DEVELOPING DEVELOPERS
LIVE WEBINARS

COMMISSIONING PROJECTS:
ENGINEERING PROCUREMENT CONSTRUCTION

25 FEBRUARY 2021 – 14:00pm

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SAWEA
Chief Executive Officer

WELCOME

Welcome to the "**Commissioning Projects: Engineering Procurement Construction**" Live Webinar 2021

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#projectdevelopment

LOCAL RESOURCES – GLOBAL COMPETENCE

SAPVIA and SAWEA, in partnership with BEPA, IPPO and REEF(SA) present the sixth webinar as part of the seven-part series of workshops to address key areas that aspiring developers need to understand.

In this session we bring a panel of experts to discuss the dynamics of the construction phase of renewable energy developments. The session will focus on Engineering Procurement and Construction (EPC) and Commissioning on renewable energy projects. The discussion will unpack planning, execution, building local capability, opportunities, and challenges experienced in the construction phase as well as the detailed process of commissioning projects and connecting to the national grid.

IN PARTNERSHIP WITH

BEPA Black Energy Professionals Association

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MAINSTREAM RENEWABLE POWER SOUTH AFRICA

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SPEAKERS

IZAK VAN DER MERWE
Raubex
Business Unit Manager: Wind Energy

DYLAN TUDOR-JONES
Gransolar Group
Country Manager

MATT ASH
Norton Rose Fulbright
Director

SIMONE ZANOT
Enel Green Power
Commissioning Leader

AGENDA: *14h00 – 16h00*

- Introduction and Welcome **SAWEA**
- RE EPC Planning and Implementation - Processes, Steps, Pitfalls, Opportunities and Risks (Wind Project specific) **RAUBEX**
- RE EPC Planning and Implementation Opportunities (Solar PV Project specific) **GRANSOLAR GROUP**
- Presentation: Projects in Construction: Challenges and Hurdles
  NORTON ROSE FULBRIGHT
- Presentation: Commissioning RE Projects (connection agreements) **ENEL GREEN POWER**
- Q & A **SAPVIA**
- Closing Remarks **SAPVIA**

SAPVIA SAWEA

IZAK VAN DER MERWE
Raubex
Business Unit Manager: Wind Energy

Izak has a Bachelor of Engineering Degree from Stellenbosch University which he obtained in 1991 and he is a registered Professional Engineer with the Engineering Council of South Africa. At the start of his career he joined Eskom and spent 13 years with Eskom during which time he obtained valuable power system and power system protection and operations experience. In 2005 he started working as a consultant until 2013 when he entered the construction industry where he has been working since. During his time with the consulting firms EON Consulting and Hatch, he obtained valuable experience in the renewable energy field which he could apply in his role in the construction industry. During his time in the construction industry, he has been working on more than 15 wind farm projects forming part of the REIPPP Programme at various project execution stages. During his career he has been involved in at least 40 of the Round 1 to 4 REIPPPP projects.

Commissioning Projects: Engineering Procurement Construction

Renewable Energy EPC Planning and Implementation (processes, steps, pitfalls, opportunities, risks)

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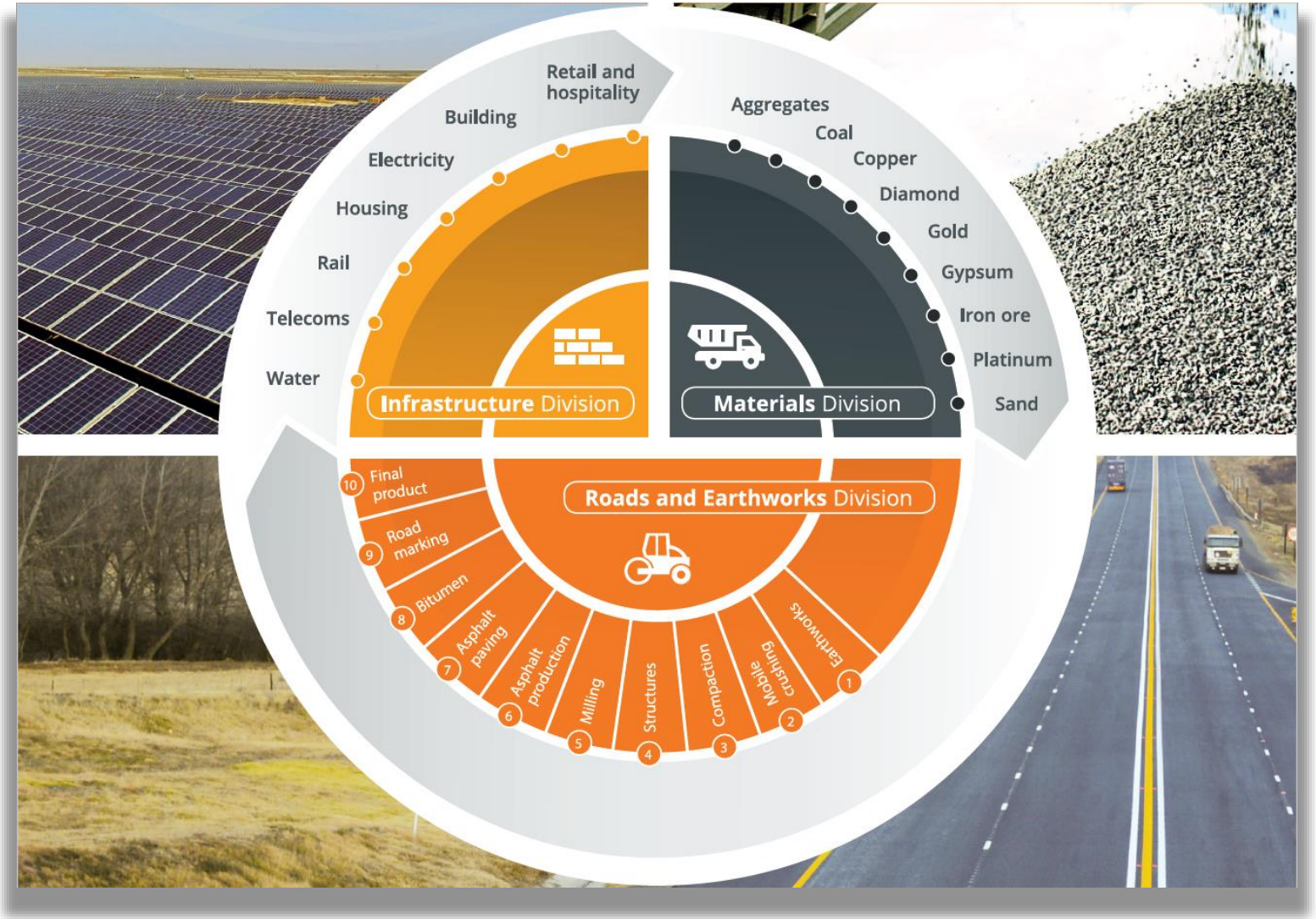
Raubex Group



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BULK EARTHWORKS AND STREET CONSTRUCTION

This discipline's activities consist of the following:

- Cut and Fill operations
- Construction of platforms for solar plants and shopping centres.
- Crushing
- Construction of earth dams and attenuation ponds
- Bulk earthworks and street construction

TELECOMMUNICATIONS AND SPECIAL PROJECTS

- Fibre and GSM Telecommunication
- Micro Trenching
- Fibre Internal/External Roads
- HDD Drilling
- Turnkey Solutions
- Fibre to Home
- Building of Subsidised Housing

CIVIL AND GENERAL INFRASTRUCTURE

This discipline specialises in:

- The development of all residential and industrial developments that include bulk storm water systems
- Bulk sewer and water reticulation pipelines / networks
- Micro piling and major concrete works
- Large bore pipelines
- Internal and external streets in and around residential and industrial developments.

ELECTRICAL INFRASTRUCTURE AND RENEWABLE ENERGY

- Renewable Energy BU operates in the RE industry (private and REIPPPP)
- Specialise in PV, CSP and wind projects from 5MW to 140MW
- Sub-EPC or Main Contractor
- Electrical and Civil construction, can perform both CBoP and EBoP works
- Has all the required plant, tools, equipment and qualified and experienced human staff and industry partners to provide effective services ranging from Design and Engineering through to Construction, Commissioning and Hand Over
- Perform installation of Electrical Reticulation and Distribution Infrastructure for Urban Development Projects

Planning phase

Developer

- Developing a project on Google Earth?
- Environmental approvals – road width
- Desktop Geotech always a problem, fight about pricing
- 132 kV OHL route survey, involve surveyor from the start, stay away from watercourses
- Substation location & size (environmental authorisation) – allow for sufficient space
- Transformer delivery route
- Permits – clear responsibilities, some can only be done by developer/IPP
- Choose the correct contractor/s
- Responsibility Matrix and Interface Agreement – spend time during planning phase
- Owner's Requirement:
  - cover everything the contractor should include in his price
  - do not over specify
  - specify what is necessary, not what you would like to have
  - do not underspecify either, optimise
- Inadequate time allowed for proper pricing
- Do not push contractors too hard on price - contractors are not in the business of charity
- Environmental issues – search and rescue
- Design review process – too long and cumbersome

EPC contractor

- Project Schedule
- Contractor must do design and engineering
- Design & Design Freeze, approvals
- Site visit & Geotech studies
- Design
  - Designer must visit site during geotech
  - Integration between Eskom ad IPP substation designs
  - Eskom design duration and process
  - Planning Long lead items
  - Eskom Telecomms
- Eskom Outages
- Site Establishment, accommodation & transport
- Water availability
- Where to obtain suitable construction material (e.g. G5, bedding sand with suitable thermal properties, etc.)
- Resource requirements
  - Site management, own staff
  - Local labour
- Subcontractor selection
- Plant requirements
- Land owner engagement
- Economic Development & Enterprise development - procurement and labour
- Technical interface between turbine supplier and BoP Contractor should start during planning phase already

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Implementation phase

Developer

- Experienced Owner's Engineers with construction experience (site supervision)
- Do not manage the project with contracts or NCRs, the personal and human touch is required
- Only inspect once activities are completed, never inspect alone/in isolation
- Never give instructions to contractor's site people

EPC Contractor

- Site establishment
- Vendor and equipment selection
- Properly manage and control all designs, data sheets and drawings to be submitted for review, track comments and get formal acceptance
- Interfaces and construction commences, civils first
  - Access route and road
  - Traffic management
- Contract between contractor and suppliers
- Internet connectivity, construction and operational phase
- Factory inspections during equipment manufacturing
- Long lead time items order & delivery
- Sometimes a disconnect between Eskom and Eskom approved suppliers for equipment
- Quality checking and documentation, handovers, etc.
- Eskom interface and Eskom deliverables
- Managing Eskom expectations
- Storm in a tea cup about some issues
- Honour informal verbal site instructions, agreements and undertakings
- Specifications being overridden on site by Eskom reps/owner's engineers
- Environmental representatives taking it too far
- Enough time for wind turbine commissioning and Grid Code Compliance Testing

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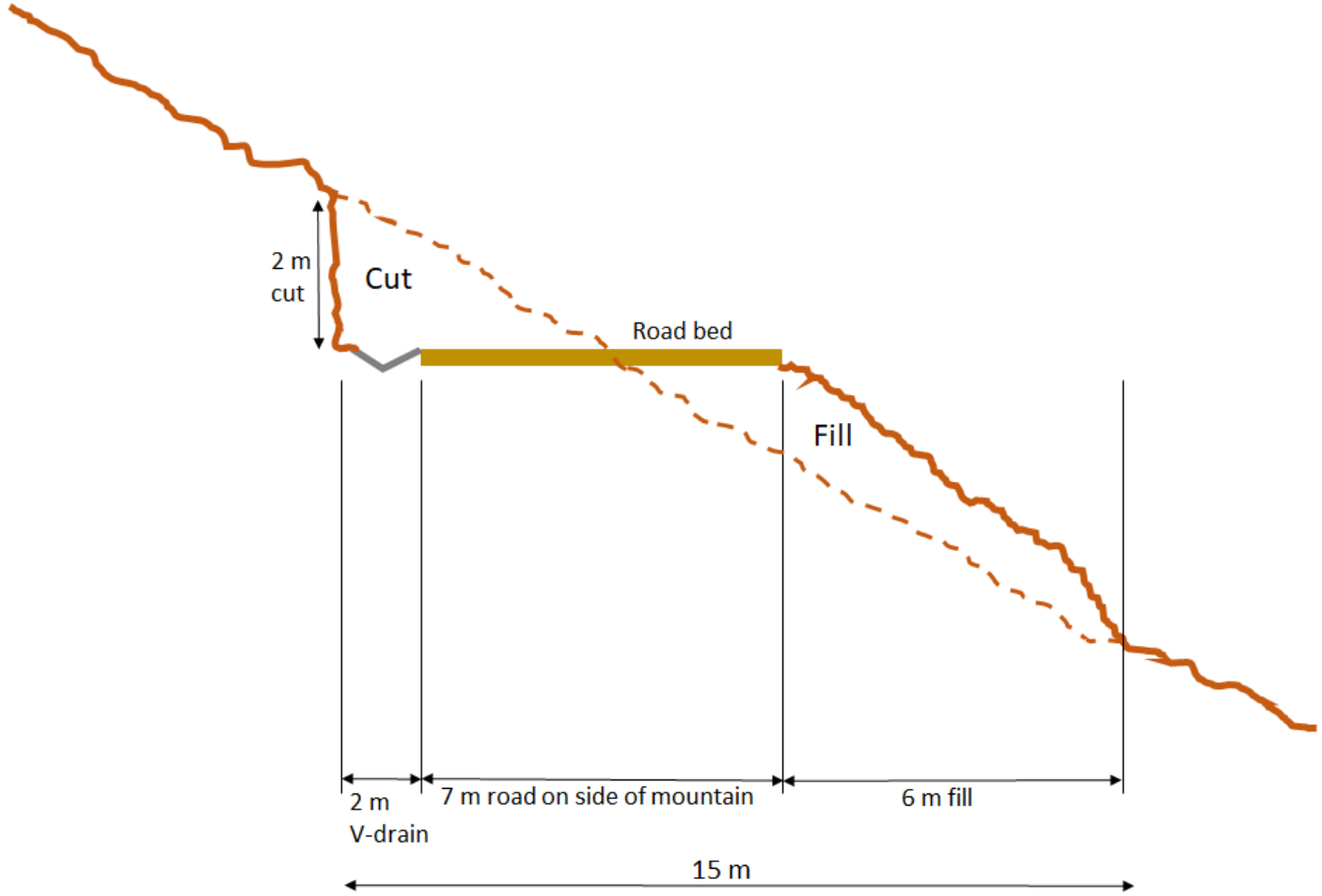
What happens when some of these things go wrong?

Geotech specification, design and construction costing

Geotech and design integration

Environmental & design execution



Not to scale

Design and construction integration

Competent contractor and importance of Quality Control

Risks

- Pressure on price too high – then standards go doen
- Optimise into stupidity
- Lack of contractors, upskilling
- Too much work all at once
- Short timeframes for the projects

Opportunities

- Development of local labour and pools of skilled and semi-skilled people
  - not site based
  - create core of skilled and semi-skilled workers
  - we create jobs as we move from site to site, but when we leave those people are often stranded
- Split contracts
- EPC EBoP contractor to commission Eskom Self Build Works and Eskom to witness to assist Eskom with timing and capacity, can accelerate works
- Design optimisation and project clusters, new way to think about Grid Connections and Eskom Network

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THANK YOU

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DYLAN TUDOR-JONES
Gransolar Group
Country Manager

Dylan is the South African Country Manager for the Gransolar Group and is responsible for representation and support for all Group Company activities in the SADC region.

These activities relate to; Gransolar Project Development, EPC and O&M services, Ingenia Solar Energy Engineering, Commissioning & Quality Control services, PV Hardware Tracker and SCADA system sales and installation services as well as E22 Energy Storage Solutions and System Integration sales including power electronics and EMS systems.

Before joining Gransolar Group four years ago, Dylan was a business owner in the C&I Solar Energy market for sixteen years. Dylan's experience and accumulated knowledge therefore spans both the Commercial / Industrial and Utility Scale solar PV industry value chains.

Over his 26-year career in the solar industry, Dylan was requested to offer technical inputs to the Eskom advisory board prior to the launch of the Eskom Solar Rebate Programme. He has co-authored various papers and industry handbooks, presented solar technology papers and educational talks to industry professionals and has been interviewed on both radio and television on topics relating to solar, sustainable living and energy efficiency. Dylan has been an invited expert speaker at local and international conferences and was a founding member and past Chairman of the SA Solar Thermal Industry Body.

Dylan was apart of the GRS team which negotiated and closed the 55MW Greefspan II EPC REIPPP Round 4 contract. He led the GRS O&M team last year in securing the renewal of two strategic O&M contracts bringing their total projects under South African operations to 280MW. Dylan was also instrumental in setting up the localization of the PVH Tracker fabrication in South Africa and securing over 400MW of supply contracts in REIPPP Round 4.

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EPC Planning & Implementation Opportunities

SAPVIA Developing Developers Webinar Series

GRANSOLAR GROUP

Introduction to Gransolar Group

Gransolar Group is a group of vertically integrated companies that specialize in solar photovoltaic energy and battery storage systems.

After 15 years of global experience, Gransolar Group has managed to differentiate itself by its high technical and execution capacity and its great agility and adaptability.

We design, manufacture and deliver, proprietary solar and storage solutions

15 YEARS 2005 - 2020

GRANSOLAR GROUP

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Gransolar Group Companies

GRANSOLAR GROUP

GRS

- Development and Construction
- EPC Contractor
- Operation and Maintenance

ISE

- Engineering Design
- Quality Control
- Testing and Commissioning

PVH

- Tracking & Support structure
- Controllers
- SCADA Systems

E22

- Energy Storage Solutions
- Industrial Design & Manufacturing
- Power Electronics & EMS

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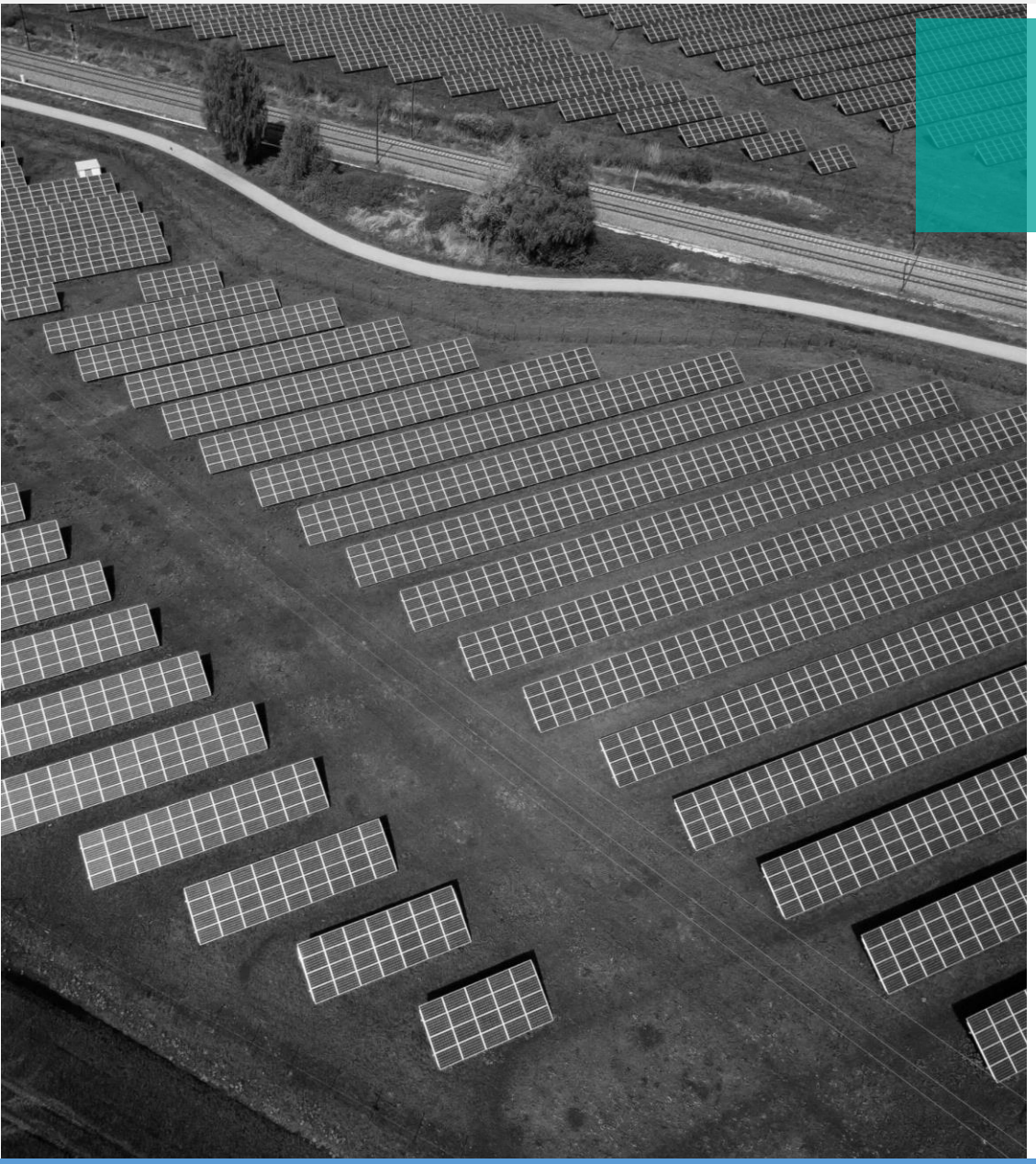


Engineering, Procurement, Construction Planning

High level percentages of what makes up an EPC contract value:

PV Modules – Approx. 35% (assuming 100% imported) subject to market availability as per project construction schedule and technology chosen.

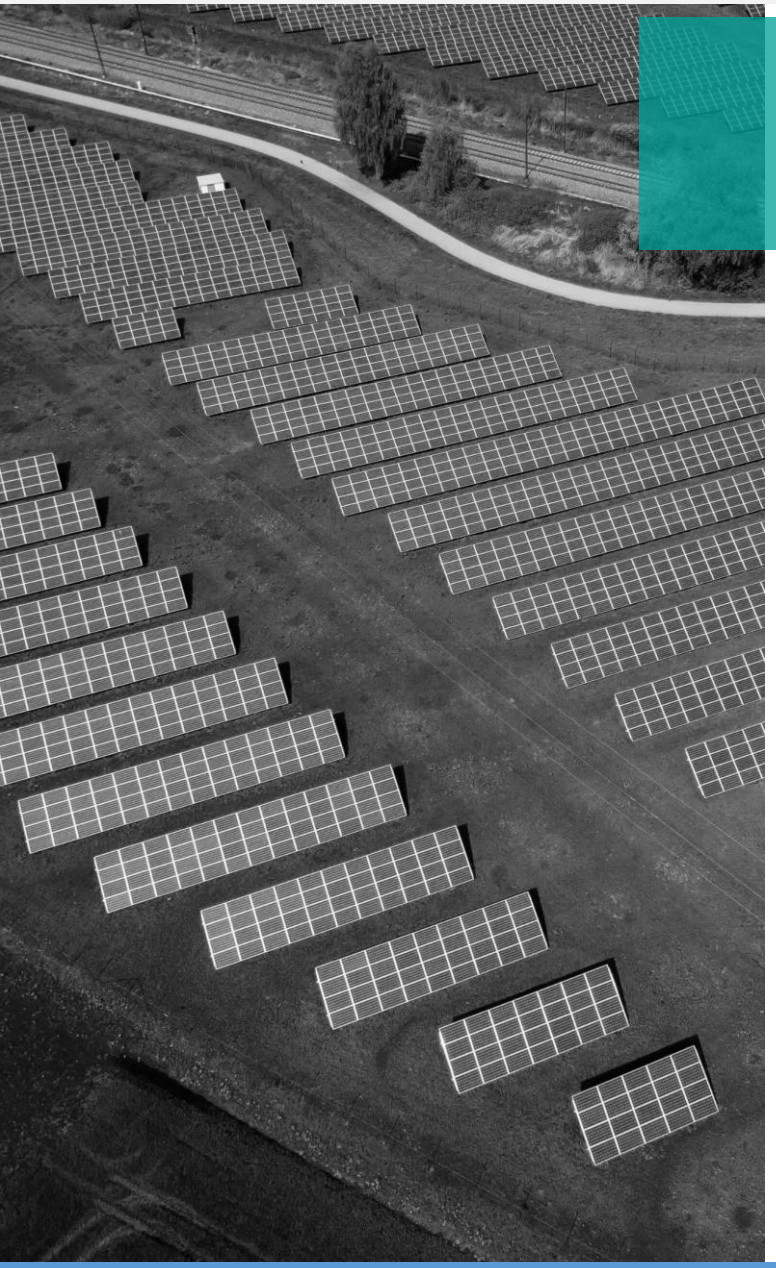
Inverters – Approx. 6-10% (assuming 35% Local Content) subject to inverter type versus project size (analyzed per project).

Structures – Approx. 10-15% subject to tracker solution and Local Content percentage.

Interconnection – Approx. 8%-10% subject to project specific interconnection requirements (substation and evacuation lines).

Balance of System – Approx. 30-40%

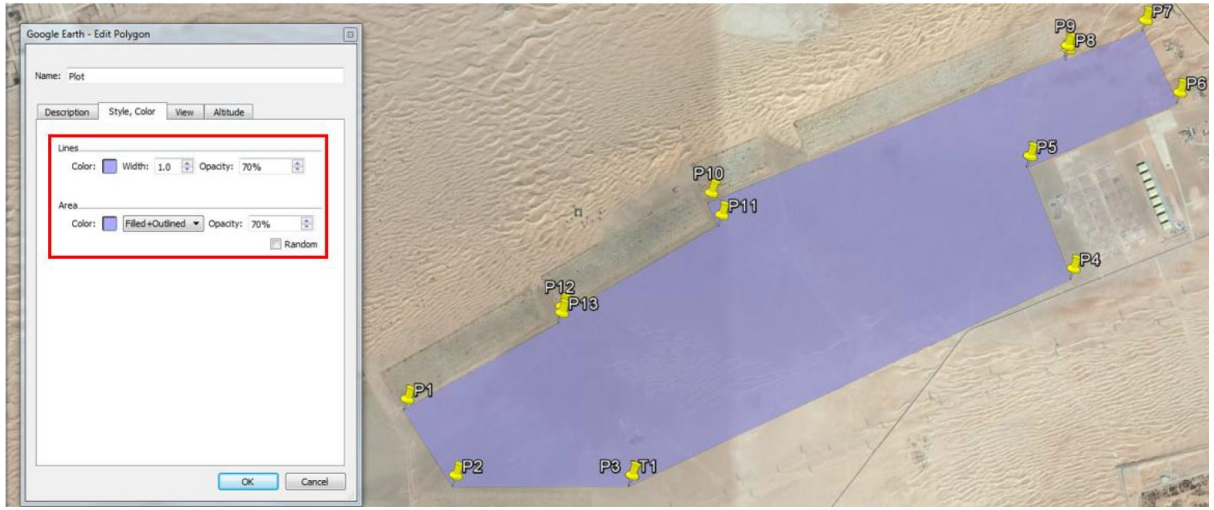
**Values are indicative and subject to specific project conditions and technology improvements*

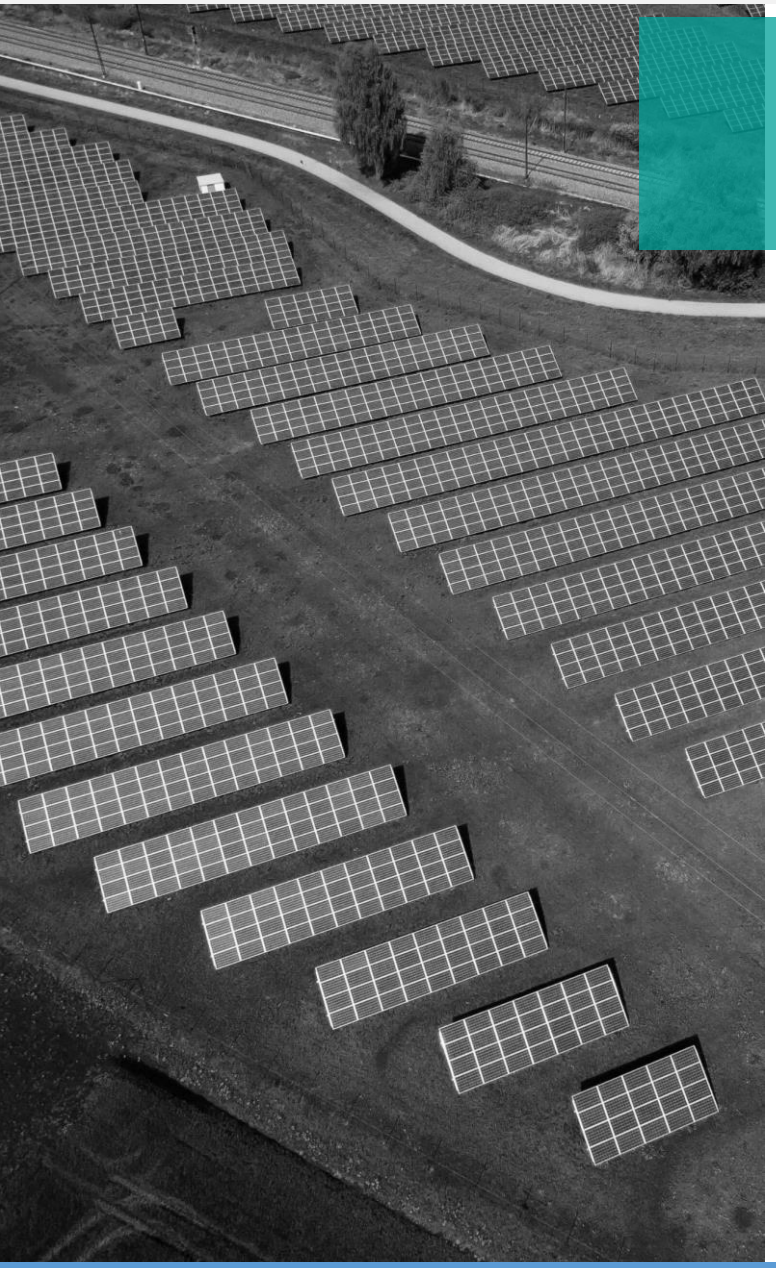


Site Information

EPC Tenders usually share site information via KMZ files, Drawings and other Technical Specifications.

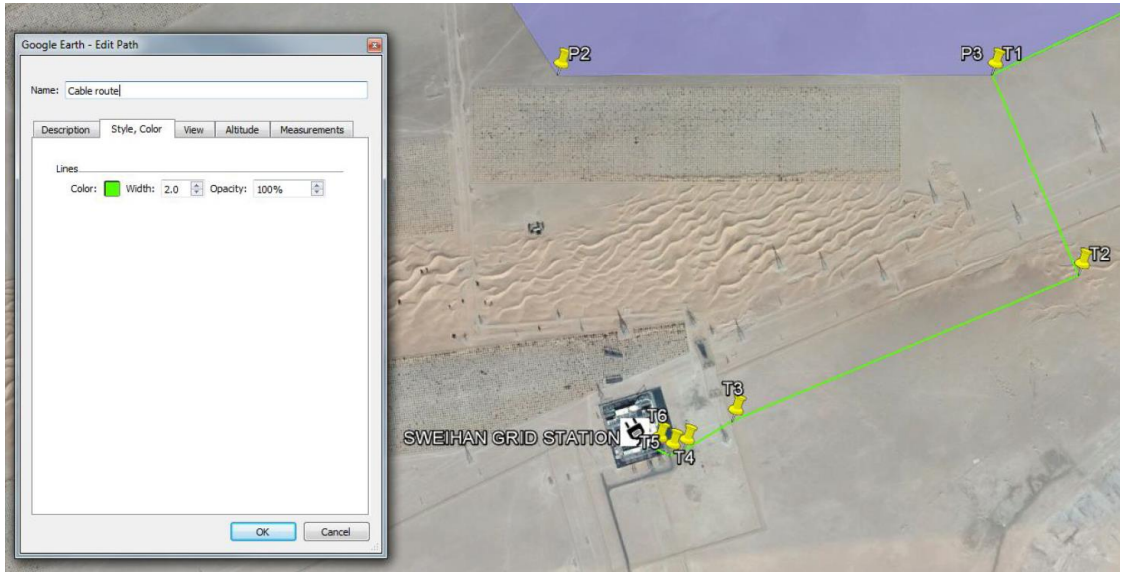
Google Earth is first used to plot the perimeter of the proposed site.



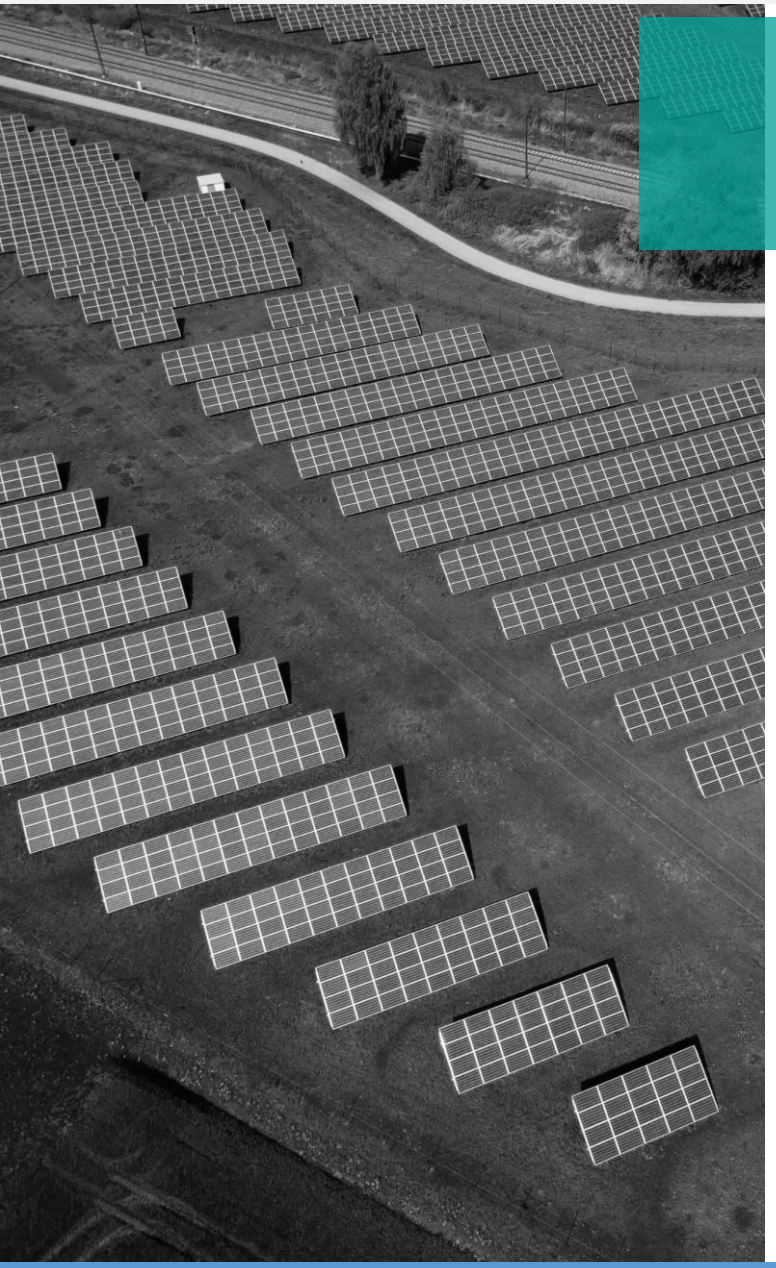


Site Information

Once the interconnection point has been defined, the evacuation cable routing needs to be defined.



Any effected services need to be identified such as existing Overhead or Underground Electrical Power Lines, Water or Sewage Pipelines or Telecom Cables.



Site Visit

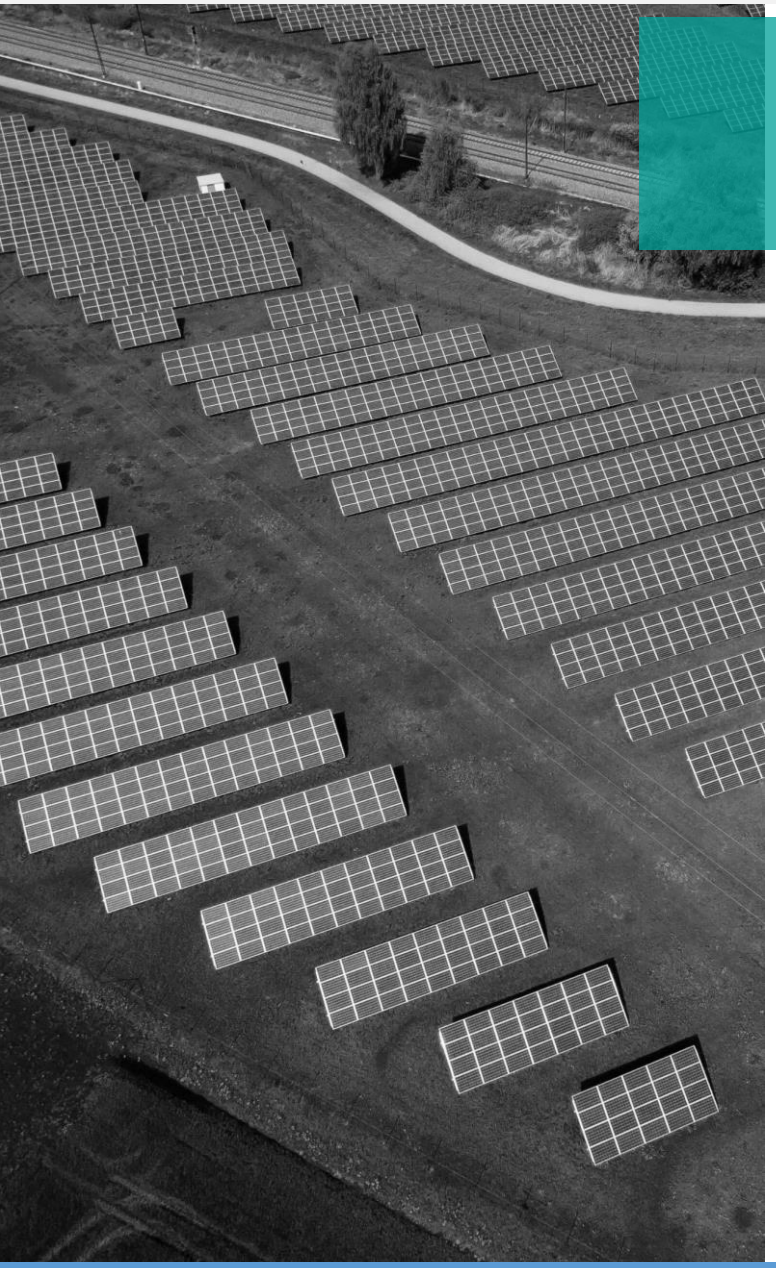
A site visit is important to establish what cannot be established via Google Earth.

Meeting with the landowner and other project stakeholders is a good starting point to gather all the relevant information from the site and its environment.

Key information includes:

- Point of interconnection
- Access to site
- PV Site / Land conditions
- Environment
- Site surroundings

Once this information is gathered and shared with the PV engineers, designs can be finalized and a detailed BoQ can be sent to each specialist sub-contractor for specific work packages.

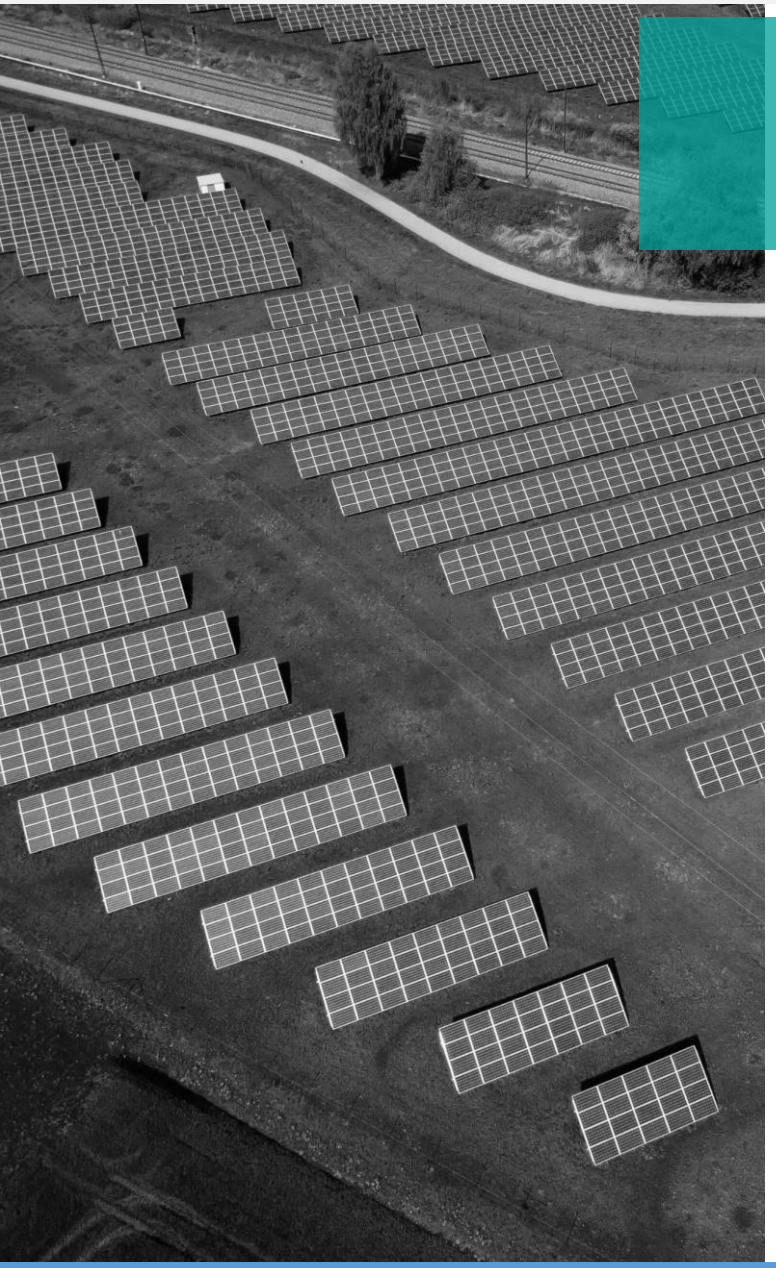


EPC Implementation Opportunities

EPC Supplier and Service Provider work packages include:

- Pre-work & Engineering
- Major Equipment
- Mobilization
- Human Resource and Economic Development Services
- Civil Works

  Foundations
- Electrical Works
- Switchgear & Substation
- Interconnection

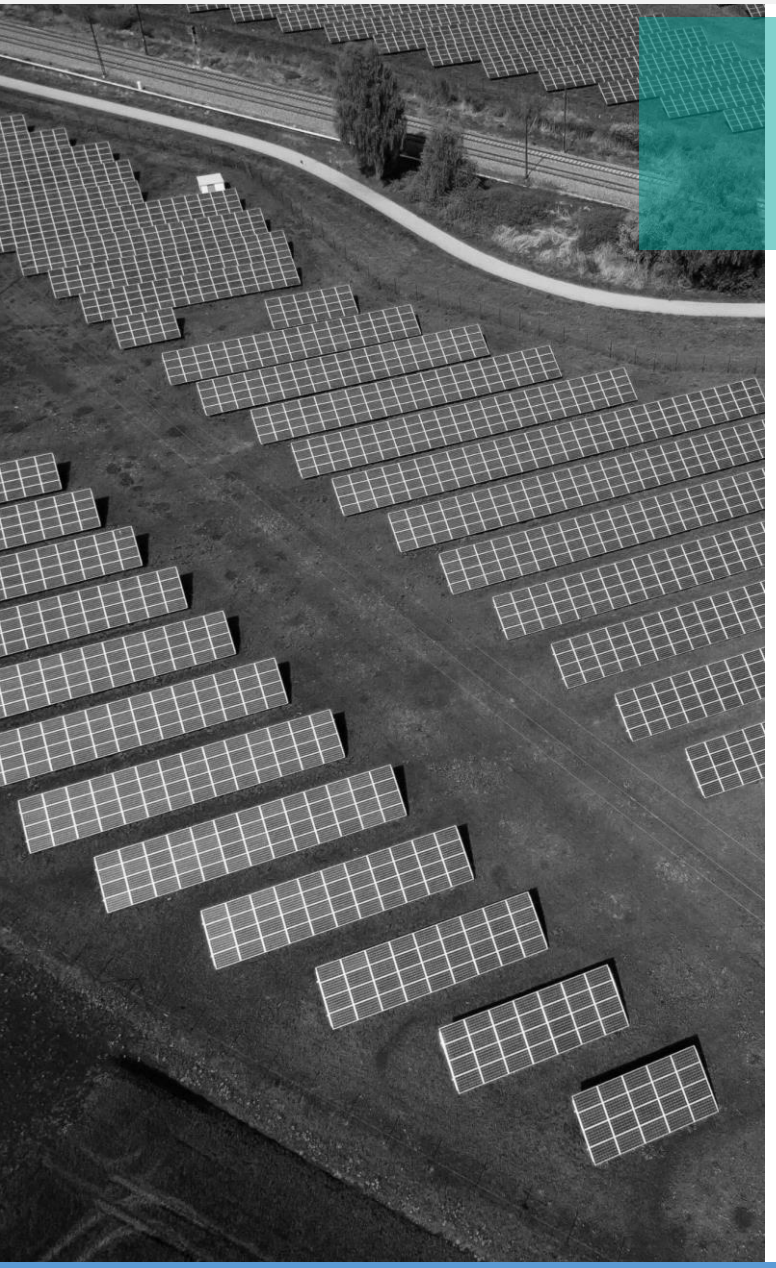


EPC Implementation and Opportunities

EPC Supplier and Service Provider work packages continued:

- Mechanical Works
- Logistics
- Scada
- Security System
- Quality Control
- Start up & Commissioning

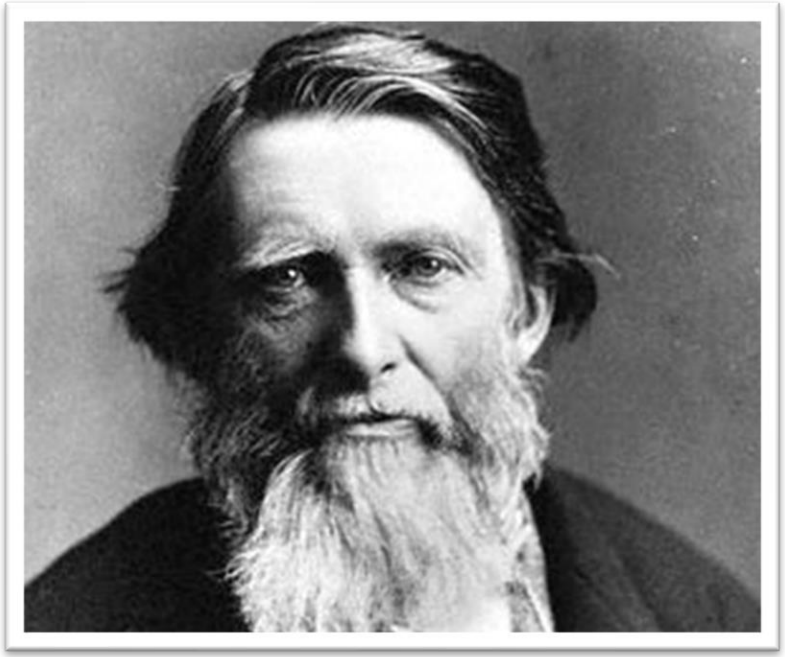
Commercial Cost Considerations



Closing Thought

"It's unwise to pay too much, but it's worse to pay too little. When you pay too much, you lose a little money - that's all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot - it can't be done. If you deal with the lowest bidder, it is well to add something for the risk you run, and if you do that you will have enough to pay for something better."

John Ruskin: 1819 - 1900



1st Floor, Hyde Gate, Hyde Park Lane
Corner Jan Smuts Ave & William Nicol Drive, Hyde Park
Johannesburg, South Africa
www.gransolar.com
T. (+27) 010 492 0558 | M. (+27) 82 450 4619
dtudor-jones@gransolar.com

MATT ASH
Norton Rose Fulbright
Director

Matt Ash is a projects lawyer based in Cape Town. He focuses his practice on energy- and major infrastructure projects, and is a highly-experienced and trusted advisor to clients across a wide variety of sectors and technologies, including energy-, transport- and civils infrastructure projects. Matt's key focus is on construction, operation, and supply agreements across the full spectrum of energy technologies – wind; solar PV; biomass; hydropower; gas-to-power; waste-to-energy (including pyrolysis); geothermal; and thermal coal. Over and above his legal qualifications and experience, Matt also is a World Bank-accredited Certified PPP Professional (CP^3P), and is well versed in public procurement across the African continent.

Matt's recent construction experience has included appointments in more than 30 projects across the REIPPPP and Risk Mitigation procurements on a mix of Sponsor/Developer, Lender, and Contractor mandates – and accordingly is singularly well-qualified to speak about challenges and solutions in the construction phase of energy projects

NORTON ROSE FULBRIGHT

Projects in Construction: Challenges and Hurdles

Matthew Ash

"Programme"

Delay

Performance Issues

Defects

Force Majeure

Corporate and commercial questions

Disputes Mechanism

Concluding Remarks

Delay

Delay - “On time and within budget” (1)

Projects under REIPPPP and RMIPPPP

- TFC - Scheduled COD determines the construction programme.
- “Time is of the essence”.

3 sources of delay:

- Employer
- Contractor
- Force Majeure.

Delay - “On time and within budget” (2)

Employer Delay

- Delay in issuing NTP or affording access to Site.
- Delay in approval of designs, plans, processes (where required).
- Delay in issuing required variations.

Mitigations and “incentives”

- Contractor entitled to EoT.
- Employer loses time (days) on the back-end of the PPA .

Delay - “On time and within budget” (3)

Contractor Delay

- Delay in commencement.
- Site issues.
- “Slippage on the construction programme.

Mitigations and “Incentives”

- Expressly exclude “Concurrent Delay”.
- Detailed provisions re site risk (e.g. geotech ‘early works’).
- Constant monitoring by Employer’s Representative.
- Contractor pays Delay Liquidated Damages for failing to meet TFC.

Delay - “On time and within budget” (4)

Upfront Mitigation

- It’s all about the (Base) Contract.
- Include a detailed construction programme that expressly highlights the critical path.
- Express provisions dealing with site risk, concurrent delay, etc.
- Monitoring protocols for the Employer’s Representative.
- Ensure a DLD package adequate to cover the anticipated risk.
- Consider interim DLDs to cover failure to meet interim major milestones in the construction programme, not just TFC.

Performance issues

Equipment performance (1)

Design

- Inadequate or deficient design.
- Equipment consequently not able to perform to specification or performance guarantees.

Mitigations and "incentives"

- The Employer's Representative and the LTA must be technically qualified and competent to review designs on an informed basis.
- Professional Indemnity insurance (Sizing!)

Equipment performance (2)

Manufacture

- Defective manufacture of critical components in the equipment.
- Equipment not able to perform to specification or performance guarantees.

Mitigations and "incentives"

- The Employer's Representative and the LTA must be technically qualified and competent to monitor manufacture on an informed basis.
- Monitor the manufacturing process, as provided for in the contract!
- Performance Liquidated Damages and Facility Rejection provisions.

Equipment performance (3)

Installation & Commissioning

- "Defects" in the installation of equipment.
- Equipment failure during commissioning and testing.

Mitigations and "incentives"

- The Employer's Representative and the LTA must be technically qualified and competent to monitor installation and performance tests on an informed basis.
- Monitor the installation process, as provided for in the contract!
- DLDs for delay; PLDs for performance; Facility Rejection provisions.

Defects

Defects (1)

Defects Notification Period

- Defects begin to present after expiry of the DNP.
- Consequent inability to require Contractor to replace at its cost.

Mitigations and "incentives"

- "Size" the DNP appropriately (depends on the context).
- Performance/Retention Bond for obligations during the DNP.
- Enforceable Manufacturer's Warranties.

Defects (2)

Serial Defects

- Same or similar defect in the same equipment / component.
- Impact on facility performance.

Mitigations and "incentives"

- Contract provisions re percentage thresholds to establish serial defects, reference to production lots (if appropriate), root cause analysis protocols, and Contractor rectification plans.
- DLDs for delay; PLDs for performance; Facility Rejection provisions.
- Enforceable Manufacturer's Warranties.

Force Majeure

Force Majeure (especially viz COVID-19) (1)

Definition of Force Majeure

- "Dictated" by the ambit of FM under the PPA.
- "Equivalent Project Relief".
- Reliance on Govt. prohibition of construction during COVID-19 lockdown as "embargo", to establish Force Majeure.

Mitigations and "incentives"

- Ensure that Project Documents' definition of Force Majeure incorporate FM risks on the radar (e.g. epidemic, pandemic, and response actions by authorities).

Force Majeure (especially viz COVID-19) (2)

Application of Force Majeure provisions

- Notification and mitigation provisions.
- EoT to include reasonable time to demobilise / remobilise.
- EoT to include time for productivity ramp-up?!?
- Typically, costs of FM are for each party's sole account.

Mitigations and "incentives"

- Strictly monitor compliance with notification and mitigation obligations.
- Consider Employer discretion to assist Contractor wrt FM costs.
- Deal expressly with time for productivity ramp-up.

Corporate & Commercial Questions

Corporate and Commercial Issues

Performance Security

- Inadequate "sizing" of DLD caps, PLD caps, and aggregate liability caps.
- Expiry of performance security.
- Enforceability of PCGs.

Mitigations and "incentives"

- Due diligence at contracting stage (financial standing; track record).
- Consider undertaking a full pre-contract risk matrix analysis, to ensure all risks covered appropriately.
- Employer's Representative carefully monitors performance security through the implementation of construction.

Corporate and Commercial Issues

The Contractor as equity participant in Project Co.

- Conflict of interests – Employer vs Contractor
- Can emasculate Employer actions / responses under the EPC Contract.

Mitigations and "incentives"

- Try to avoid this structure, if possible.
- If Contractor equity participation in Project Co. is commercially-imperative, then the potential conflict of interests must be dealt with in the Project Co. shareholders agreement (e.g. Contractor recusal from Project Co. board meetings and decisions pertaining to EPC Contract)

Disputes

Dispute Resolution Framework

The Problem

- "One-size-fits-all" "Boiler Plate" "plug-n-play" clauses lead to material regret!
- Parties already in dispute cannot agree on dispute resolution mechanics.
- Typical clauses are not appropriate for the expeditious and effective resolution of daily technical issues

Mitigations and "incentives"

- Bespoke DR schedule incorporating fast track independent expert determination of technical / financial disputes and providing for alignment with related disputes.
- Efficient, expeditious, and cost-effective.

Final Comments

Do the "hard yards' up front

Spend time and effort on:

- EPC Contract requirements (Particular Conditions; "Hold-the-Pen")
- Due diligence on proposed Contractors.
- Tender processes that maintain competition.
- Selection of professional advisors (Owner's Engineer/ Employer's Representative; Financial Advisors ; Legal Advisors) who really understand the project technology and the consequent particular risks in the project construction phase.

NORTON ROSE FULBRIGHT

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SAPVIA

SAWEA
South African Wind Energy Association

Simone Zanot is a nuclear and energy engineer from Rome, Italy. He joined Enel group in 2010and He worked in Italy, France, Slovakia, Chile, Peru and Australia, covering different roles in the company, such as Engineering Specialist, Regulatory Specialist and Deputy Project Manager. He is currently in charge of coordinating Enel Green Power Commissioning of Renewable Energy Projects in South Africa and Australia. His passions are travelling, music, art and... face new challenges

SIMONE ZANOT
Enel Green Power
Commissioning Leader

Developing Developers Webinar – Commissioning Renewable Energy Projects

25/02/2020

Simone Zanot

Green Power

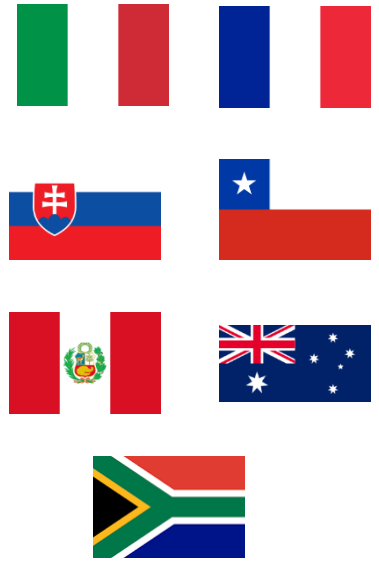
Today's agenda

1. Purpose of the presentation
2. What is RE commissioning
3. Focus on Wind project commissioning
4. Focus on a Typical COD tests sequence with ESKOM/RETEC
5. Main Commissioning Lessons Learnt

Your speaker!

11 years in Enel

Nuclear & Energy Eng.



1. Purpose of the presentation

What is commissioning?	From Commissioning to Commercial Operation	Wind projects commissioning	Share some lessons learnt
•When does it start? •When does it finish?	•Define stages and main activities leading to COD*	•Steps for the SubStation and WTG start-up	•Benefit from experience and use it in future plants

*Commercial Operation Date

2. What is RE commissioning?

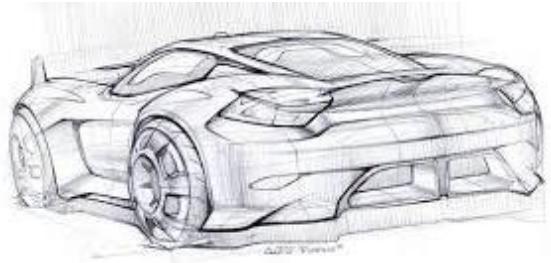
Would you ever buy a car never tested before?

2. What is RE commissioning?

Car analogy

Somebody builds the car

1



Somebody else tests the car

2

I finally drive the car

3

2. What is RE commissioning?

Three stages of a RE project

CONSTRUCTION

1

EGP – Wind Turbine construction

COMMISSIONING

2

OPERATION

3

EGP around the world

2. What is RE commissioning?

Steps of Commissioning

COLD COMMISSIONING	HOT COMMISSIONING	Ramp-up	Operation and Hand-Over
• Functional checks using proper testing tools • Temporary source of supply/power to check commands, control logic units, circuits • Mandatory to start the operational tests	• Tests operating the components/equipment in presence of normal power supplies • Ensure the compliance components/systems w. project specification	• The generation system starts exporting energy from 0 to 100% • Once all generating units are completed, the plant is ready to start COD tests	• COD tests approved, commissioning ends and operation starts • The project will be handed over to the Operation&Mainenance team (Service)

3. Focus on Wind Project commissioning

Steps of Commissioning

COLD COMMISSIONING

- WTG's and SubStation **components** are all tested and checked
- Substation connection and **communication** to existing Network is **checked**
- Testing Procedures are all **approved** to energize the SubStation

HOT COMMISSIONING

- SubStation is **energized for the first time** from the external Grid
- HV Circuits are then energized and WTG's start-up tests begin
- WTG generates **1st kWh** to the external Grid

Ramp-up

- All the WTG's are hot commissioned
- Reliability Run Tests are performed
- WTG SCADA/PPC are integrated with main Plant SCADA
- **Tests for Commercial Operation** with ESKOM and RETEC

Operation and Hand-Over

- Minor pending works in WTG's and SubStation are completed
- Plant **handed-over** to Operation&Mainenance **services** company

3. Focus on Wind Project commissioning

SubStation Commissioning (1/2)

Study the project – SLD, Logics and protections, interconnection schemes and diagrams, equipment manuals

Factory and Site Acceptance Tests (FAT, SAT) assessment

Commissioning Kick-Off Meeting and Organization of Site and Commissioning Teams

Time Schedule First Draft and Review with Contractors + notifications to ESKOM

Checks, Tests, Preliminary Energization on individual equipment [Cold Commissioning]

3. Focus on Wind Project commissioning

SubStation Commissioning (2/2)

- SCADA Set-up and Configuration – both Main Plant SCADA and interconnections with Grid / Plant Equipment
  - Point-to-Point, End-to-End, Communication Tests with ESKOM Control Room
    - Energization procedures finalization and Team alignment
      - HV Line First Energization, HV Substation First Energization, Step-up Transformer energization
        - Plant HV Busbar Energization and CB (GIS) Energization

3. Focus on Wind Project commissioning

WTG Commissioning (2/2)

Energize HV Collectors and WTG's (in steps)

- Verify WTG correct parameters post-energization
  - WTG hot commissioning activities as per Start-up procedure prepared by WTG Supplier
    - Once WTG pre-generation checks are passed, it starts generating and performs Reliability Run Test
      - Hot Commissioning of WTG PPC, Met Masts installed in WTG and ancillary systems required for COD tests

4. COD tests sequence and Stakeholders

COD tests

NERSA "grid connection code for Renewable Power Plants connected to the electricity transmission system or the distribution system in South Africa (V. 3.0)" requires a grid code compliance test according to the guideline "Renewable Power Plant Grid Code Compliance Test Guideline Rev 3.0"

I. «Internal» Dry Run and SCADA Functionality Tests with ESKOM

II. RETEC Approval of Tests and Confirmation to come to site

III. Tests with RETEC at site and report approval

IV. IE*/SBO involvement and COD approval**

***Independent Engineer / **Single Buyer Office (ESKOM)**

4. COD tests sequence and Stakeholders

Structure of the first half of COD tests

ACTIVITY	DESCRIPTION

Dry Run Test + Report preparation	• Tests which requires wind resource to confirm the compliance with grid studies
	  • Absolute Active Power Constraint
	  • Active Power Gradient Constraint
	  • Reactive Power Control Function
	  • Power Factor Control
	  • Voltage Control Function
	  • …

SCADA Functionality tests with ESKOM Regional + National & Standby Control Centres + Approval letters	• Test with the Control Centres not in parallel (different days)
	• Tests are described in SCADA procedure agreed with ESKOM
	  • Voltage / Q / PF / Curtailment Mode Test
	  • Generation Stop/Start Test /IPP Plant Shutdown Test / Loss of Grid Tes
	  • …

RETEC Approval and Mobilization to site	• RETEC reviews and approves the previous tests • RETEC plans to come to site for “final tests” in accordance with wind resource availability

O Owner – C Contributor

4. COD tests sequence and Stakeholders

Structure of the second half of COD tests

ACTIVITY	DESCRIPTION
Grid Code Compliance Tests with RETEC on site and report approval	• Same tests of "Dry Run", although RETEC might request additional checks and parameters to be tested • RETEC will perform a site + document inspections
Independent Engineer submission of the "Unit Completion Certificate" to ESKOM-SBO	• Third Party to be involved by IPP as interface to ESKOM SBO
IPP "Notice of Commencement" Submission to ESKOM-SBO	• IPP requests SBO to approve Commercial Operation
ESKOM SBO Issuance of Operation Certificate (COD Date)	• COD is finally achieved!

O Owner – C Contributor

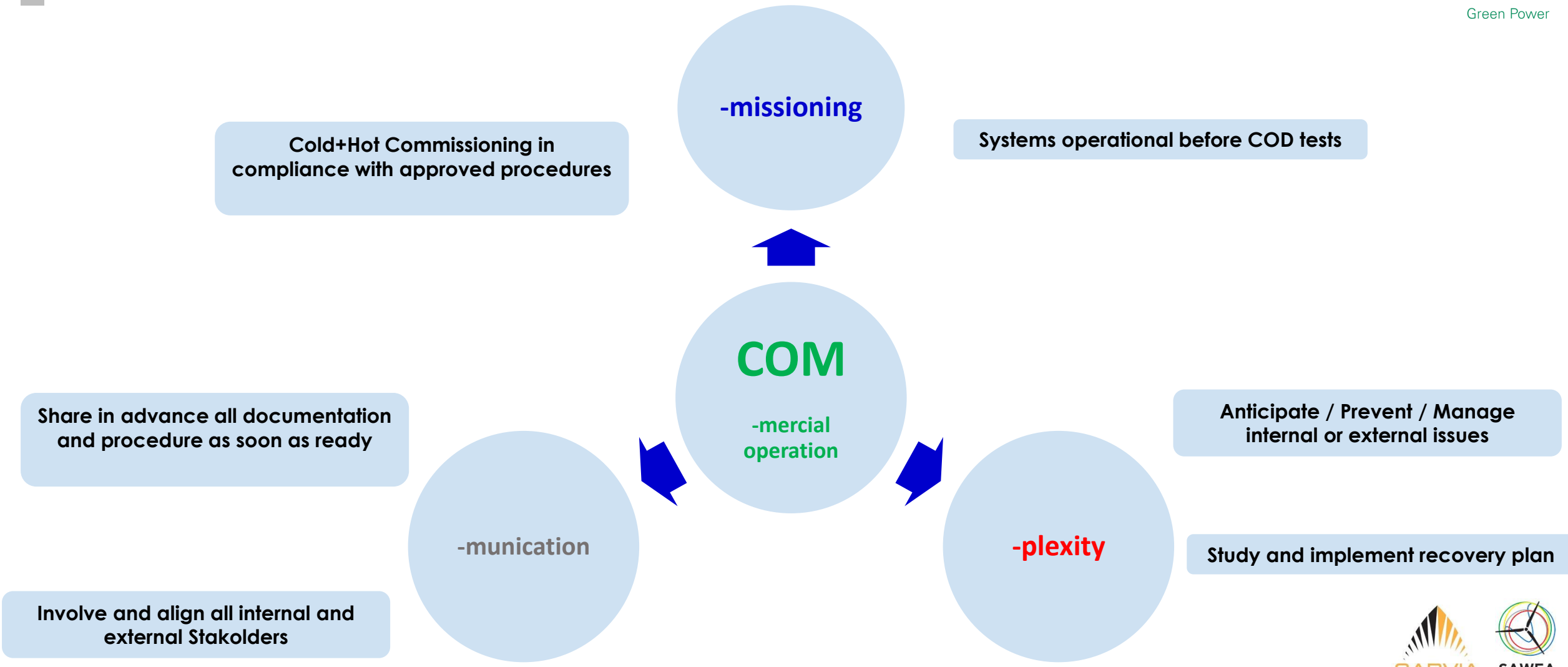
5. Some Lessons Learnt

Main feedbacks from experience

1. Define Owners of tasks and deadlines to be respected
2. Common understanding of ESKOM/RETEC Procedures, Requirements, Specific Requests
3. Alignment of Site – Engineering – Testing – Reporting Teams involved
4. Anticipate-Optimize-Minimize durations of activities
5. Act fast in case of internal/external issues

5. Lessons Learnt

3 “COMs” for COMmercial Operation Achievement



THANK YOR FOR YOUR ATTENTION

I hope you enjoyed it!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Niveshen Govender
SAPVIA
Chief Operating Officer

QUESTIONS AND ANSWERS SESSION

Please type your questions in the message box and we will respond

Niveshen Govender
SAPVIA
Chief Operating Officer

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