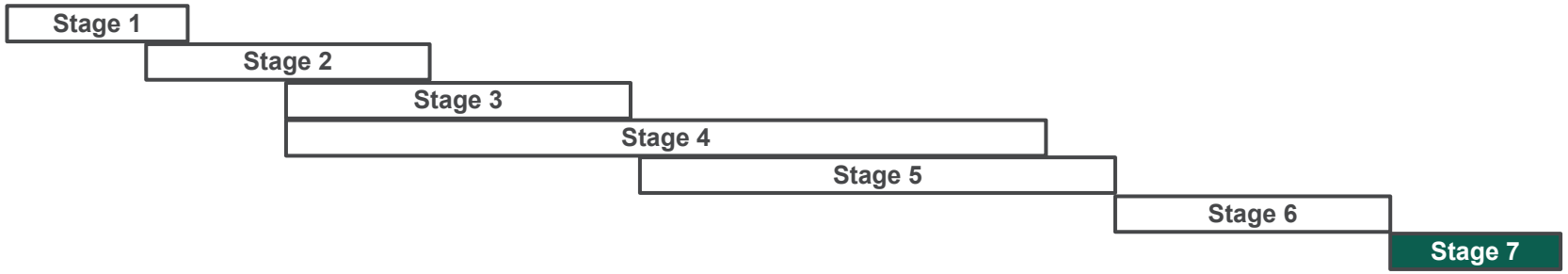
Resalta (or the EPC contractor in the case of the self-financing model) performs internal testing of the solar powerplant. This ensures that all components and the system as a whole are properly connected and coordinated. In this step, a quality inspection of the installed equipment and performed works is carried out, that also includes checking all essential elements installed/built.

Typical testing includes:

- Functional tests on supplied components and equipment
- System operation
- Testing safety devices
- Compliance of the installed equipment with the applicable standards and declarations
- Measurement protocols

Step 6.2. Inspection before final handover

It is the final step before the solar powerplant and the whole system is handed over to the operations and maintenance team and the Client begins to benefit from renewable electricity at the preset tariff.



Stage 7: Operation & Maintenance

Step 7.1 O&M staff training

Step 7.2 O&M scope

Stage 7: Operation & Maintenance

Stage Description

The operation and maintenance phase begins when the solar photovoltaic rooftop systems have been fully installed and launched. This phase is the longest in duration. It lasts until the end of the lifecycle of the solar PV system, which is usually 25 to 30 years.

The first step is to provide training (Step 7.1) for the staff who will operate and be responsible for maintaining the system. Under the self-financing model, the EPC provider typically provides operation and maintenance services for 2-3 years after the system launch. After that, the facility owner must plan the scope and activities of O&M (Step 7.2). Under the SaaR model, Resalta takes care of O&M activities.

Step 7.1. O&M training

To ensure the sustainable operation of the system, it is crucial that the operator has a good understanding of the operation of the solar power plant and the importance of maintenance. This is especially important for the self-financing model when the system is owned and maintained by the project owner. If the project owner uses their own staff for management and maintenance, they must initially appoint a person responsible for the solar PV system and ensure that the person has the appropriate skills. The training of this person must be done by the EPC provider.

In the case of a power purchase agreement, the facility owner is not responsible for system maintenance. However, adequate knowledge of solar PV and its components is useful for easier communication between individual stakeholders.

What the system operator must do:

- Know the basics of the operation of a solar power system
- Carry out periodic inspections of the solar power plant
- Observe safety at work (ie. high voltages, risks associated with the PV system, etc.)
- Regular performance review/monitoring (ie. understanding of system parameters, etc.)
- Use of measuring devices (clamps, etc.) or control system
- Preliminary troubleshooting
- Clean system components
- Warranty period

Step 7.2. O&M scope

According to the energy regulations, each solar powerplant must have a professionally qualified person who will perform the services prescribed in accordance with the legislation.

Measurements for each solar powerplant are carried out within a prescribed time frame. Local measurements of electrical installations, lightning conductors and protections are also required by law.

The maintenance inspection of a solar power plant includes:

- Inspection and documenting of the current / implemented conditions
- Inspection of the indications for firefighters
- Inspection of the adequacy of hazard statements
- Inspection of the adequacy of measurements
- Inspection of the neatness and safety of the space where the solar PV powerplant is located

Step 7.2. O&M scope

Regular inspections of all power plant components

The maintenance of solar powerplants also includes regular inspections of all components of the powerplant. Regular inspections are required at least once a year.

The following elements are inspected: solar modules, electrical circuit, surge protection, inverters, load-bearing substructure, electric meter, mains connection, lightning rod.

- In the case of modules, the color of the glass is inspected, to check whether moisture has penetrated between the glass and the cells, or whether there are possible stretches of the frames and cracks in the glass.
- If the solar power plant is located in an area where it is very windy, the mounting of the solar modules is also checked, as is the aluminum construction.
- In the case of a substructure, the expansion joints of the structure, the clamping of the modules and, in general, the overall substructure are inspected.
- The inverters are also checked, especially if the ventilation is uninterrupted. The inverters are also checked for wear on the contacts, which are also replaced if necessary. In the case of inverters, it is also important to check the water tightness and overvoltage protection.
- In the case of a lightning conductor, all joints of the lightning conductor are checked.

Step 7.2. O&M scope

Regular inspections of all power plant components

Inspection of the substructure
- Inspection of the screws attached to the base
- Inspection of the screw connections of the substructure
- Inspection of the attachment of the modules
- Inspection of the earthing of metal parts

Inspection of the modules
- Mechanical (screw inspection)
- Thermal (inspection with a camera)

Inspection of the DC wiring
- Uoc and Isc measurements of individual shears
- Inspection of DC connectors

Inspection of the distribution boxes
- Inspection and functionality test of all elements
- Inspection of the screws

Inspection of the inverters
- Functionality check
- Parameter setting check and reset if necessary
- Cleaning of cooling elements and filters

Inspection of the network connection
- Inspection of the functionality of the elements
- Checking of the cable connections

Step 7.2. O&M scope

Cleaning of the modules

Solar powerplants that are set at a sufficiently steep angle generally do not need cleaning or are cleaned less frequently (every 5 years) on average, as the rain takes care of removing obstructions and dirt. Dust that accumulates during dry weather has a negligible impact on the powerplant's efficiency. Exceptionally, cleaning is necessary in cases where a large amount of bird droppings accumulates on the modules or if the power plant is located along a macadam road and dirt from the road accumulates on it.

Solar powerplants that have a small angle or are on flat roofs require more frequent cleaning. It is necessary to take care of regular cleaning of the modules annually or every two years. Cleaning may only be carried out by an installer or a qualified person, as such work can be dangerous due to possible damage to the modules or electrical wiring. Dirt that can accumulate at a solar power plant is smog, sand, bird droppings, pollen, algae, etc.

Lack of regular and professional cleaning can lead to a 5% to 20% reduction in the efficiency of a solar powerplant.

Step 7.2. O&M scope

Solar PV powerplant monitoring & error reporting

The power plant is monitored online or through personal computer, possibly with the help of a smartphone.

Error notifications are sent via e-mail or SMS, if a suitable (GSM) interface is installed.

There are two types of monitoring:

- Basic monitoring: daily, monthly, annual power plant production. The solar PV operation is monitored online in real time and daily notifications about electricity production and errors are received.

- Advanced monitoring: the operation of each module is monitored separately in real time. The O&M manager is informed at all times whether all modules work the same and if any issues arise such as dirt, module damage, module aging. This increases the power plant's yield because the system enables the manager to make the best use of the solar power plant, allowing for quick fault detection and remediation.

Resalta™

Thank you

Resalta Energy SRL
Calea Dorobanti 237
Bucuresti
Romania
alexandra.soreanu@resalta.com
0734 639 747

resalta.com