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Power Generation Symposium | Europe

A Rolls-Royce solution

When a standard solution doesn't fit

Smart solutions for complex requirements

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When a standard solution doesn't fit

01 **Project Planning at an early stage is essential**

02 **3 Steps to deliver a complex solution**

03 **How can we support you to deliver complex solutions?**

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01

Project Planning at an early stage is essential

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Global Requirements vs.

Local Requirements

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Project Planning at an early stage is essential

Phrases we all hear during project development:

“We just need some backup to step in when our renewables are not available. It is about x MWe…”

“Emergency generators are pretty of-the-shelf commodities, we do not need special considerations…”

“We do not need installation and commissioning support. We have done several CHPs we know what we do…”

“Asset integration into SCADA, Automation and Controls we do on our own…”

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Project Planning at an early stage is essential

Often standard equipment is supposed to be sufficient, thus no detailed engineering is done.

This often results in unfulfilled expectations and frustrated customers.

Or even worse...

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3 Steps to deliver a complex solution

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Complex Solutions are no Rocket Science...

...Rocket Science is as simple

as $v_2 = \sqrt{\frac{2GM}{r}}$ ...

Design and Delivery of a complex solution is a lot more

3 Steps to deliver a complex solution

1. **Requirements Management**
   - Do a full CDE-Review
   - In case of doubt: Ask or at least explain what you do and why
   - List all requirements and make them known to the delivery team
2. **Systems Engineering**
   - Divide in manageable subsystems or functional groups
   - Defines clear interfaces
   - Do validation & testing
3. **Project Management**
   - Nominate dedicated, experienced PM for large Projects
   - Do stakeholder and expectations management

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3 Steps to deliver a complex solution

Step 1 – Requirements Management

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Step 1 – Requirements Management

- **C**omply
  with customer requirements
- **D**eviate
  from customer requirements
- **E**xception
  from customer requirements

Increasing Importance

Generator's Spec No.	Rev No.	Spec Date	Section:	Sub-Section	Original Requirement of the Specification, Drawings and associated Design Documents or outlined in the RFP.	Deviation [D] Exception [E]	Description and Reason for Deviation / Exception	Organisation For Review Assigned By The A/E: N.63	KCE	CD	Cx	Other	Accepted [A] Rejected [R]	Engineer of Record's reason for acceptance or rejection - (Comment on behalf of DCE)
					3. Include required backup protection and safety devices to prevent engine overspeed.	D	Backup protection realized with Bender DGC2020HD						A	24/03/2022 AE: Accepted meets design intent.
					1. An air box crankcase ventilation vapor recovery system to be provided. A drain valve to be provided to expel residue. Provide gauges to measure pressure drop across the assemblies.	D	No pressure drop measurement included. Engine is equipped with an closed crankcase ventilation system with oil separator. Recovered oil will be drained to oil pump sod closed str to the air inlet manifold before turbo charger. Replace of oil separators will be done acc. to maintenance schedule. Crankcase pressures will be monitored by pressure sensor with a fixed limit for warning (Limit 1) and engine shutdown (Limit 2).						A	24/03/2022 AE: Technically acceptable solouition.
					E. Sub-transient direct axis (X"D): 12 percent maximum, but not less than 9.5 percent at the anticipated load power factor of 0.95 lagging and selected voltage.	D	Not considered for Admin sed VT Generators						A	24/03/2022 AE: Correct interpretation of the specification.
					1. Bearings to be pre-lubricated, shielded, cartridge ball bearings with provisions for adding and/or changing grease through grease pipes extended to the generator exterior. Minimum B-10 bearing life to be 40,000 hours.	D	Bearing life 36,000 hours 2022/04/01 MTU_RK: No cost option available. Standard design of alternator manufacturer and for an emergency diesel genset more than enough. If not sufficient please provide definition of life time that we can double check? BT or ENG?			DISC			R	24/03/2022 AE: Is this available as a cost option? DISC to confirm.
					1. The generator to be self-ventilated and to have a one piece, cast aluminum alloy, single directional internal fan for high volume, low noise air delivery.	D	Single directional internal fan made out of steel						A	24/03/2022 AE: Technically acceptable solouition.
					A. Digital type, microprocessor based mounted in the control panel. Provide with Volts-per-Hertz operation, loss of sensing, overlunder excitation protection, short circuit current limit, and zero droop regulation.	D	Mounted in alternator terminal box						A	24/03/2022 AE: Technically acceptable solouition.
					1. Two battery racks suitable for floor mounting adjacent to the skid. Battery racks to be coated or painted to resist acid and alkali corrosion. Each battery rack to be suitable for specified seismic requirement.	D	Batteries are directly mounted to the base frame on both sides of the generator. Seismic zone is not defined in Section 26 05 01. No seismic consider yet.						A	24/03/2022 AE: Technically acceptable solouition.

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Step 1 – Requirements Management

In case of doubt: Ask or at least explain what you do and why

What is required?

2.15 GENERATOR OUTPUT CIRCUIT BREAKER

A. Each generator shall be provided with an output circuit breaker either engine mounted or in a free-standing, IP54 switchboard section meeting IEC61439 Form 4b Type 6 requirements.

→ Make a comment in the CDE or raise a RFI

RFI FORM 1: GENERAL TECHNICAL & PROCESS BID QUESTIONS (PRE)

Baseline RFP – (EQUIPMENT)

This form shall be used to cover general procedural, process-related or technical questions.
All questions submitted on this form will be compiled and shared with all vendors invited to submit packages of like equipment.

REF	Date	QUESTION	VENDOR	DOCUMENT REFERENCE	FINAL BASELINE RESPONSE	Customer Response	AE Response	Open/Closed	Date Closed	Action
1	04 May 2022	Acoustics: 75dBa@1m for snow hood design + 85dBa@1m for SKU design: mistake or not? We expect 75 rather.	Rolls Royce Solutions	RFP	06-May DB - 75dBa	06-May DB - 75dBa		Closed		
2	04 May 2022	Enclosure Arrangement: (The generators shall be "straight through" design with respect to the ventilation arrangement. A penthouse arrangement shall not be permitted.) acc. CDE. Is nevertheless an Air inlet tower permitted?	Rolls Royce Solutions	RFP	06-May DB - Air inlet tower not permitted	06-May DB - Air inlet tower not permitted		Closed		
3	04 May 2022	Operating hours / bulk tank: 30 hours (acc. CDE) vs. 48 hours (acc. MDD-E70000)?	Rolls Royce Solutions	RFP	06-May DB - 30hrs	06-May DB - 30hrs		Closed		
4	04 May 2022	Oil tank: 100 hours (CDE) vs. 30 hours?	Rolls Royce Solutions	RFP	06-May DB - 30 hrs	06-May DB - 30 hrs		Closed		
5	04 May 2022	Footprint/plinth: confirmation about the total installation length available? Is our assumption bis 12810mm + 5285mm in total right?	Rolls Royce Solutions	RFP	06-May BB - 17m length (excluding snow hoods) Footprint on foundation with attenuator each side		06-May BB - 17m length (excluding snow hoods) Footprint on foundation with attenuator each	Closed		
6	04 May 2022	Wind load: - Base wind load according to Eurocode 1 for SKU design? - Base wind load according to Eurocode 1 for Snow hood design?	Rolls Royce Solutions	RFP			09-May - Follow up required/DB to chase up	Open		Client
		SKU genset power: we find contradictory information in the								

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Step 1 – Requirements Management

List all requirements and make them known to the delivery team

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
		PACKAGE NAME								Organisation for Design Assigned						
	No.		Rev No.	Spec Date	Section:	Sub-Section:	Original Requirement of the Specification, Drawings and associated Design Documents as outlined in the RFP.	Deviation [D] acepted [E]	Description and Reason for Deviation / Exception	EPMS	DCE	DCD	Cx	Ops	Accepted [A] Rejected [R]	Engineer of Record's reason for acceptance or rejection – (A Comment on behalf of DCE)
3	49	26 32 13		13 Dez 19	2.4	J. 3.	Provide a fitting on the engine manifold to permit back pressure measurements.	D	One plugged 1" sleeve is available at the inlet of the chimney installed silencer to permit back pressure measurements						A	Final Statement - FA Accepted and Closed 29/05/20
4	50	26 32 13		13 Dez 19	2.4	J. 4.	Vertical generator exhaust stacks are to be fitted with a Stainless steel counter balanced rain flapper on the top of the stack. Flapper will be fitted with a cable that extends to ground level to manually close the flapper should it become stuck in the open position	D	Flapper not required due to use of a deflector hood						A	AE agrees with using a deflector hood is a better solution than flappers Final Statement - FA Accepted and Closed 29/05/20
5	51	26 32 13		13 Dez 19	2.4	J. 7.	See mechanical drawings for height of required exhaust stack, minimum of 14m at generator pad. Provide structural supports and stainless steel hardware for the exhaust stack.	D	17,70m required from ground 0 according the Colo units						A	Final Statement - FA Accepted and Closed 29/05/20
6	52	26 32 13		13 Dez 19	2.4	K. 2.	The system is to be rated to maintain 45 degrees C minimum coolant temperature at lowest site ambient temperature. A cutout switch to shut down the heater during engine operation shall be provided. Engine jacket water low temperature alarm shall alarm for adjustable low temperature/jacket water heater failure.	D	Our jacket water heater is self-controlled and water temp. will be maintained between 38°C and 43°C						A	Product limitation, targeting 43.5oC with a 5.5oC deadband Final Statement - FA Accepted and Closed 29/05/20
7	53	26 32 13		13 Dez 19	2.4	N. 1.	Provide integral sub-base fuel tank with capacity for 48 hours of operation at full design load for the colo i.e. normal N+1 electrical system operation. Minimum tank volume shall be 28,800ltrs(colo) and 24,000ltrs(Admin), plus an additional 20 percent to allow for overfill prevention and pick-up tube height from bottom of tank. Tank construction must meet BS799, ISO 4263, ENI4015 and PGS30 requirements, as well as any local authority having jurisdiction. a. Provide alternate pricing for fuel tank with capacity for 24 hours of operation at full load	D	Tank volume is 12000ltrs. Volume designed based on 75% of generator rated load plus additional 20%. Design will be according KIWA						A	Matches the ESP standby rating Final Statement - FA Accepted and Closed 29/05/20

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3 Steps to deliver a complex solution

Step 2 – Systems Engineering

- Divide in manageable subsystems
- Define clear interfaces
- Do validation & testing

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Design and Delivery of a complex solution is a lot more

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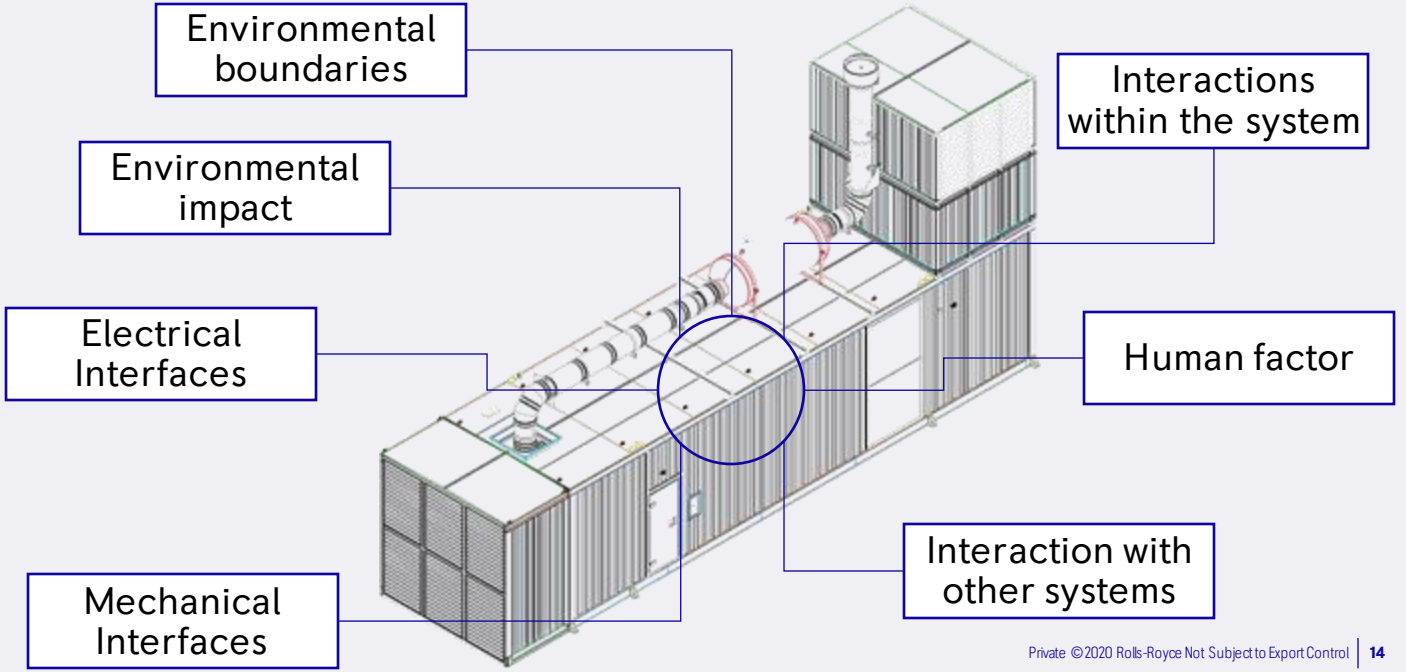
Step 2 – Systems Engineering

Systems engineering is the capability to manage those (and more) tasks:



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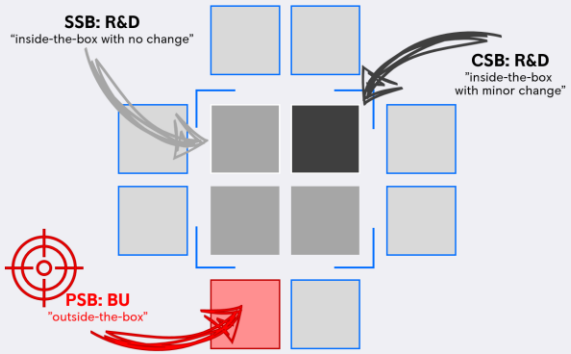
Step 2 – Systems Engineering



Prerequisites to divide in manageable subsystems :

- Deep knowledge of RRS Portfolio and technical boundaries for the choice of the right (combination of) subsystems
- Customization of the products, in order to fulfill all the Customer//Project specific requirements
- Connection of the boundaries of the RRS Portfolio to subsystems outside-the-box
- Capabilities to specify subsystems and to negotiate details with your sub-suppliers and other trades of the project
- Counseling capabilities towards the Customer

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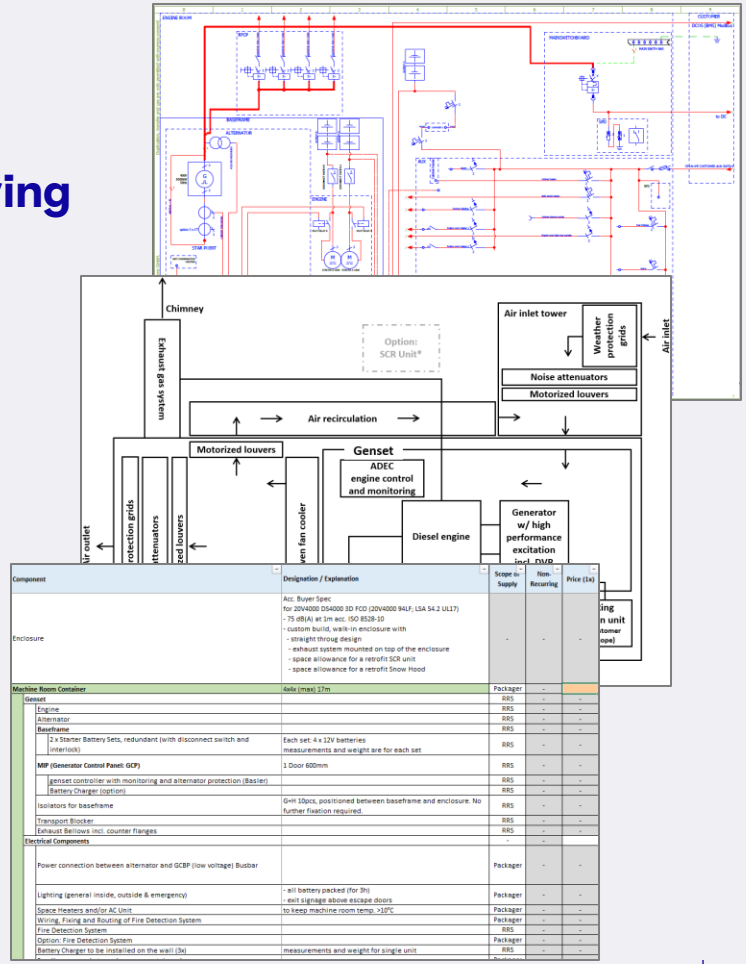
Step 2 – Systems Engineering

Fundamental at this point is the **holistic** and **seamless** interface management:

- Within subsystems
- Between parties:
  - Customer
  - General Contractor
  - RRS
  - Sub-suppliers
- Within documentation



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Step 2 – Systems Engineering

Agree with the Customer a suitable validation and testing plan, in order to guarantee that the subsystems are within specification:

- Set up a sound Qualification plan
- Build a demonstrator / First of Kind
- Factory Witness Test on First of Kind
- Factory Acceptance Test for all subsystems
- Cold Checks before the delivery
- Onsite Testing and Final Acceptance Test

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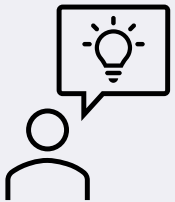
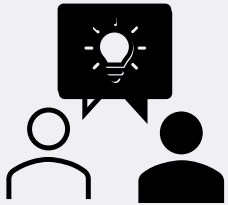
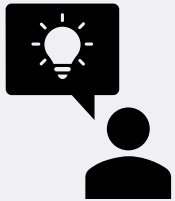
Step 3 – Project Management

- Nominate dedicated, experienced PM for large Projects
- Do stakeholder and expectations management







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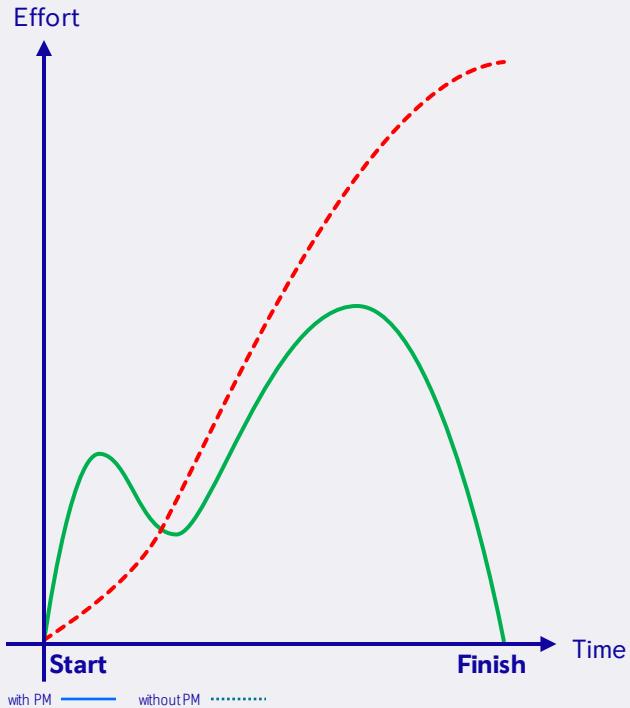
Step 3 – Project Management (PM)

Benefits



Principles of success

- Customer Focus
- Structured planning and execution of tasks
- Cross-functional cooperation
- Consistent use of the PM standards
- Prompt decision-making founded on solid preparation
- Stakeholder and expectation management

Step 3 – Project Management

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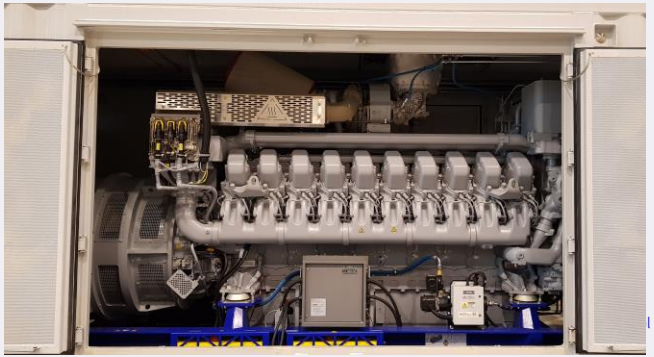

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Step 3 – Project Management

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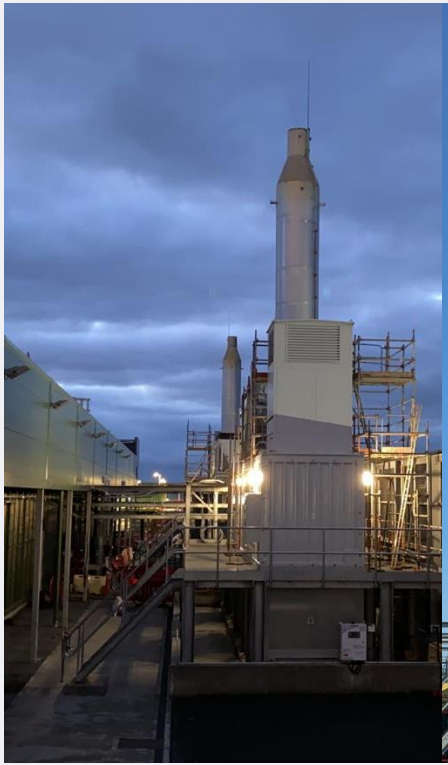

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What are the goals of this simple 3 Step-Approach

- Delivery of a reliable and robust solution
- Fastest delivery time
- Make use of standard components
- Optimize cost

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as $v_2 = \sqrt{\frac{2GM}{r}}$ ...

Design and Delivery of a complex solution is a lot more

3 Steps to deliver a complex solution results of good Planning...

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03

How can we support you to deliver complex solutions?

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Design and Delivery of a complex solution is a lot more

How can we support you to deliver complex solutions?

The use of standard components offers many advantages in complex system design, i.e.:

- Competitive pricing
- Short delivery time
- High Robustness

Which additional option would you like to order from our standard portfolio?

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Thank you for your attention!

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