الإطار التنظيمي لكفاءة الطاقة بالمنافع

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المركز السعودي لكفاءة الطاقة
Saudi Energy Efficiency Center

تمهيد

يهدف المركز السعودي لكفاءة الطاقة إلى ترشيد ورفع كفاءة إنتاج واستهلاك الطاقة، وتوحيد الجهود بين الجهات الحكومية وغير الحكومية في هذا المجال، ووضع برامج وطنية لكفاءة الطاقة وتحديد المؤشرات والأهداف والخطط والسياسات المتعلقة بذلك، ومتابعة تنفيذ الخطوات اللازمة لتحقيقها مع الجهات المعنية، والتحقق من نتائجها ومدى فاعليتها وإعداد تقارير دورية بذلك، وذلك وفقاً لما ورد في تنظيم المركز الصادر بقرار مجلس الوزراء رقم (353) وتاريخ 1439/7/3هـ، بالإضافة الى الأمر السامي رقم (61773) وتاريخ 1441/11/18هـ الذي نص على قيام المركز السعودي لكفاءة الطاقة بالتنسيق مع الجهات المعنية بقطاع الكهرباء وتحلية المياه بتحديد مستهدفات تحسين استهلاك الوقود في محطات توليد الكهرباء (بما في ذلك نقل وتوزيع الكهرباء)، ومحطات تحلية المياه، ووضع الآلية اللازمة لقيام تلك المحطات بتحقيق تلك المستهدفات.

على ضوء ذلك، تم تطوير وثيقة الإطار التنظيمي لكفاءة الطاقة في قطاع المنافع والتي تتضمن نظرة عامة عن الإطار التنظيمي لكفاءة الطاقة في قطاع المنافع ومتطلبات كفاءة الطاقة على الوحدات القائمة والوحدات الجديدة بالإضافة الى شبكات نقل وتوزيع الكهرباء والالتزام باشتراطات كفاءة الطاقة بحلول عام المستهدف والية تسليم خطط تحسين كفاءة الطاقة واشتراطات التقارير والبيانات، آليات المرونة، والعوامل المؤثرة على كفاءة الطاقة وغيرها من الأقسام المشمولة ضمن هذه الوثيقة.

المركز السعودي لكفاءة الطاقة
Saudi Energy Efficiency Center

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1. Glossary of terms and acronyms

Term	Definition
WERA	Water & Electricity Regulatory Authority
SEEC	Saudi Energy Efficiency Center
Asset	Refers to a unit in a plant or a plant as a whole or electricity transmission and distribution overhead lines (OHL), underground cables (UGC) , substations (Transforming Substation, Switching Substations and Compensation Substations) , Substation equipment such as transformers, capacitors, reactors, compensator, buses and circuit breakers.
Auxiliary consumption	Energy used for managing the system. This may be fans, pumps, air compressors, air conditioning, electronic devices, lights, or any other energy consumption
AHCO	Arabian heavy crude oil
ALCO	Arabian light crude oil
Block	Combination of one or more gas turbine(s) coupled with one steam turbine
Btu	British Thermal Unit
Company	Entity that owns or operates one or multiple assets / networks (e.g., power generation plants, cogeneration plants, water desalination plants, electricity transmission and distribution networks)
Cogeneration type	Technology used to generate electricity and steam (e.g., Cogen-ST, Cogen-SC, Cogen-CCGT)
Cogen-GT	Cogeneration – Gas Turbine Generation of electricity and heat jointly, especially the extraction/export of the heat to a heat recovery boiler(s) for useful process
Cogen-ST	Cogeneration – Steam Turbine Generation of electricity and steam jointly, especially the extraction/export of the steam for useful process
Cogen-CCGT	Cogeneration – Combined Cycle Steam Turbine Generation of electricity and steam jointly, especially the extraction/export of the steam for to drive a steam turbine for useful process
CCGT	Combined Cycle Gas Turbine
Directly connected Customers	Any User directly connected to the Transmission System, other than the Generator or Distribution Entities.

Distribution Entity	Entity that owns, operates, and distributes electricity through a Distribution System
Distribution Code	The Saudi Arabian Distribution Code
Distribution Service Provider (DSP)	Entity responsible for operating and maintaining secure, reliable and efficient electricity distribution system. The distribution system transports electricity from the transmission system or from embedded generating units to the final customer
EE	Energy Efficiency
EE KPIs	Energy Efficiency Key Performance Indicator(s)
Embedded/Captive Generating Unit/Station	Generating Unit/Station that is connected to a distribution system or to the system of any user and has no direct connection to the transmission system
Embedded Generators	Generator with generating units that are directly connected to the distribution system and include customers with CHP and customers with auto-production
Full load operating hours	Percentage in which the Unit operates in full hour annually
Generation	Process of producing electric energy from other forms of energy; also, the amount of electric energy produced, usually expressed in kilo watt hours (kWh) or mega watt hours (MWh)
Generating Station	Installation comprising one or more generating units (even where sited separately) owned and/or controlled by the same Generator, which may reasonably be considered as being managed as one generating station
Generating Unit	Electrical generating unit within a generating station, with all plants and Apparatus at that station (up to the Connection Point), relating exclusively to the operation of that generating unit. A Generating Unit can be either: • Synchronous Generating Unit • Power Park Module
Generation type	Technology used to generate electricity (e.g., ST, SC, CCGT)
Grid	High Voltage and Extra High Voltage backbone system, consisting of interconnected transmission lines, substations, and related facilities for transporting bulk power and energy. Also referred to as the Transmission System
Grid Code	The Saudi Arabian Grid Code
Gross Efficiency	Gross power generation / total fuel consumed
HRSG	Heat recovery steam generator
HFO	Heavy fuel oil
Initial performance test	First performance test at the commissioning year. Also known as “acceptance test “
ISO conditions	The production capacity of gas turbines is rated by the International Standards Organization (ISO), which specified the

	following reference air inlet conditions: air 15°C (59°F), relative humidity 60% and absolute pressure (sea-level) 101.325 kPa (14.7 psia)
KWhe	Total equivalent electricity consumption which includes the direct electricity consumption and the electricity equivalent of the steam consumed
KWhes	Electricity Equivalent of Steam Consumed
Last performance test	Latest performance test conducted annually or after maintenance
LHV	Lower heating value. Also known as net calorific value
MED	Multi Effect Desalination
MSF	Multistage Flash Desalination
Net heat rate	Ratio of thermal energy of the fuel consumed (LHV) and the net electricity generated in the same period. At plant level and unit level
Network losses	Difference between the energy entering the system and the energy delivered to customers/networks.
Output TDS	Output total dissolved solids
Other Energy	Any other unconventional source of energy
Power System	Any power system owned or operated by a User/TSP consisting of generating units, transmission / distribution system, or any other electric lines, plants and Apparatus
Renewable Resource Generation	Generating unit based on renewable resources for the generation of electricity including solar thermal, solar PV, wind, geothermal, etc. Hybrid technologies are also considered when operating on renewable resource only
RFP	Request for proposal
RO	Reverse Osmosis
System heat rate	Overall heat rate of the system at KSA level
Substation	Site at which switching and/or transformation equipment is installed
ST	Steam Turbine
SC	Simple Cycle Gas Turbine (or Single Cycle Gas Turbine)
Transmission Service Provider (TSP)	Legal entity that is licensed to own and maintain a network on the transmission system (or has such right by virtue of its historic existence for this purpose)
TSEC	Total Specific Electricity Equivalent Consumption
Unit	Single gas turbine or steam turbine
Virtual power generation	Amount of electric energy in a cogeneration plant that could be produced from the extracted steam

2. Framework overview

2.1. Introduction

In March 2018, The Council of Ministers approved resolution No. 353, which expands SEEC's mandate to include the "energy (fuel) consumption in electricity generation including electricity transmission and distribution and water desalination".
Therefore, SEEC launched utilities initiative aiming to develop a framework to improve the energy efficiency of power generation, cogeneration, water desalination sectors and electricity transmission and distribution networks.

2.2. Scope of the framework

2.2.1. Assets and networks in scope

The framework document focuses on the power generation, cogeneration, water desalination, as well as electricity transmission and distribution networks.

2.2.1.1. Power generation, cogeneration and water desalination assets

Sector	Asset type	Asset definition
Power generation	Simple Cycle Gas Turbine (SC)	Unit; i.e. individual gas turbine
	Steam Turbine (ST)	Unit; i.e. individual steam turbine
	Combined Cycle Gas Turbine (CCGT)	Bloc; i.e. steam turbine, heat recovery steam generator and associated gas turbines
Cogeneration	Simple Cycle Gas Turbine (Cogen-GT)	Bloc; i.e. heat recovery steam generator with associated gas turbines
	Steam Turbine (Cogen-ST)	Unit; i.e. individual steam turbine and associated boilers
	Combined Cycle Gas Turbine (Cogen-CCGT)	Bloc; i.e. steam turbine, heat recovery steam generator and associated gas turbines
Seawater desalination	Reverse Osmosis (RO)	Plant
	Multiple-Effect Distillation (MED)	Unit
	Multi-Stage Flash (MSF)	Unit

The following assets are excluded from the scope of the framework:

- **Power generation**: Internal combustion engines and diesel generators
- **Water desalination**: Seawater desalination having capacity less than 10,000 m^3/day

2.2.1.2. Electricity transmission and distribution networks

Sector	Voltage level	Definition
Electricity transmission network	≥ 110 kV	The Transmission System consists of all lines and Substation Equipment where the nominal voltage are of 110 kV and above. The Transmission system consists of: • The Electricity Transmission System • Assets Connected to the Electricity Transmission System and belonging to the Transmission service provider (TSP). • Generating Stations and networks linking such Power Stations to the Transmission System • The control area for which the TSP is responsible. The Electricity Transmission System definition is not linked to specific assets but includes those components of the electrical network that have a measurable influence at Transmission level, on each other as they are operating as one Power System. Also, has the same meaning as Grid.
Electricity distribution network	< 110 kV	The system of wires and associated facilities belonging to a franchised Distribution Entity, extending between the delivery points on the connection Point to the premises of the end users of electricity. Also, it is an electricity network consisting of assets operated at a nominal voltage of 69 kV or less.[1] The electric lines, Plant and switch-gear used to convey electricity to final Customers (excluding customers connected directly to the Transmission System (grid)).[2]

Any change in the existing electricity transmission and distribution networks (e.g., network expansion, network topology change) is included in scope of the framework.

[1] As per the Saudi Arabia Grid Code definition
[2] As per the Saudi Arabia Distribution Code definition

2.2.2. Assets qualification

2.2.2.1. Existing assets

Existing assets are the assets that were leveraged in commercial operations on/before the end of 2017. This ensures that the baseline Energy Efficiency (EE) performance is representative of a full year of commercial operations.
The existing assets are required to comply with all the existing assets' requirements detailed in this framework. The existing assets' enforcement mechanisms apply to all existing assets.

2.2.2.2. New assets

New assets are the assets that were not part of the tendering process before the announcement of the framework as mentioned in the document. The starting point of the tendering process is the date of the issuance of the request for proposal (RFP) to potential investors and/or contractors.
New assets are required to comply with all the new assets' requirements detailed in this framework. The new assets' enforcement mechanisms apply to all new assets.

2.2.2.3. Grey area assets

Grey area assets are the assets that do not meet the criteria to be qualified as new or existing assets. The EE requirements of the first cycle do not apply to the grey area assets. However, the grey area assets are required to comply with the framework reporting requirements starting from the year when these assets are leveraged for commercial operations. All the assets that will be part of commercial operations before the start of the next cycle will be included in the scope of the second cycle[3] of existing assets.

[3] Framework cycles are detailed in section 2.4.

2.3. Energy efficiency key performance indicators (KPIs)

This section describes the EE KPIs used by SEEC to measure the EE performance of the assets and networks within the framework scope.

2.3.1. Power generation

The EE KPI used for power generation assets is the net heat rate[4], based on the lower heating value (LHV) of the fuel. The net heat rate is calculated on an annual basis at the:

- Unit level for Steam Turbines and Simple Cycles
- Block level for Combined Cycle Gas Turbines

For all generation types, the same net heat rate formula is used:

Equation 1 - Power generation - Net Heat Rate

$$\text{Net Heat Rate}\left(\frac{\text{Btu}}{\text{kWh}}\right) = \frac{\text{Total Fuel Heat Input}}{\text{Actual Net Generation}}$$

[4] Heat rate indicates the energy efficiency

The illustrations including high-level parameters used to calculate the net heat rate are presented below for each generation type:

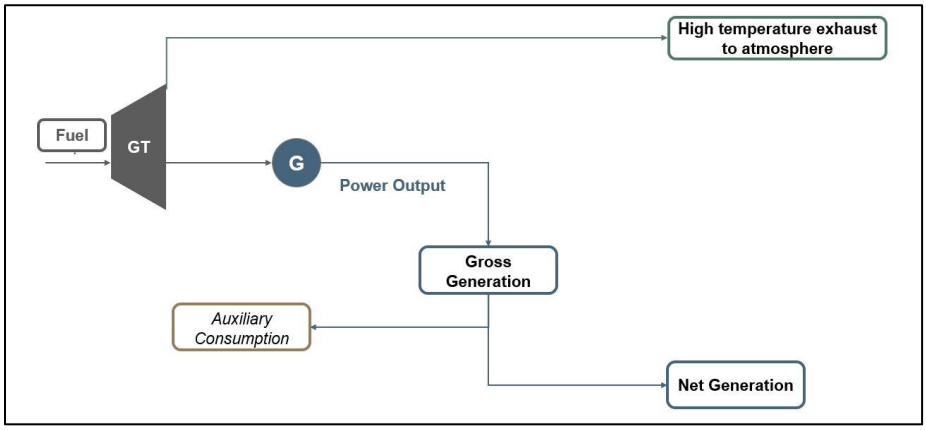

Figure 1: Simple Cycle - Heat Rate input parameters – Illustrative

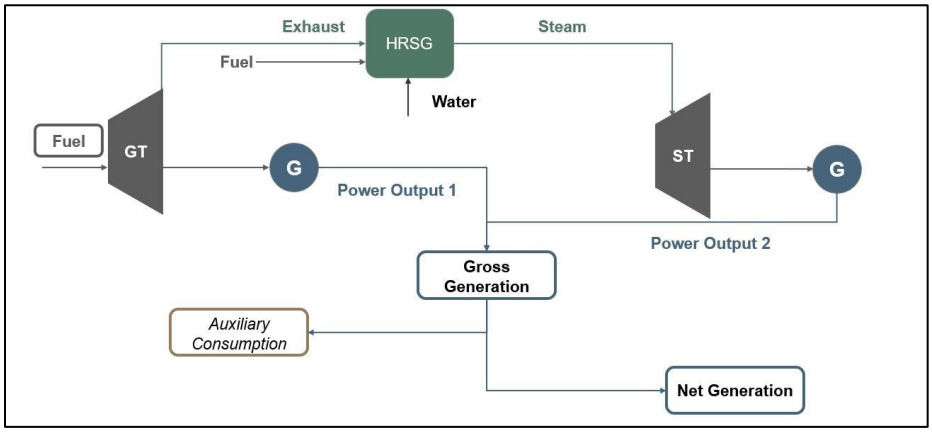

Figure 2 - Combined Cycle Gas Turbine - Net Heat Rate inputs – Illustrative

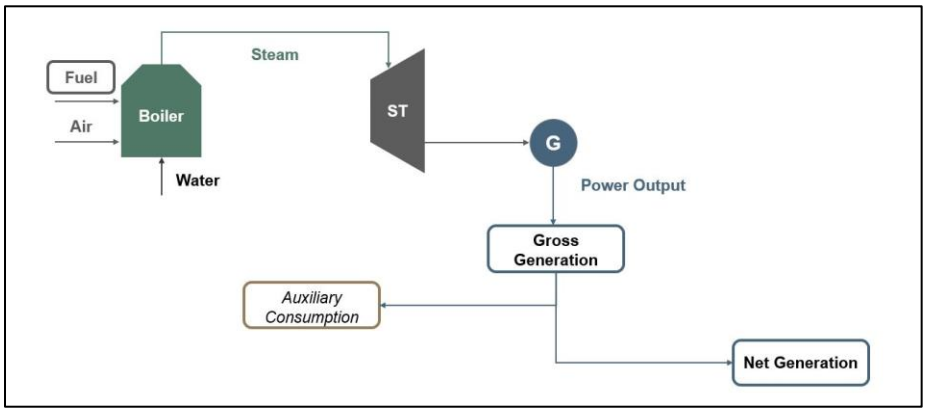

Figure 3 - Steam Turbine - Net Heat Rate input parameters – Illustrative

The difference between the plant level[5] and the sum of unit level fuel consumption, if any, shall be allocated to the individual unit based on its fuel consumption. The KPI calculation at the unit level will be done based on the reported values after fuel allocation.
Similarly, the difference between the plant level and the sum of the individual unit level auxiliary consumption, if any, shall be allocated to the individual unit based on its generation. The KPI calculation at the unit level will be done based on the reported values after allocation of auxiliary consumption.

2.3.2. Cogeneration

The EE KPI used for cogeneration assets is the equivalent net heat rate based on the LHV of the fuel. The equivalent net heat rate is calculated on an annual basis and its formula depends on the cogeneration type. The equivalent net heat rate formula accounts for the steam extracted / generated and used in other processes.

2.3.2.1. Cogeneration – Gas Turbine

For Cogeneration – Gas Turbine (Cogen-GT) assets, the net heat rate formula is:

Equation 2 - Cogen-GT Net Heat Rate formula

$$\text{Equivalent Net Heat Rate } \left(\frac{\text{Btu}}{\text{kWh}}\right) = \frac{\text{Total Fuel Heat Input} - \text{Equivalent Fuel Energy}}{\text{Actual Net Generation}}$$

Equation 3 - Cogen-GT Equivalent Fuel Energy formula

$$\text{Equivalent Fuel Energy (Btu)} = \frac{\text{Net Steam Enthalpy from HRSG}}{\text{Boiler efficiency}}$$

Where Net Steam Enthalpy from HRSG is the difference between the enthalpy of steam delivered to the client minus the enthalpy of return feedwater/condensate/steam from the client.

The boiler efficiency is an assumed parameter given that Cogen-GT assets do not usually have boilers. The value used is 87% for assets using natural gas as primary fuel[6] and is based on the LHV of the fuel.

[5] Plant level includes the unit level consumption and additional consumption if any. For example: emergency diesel generator, fire pumps, etc. The details are provided in the data collection templates/data collection user manual
[6] This value is based on the efficiency reference values for production of electricity and heat included in the "Commission delegated regulation (EU) 2015/2402 of 12 October 2015"

2.3.2.2. Cogeneration – Steam Turbine and Combined Cycle Gas Turbine

For Cogeneration – Steam Turbine (Cogen-ST) and Cogeneration – Combined Cycle (Cogen-CCGT) assets, the net heat rate formula is:

Equation 4 - Cogen-ST & Cogen-CCGT Net Heat Rate formula

$$\text{Equivalent Net Heat Rate } \left(\frac{\text{Btu}}{\text{kWh}}\right) = \frac{\text{Total Fuel Heat Input}}{\text{Actual Net Generation} + \text{Virtual Power Generation}}$$

Equation 5 - Cogen-ST & Cogen-CCGT - Virtual Power Generation formula

Virtual Power Generation (kWh)for condensing steam turbines
= (Total Enthalpy from Steam Extractions
− Total Enthalpy at Condenser Pressure at isentropic efficiency) x Mechanical Efficiency

Virtual Power Generation (kWh) for back pressure steam turbines
= (Total Enthalpy from Steam Extractions
− Total Enthalpy at fixed condenser Pressure of 0.1bara at isentropic efficiency) x Mechanical Efficiency

In order to calculate the Electricity Equivalent of Steam Consumed, the following assumptions are used:

- Reference condenser pressure at KSA site conditions:
  - For backpressure turbines: 0.1 absolute bar
  - For condenser turbines: Actual condenser pressure
- Isentropic efficiency: 80%
- Mechanical efficiency: 97%

The assumptions are based on standard references set by the US Environment Protection Agency[7].

[7] Cogeneration Unit Efficiency Calculations-EPA Docket Number: OAR-2003-0053 March 2005.

The illustrations including high-level parameters used to calculate the net heat rate are presented below. Further details are available in the data collection user manual / templates:

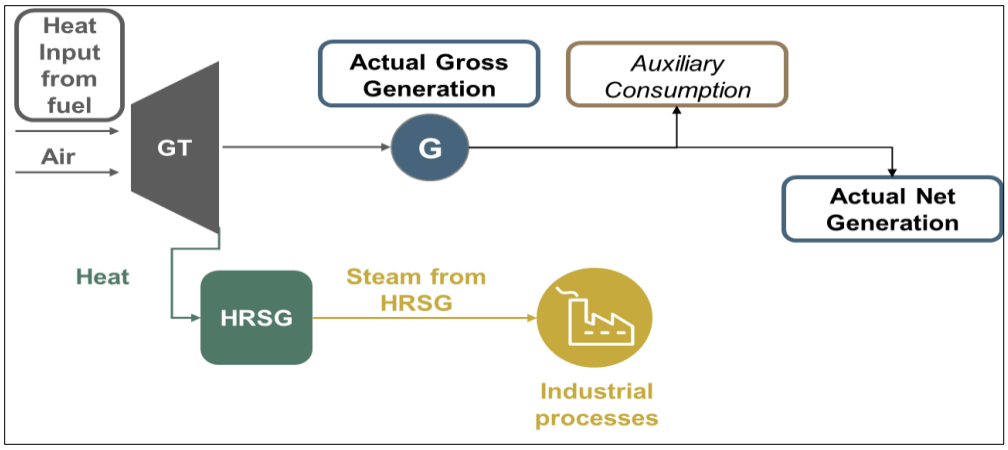

Figure 4 - Cogen-GT - Net Heat Rate input parameters – Illustrative

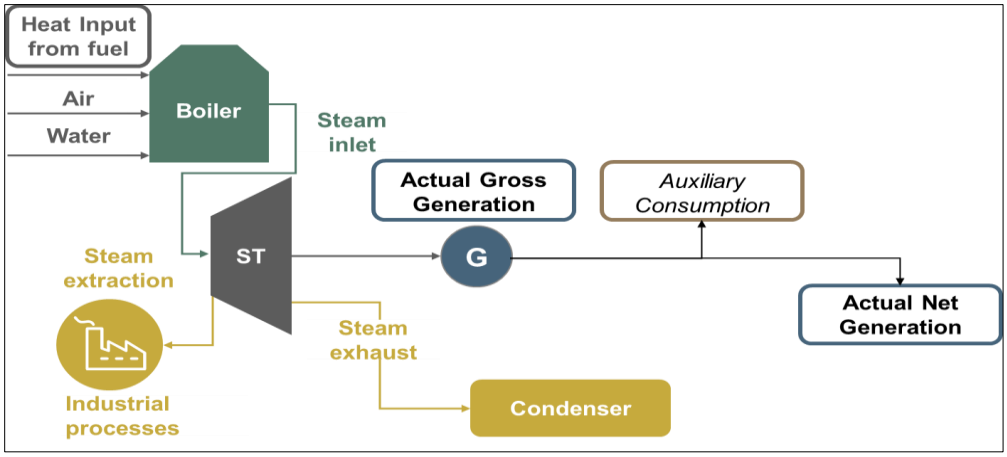

Figure 5 - Cogen-ST - Neat Heat Rate inputs - Illustrative

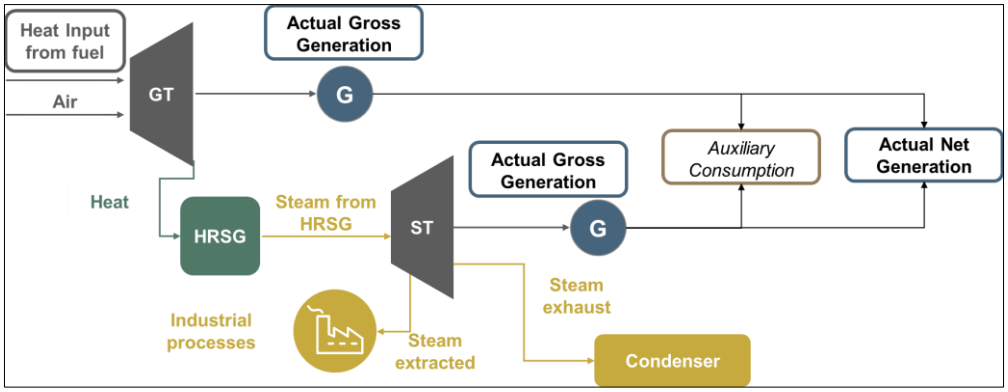

Figure 6 - Cogen-CCGT Net Heat Rate inputs - Illustrative

2.3.3. Water desalination

The EE KPI used for water desalination is the TSEC (Total Specific Electricity Equivalent Consumption) in kWh_e/m^3. The TSEC is defined using the formula below:

Equation 6 - Water Desalination TSEC formula

$$\text{TSEC}\left(\frac{\text{kWh}_\text{e}}{\text{m}^3}\right) = \frac{\text{Electricity Consumed} + \text{Electricity Equivalent of Steam Consumed}}{\text{Net Volume of Desalinated Water}}$$

Where the Electricity Equivalent of Steam Consumed is defined as follows:

Equation 7 - Electricity Equivalent of Steam Consumed Formula

$$\text{Electricity Equivalent of Steam Consumed}(\text{kWh}_{\text{es}}) = \left(\text{Total Enthalpy from Steam Extractions}[8] - \text{Total Enthalpy at Condenser Pressure at isentropic efficiency}\right) \text{x Mechanical Efficiency}$$

In order to calculate the Electricity Equivalent of Steam Consumed, the following assumptions are used:

- Reference condenser pressure at KSA site conditions: 0.1 bar
- Isentropic efficiency: 80%
- Mechanical efficiency: 97%

The assumptions are based on standard references set by the US Environment Protection Agency[9].

The input parameters required are illustrated below for each desalination type. These figures are illustrative only, and for the KPI calculation, kindly refer the data collection user manual.

[8] Steam extractions include the extractions from turbines, letdown stations, steam taken directly from boiler/ HRSG, etc.
[9] Cogeneration Unit Efficiency Calculations-EPA Docket Number: OAR-2003-0053 March 2005.

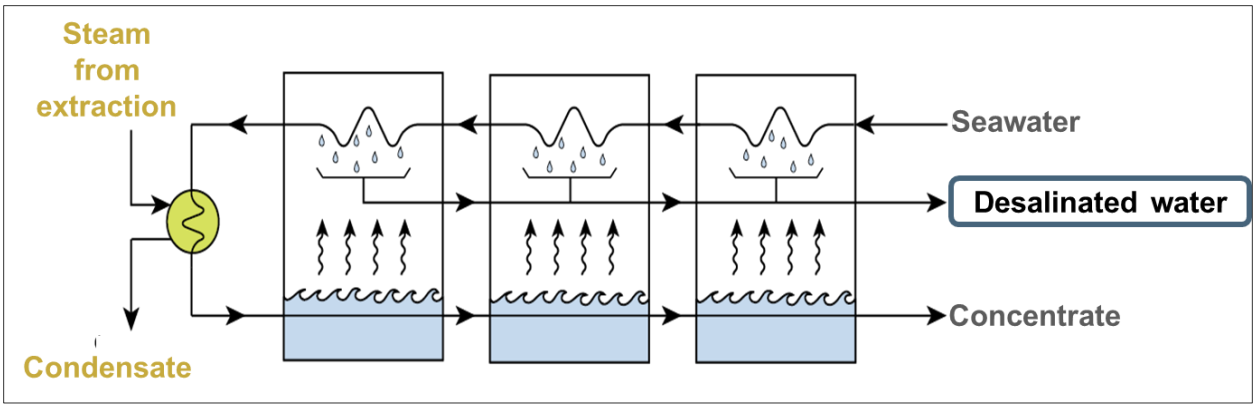

Figure 7 - MSF TSEC inputs - Illustrative

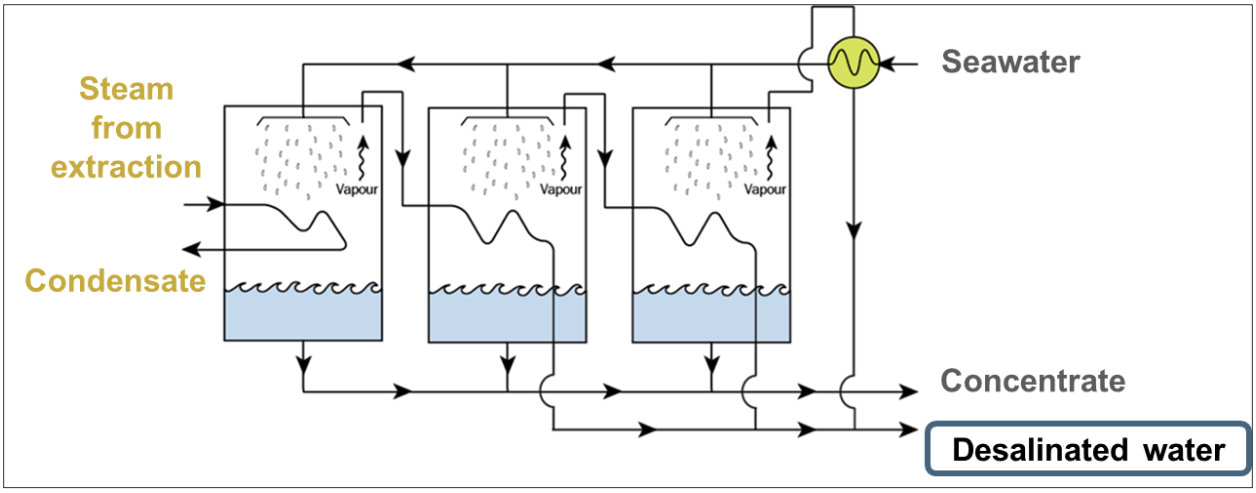

Figure 8 - MED TSEC inputs - Illustrative

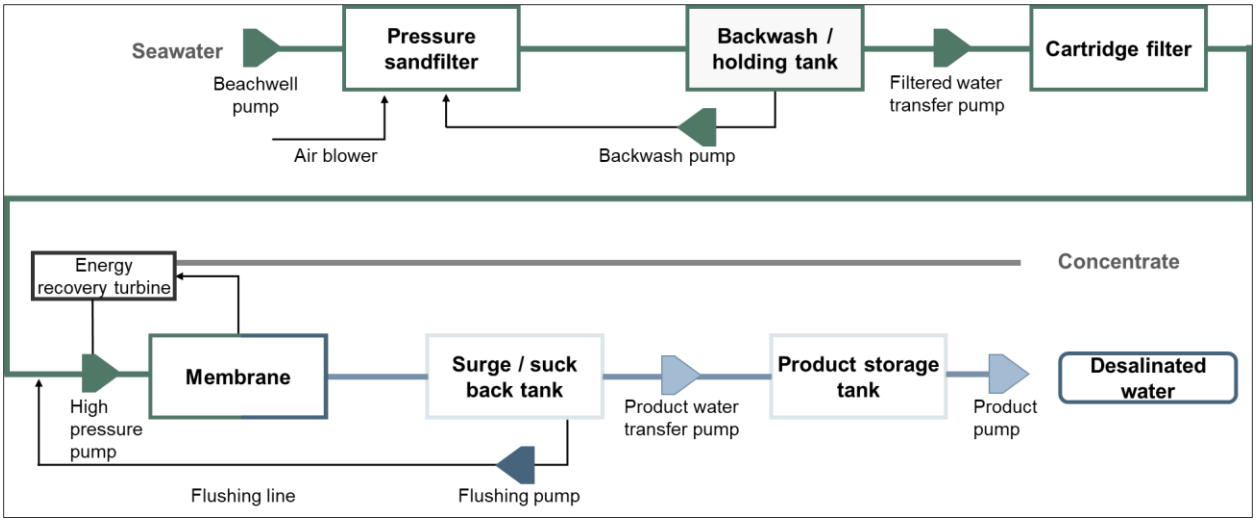

Figure 9 - RO TSEC inputs - Illustrative

The boundaries for the water desalination are defined from the seawater intake to the product storage tank. Also, for the steam import, the boundary of the water desalination starts from the steam extraction point from the turbine. The detailed explanation of the boundaries is as follows:

a) The energy consumption from water intake system till the product storage tank is included in the KPI calculation
b) Energy consumption to transfer water to the customers or supplied to the water grid is not included in the calculation of the KPI
c) The steam energy is calculated from the steam extraction pressure from the turbine and not the steam pressure delivered to the MSF/MED. In case the steam turbine is not available/running and the steam is directly imported from boiler through letdown stations, then also the turbine extraction pressure is considered and this loss is attributed to power side not the desalination side

2.3.4. Electricity transmission and distribution

Energy efficiency KPIs used are the network losses. These KPIs are calculated for electricity transmission network and distribution network separately:

- Electricity transmission network losses
- Electricity distribution network losses

The Losses are evaluated by computing the difference of the energy injected into the network and the energy delivered by the network. This applies to both the electricity transmission network and the electricity distribution network separately.

Network related energy efficiency KPIs are calculated at individual company[10] level (e.g., electricity transmission losses for company A, electricity distribution losses for company A, electricity transmission losses for company B).
However, total network losses (combination of the electricity transmission and distribution losses) are also calculated at kingdom / companies' level, and measured for indicative purposes only, and will not be compared with the energy efficiency targets. For further details, kindly refer to the "Energy Efficiency requirements" section.

[10] "Company" in electricity transmission and distribution networks' related sections refers to TSP – Transmission system provider and/or DSP – Distribution system provider

Total network losses

The following section highlights the simplified overall network's layout and the equations to calculate the overall network losses.

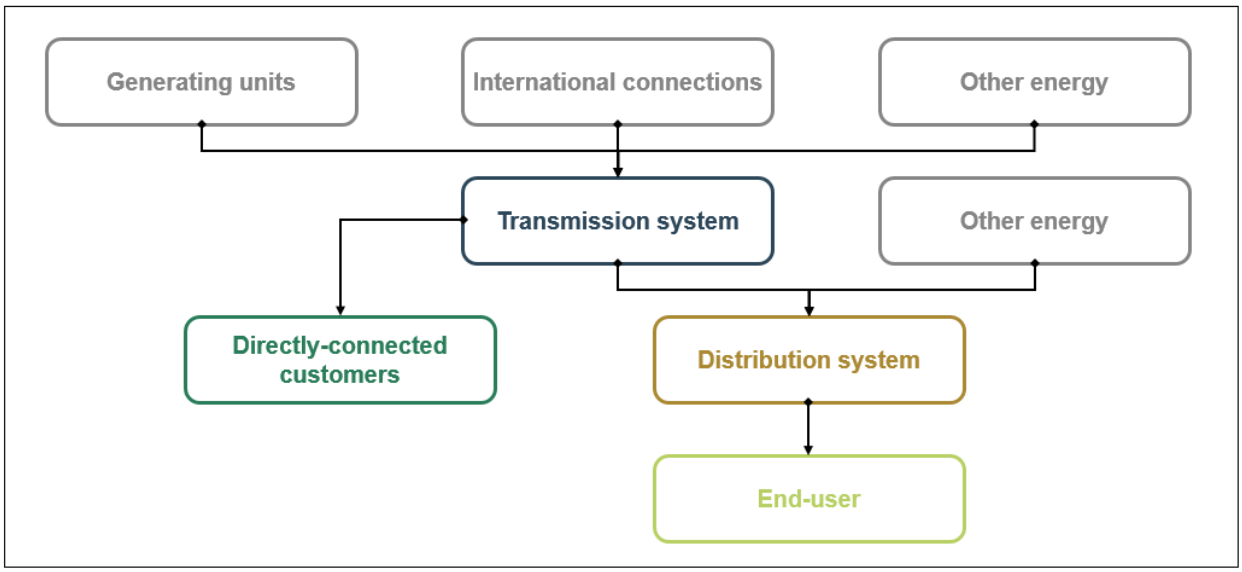

Figure 10: Network Layout - Energy Flow - Illustrative

Equation 8 - Electricity transmission and distribution - Network Losses

$$\text{Total Network Losses}\left(\frac{\text{MWh}}{\text{MWh}}\right) = \frac{\text{Total Injected energy} - \text{Total Delivered energy}}{\text{Total Injected energy}}$$

Electricity transmission losses

The following section highlights the simplified electricity transmission network's layout and the equations to calculate the electricity transmission network losses.

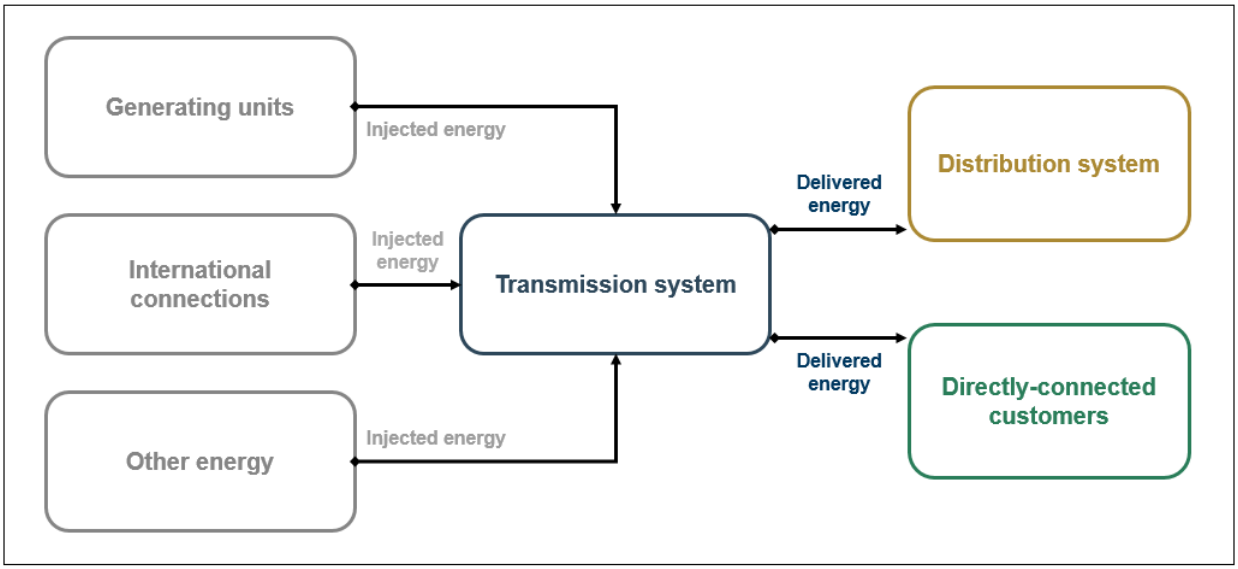

Figure 11: Electricity transmission network losses - Energy Flow - Illustrative

Equation 9 - Electricity transmission and distribution - Transmission Losses

$$\text{Transmission Network Losses } \left(\frac{\text{MWh}}{\text{MWh}}\right) = \frac{\text{Injected energy} - \text{Delivered energy}}{\text{Injected energy}}$$

Electricity distribution losses

The following section highlights the simplified electricity distribution network's layout and the equations to calculate the electricity distribution network losses.

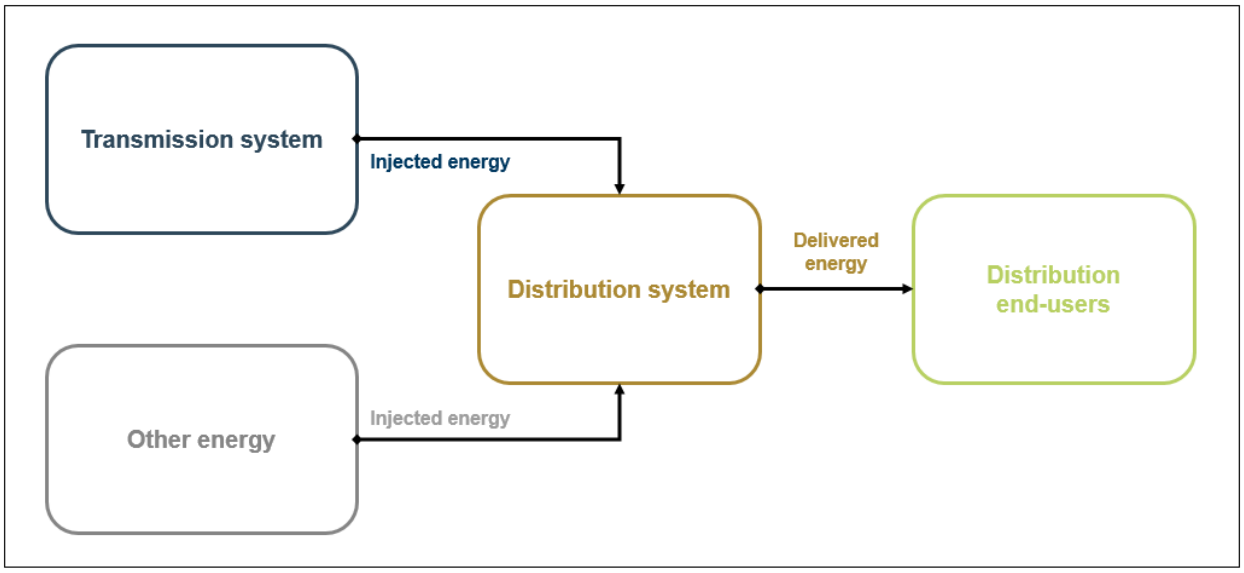

Figure 12: Electricity transmission and distribution - Distribution Losses

Equation 10 – Electricity transmission and distribution - Distribution Losses

$$\text{Distribution Network Losses } \left(\frac{\text{MWh}}{\text{MWh}}\right) = \frac{\text{Injected energy} - \text{Delivered energy}}{\text{Injected energy}}$$

2.4. Framework cycles for existing assets / electricity transmission and distribution networks

Existing assets

The framework will include two cycles. Each cycle duration allows companies sufficient time to identify, design and implement measures to improve the Energy Efficiency of their fleet.
The first cycle will set targets on existing power generation, cogeneration, and water desalination assets in 2020 based on 3-year performance data. The targets are required to be achieved in the target year 2025.
The second cycle will set targets on existing power generation, co-generation and water desalination assets in the same manner of the first cycle.

The existing assets cycles are illustrated below:

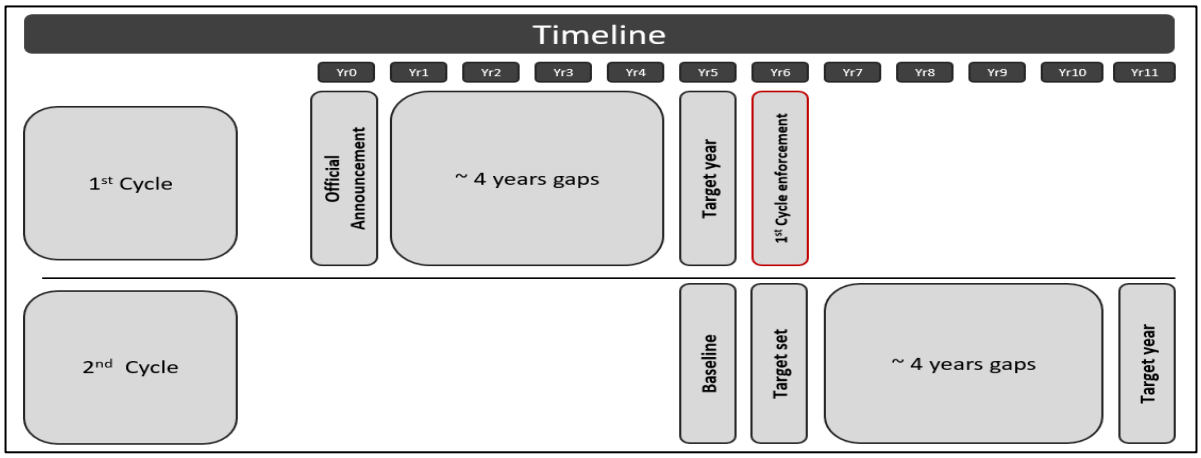

Figure 13 - Framework cycles - Existing assets – Illustrative

Electricity transmission and distribution networks

The framework will also include two cycles. Each cycle duration allows transmission and distribution system providers sufficient time to identify, design and implement measures to reduce the losses of their networks.
The first cycle will set targets on electricity transmission networks and electricity distribution networks in 2021 based on the 2019 baseline. The targets are required to be met in 2025 and 2030 for the first cycle and second cycle respectively.

The electricity transmission and distribution networks cycles are illustrated below:

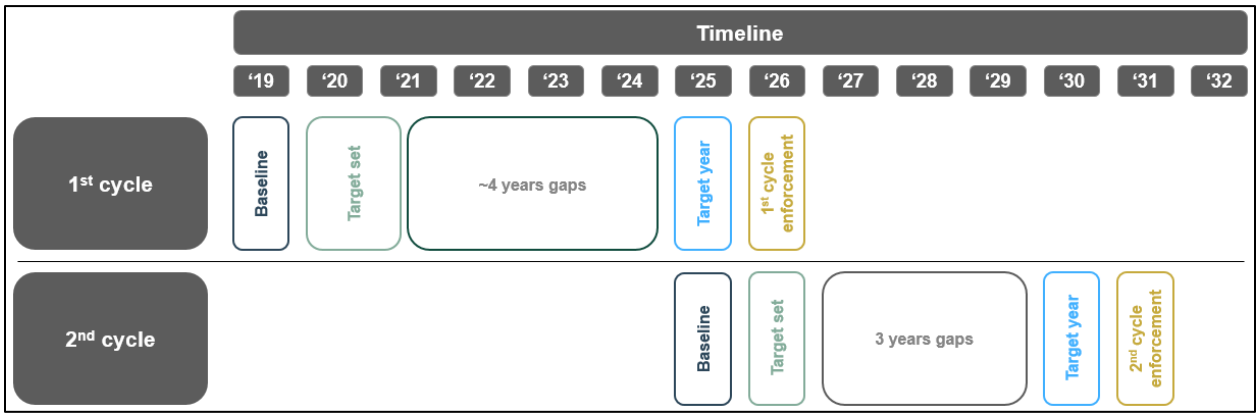

Figure 14 - Framework cycles – Electricity transmission and distribution networks - Illustrative

2.5. Baseline establishment

Existing assets

SEEC established the energy efficiency baseline for all the existing assets based on the 2018 data. The data was collected directly from companies and was reviewed and validated by SEEC. When necessary, SEEC conducted site visits to ensure that the baseline data is exhaustive and plausible.

Electricity transmission and distribution networks

SEEC established the energy efficiency baseline for all electricity transmission and distribution networks based on 2019 network losses. The data was collected directly from service providers by SEEC in participation of WERA. The baseline was reviewed and validated by SEEC through rounds of engagements and using WERA data to ensure that it is plausible.

3. Energy efficiency requirements

3.1. Existing assets

3.1.1. Methodology to set EE requirements for existing assets

The energy efficiency targets are set based on the local benchmarks of similar assets. The data source for the local benchmarks is the 3-year performance data for years 2018, 2019 and 2020, collected and validated by SEEC in each performance year. The target shall be achieved (or outperformed) by the first cycle target year.
In order to identify relevant benchmarks, SEEC grouped the assets into clusters with similar features. The clustering criteria are detailed in the section below for each sub-sector. SEEC computed the benchmarking curve to identify the local top performance, for each cluster.

3.1.2. Power generation

3.1.2.1. Power generation clustering criteria

The clustering criteria used for power generation assets are the following:

- Generation type, i.e. simple cycle, combined cycle, etc.
- Primary fuel type used
- Net capacity at last performance test
- Cooling type (for CCGT only)
- Full load operating hours

The segmentation is specific to each generation type to reflect fundamental differences in the asset's characteristics. The full segmentation is available in the following sections.
For each cluster, the benchmark was calculated as the breakpoint between the 1st and 2nd quartiles. Each asset is associated to a single cluster. The assets are required to meet (or outperform) the benchmark of their own cluster. Below are the benchmarks calculated for each cluster.

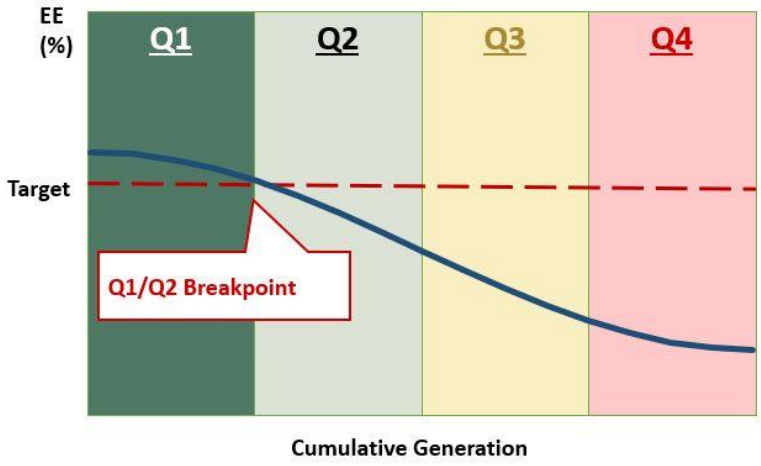

Figure 15 – power generation clusters breakpoint

3.1.2.2. Simple Cycle clustering criteria and EE requirements

The following criteria were used to cluster the Simple Cycle assets and will ensure that the assets within the same cluster are comparable:

Table 3 - EE clustering criteria for existing Simple Cycle assets

Generation type	Primary fuel type	Net Capacity	Full Load Operating Hours
Simple Cycle	Natural Gas & Diesel	0-50 MW	10%-25%
			25% -50%
			>50%
		50-100 MW	10%-25%
			25% -50%
			>50%
		100+ MW	10%-25%
			25% -50%
			>50%
	ALCO	50-100 MW	10%-25%
			25% -50%
			>50%

Note: Any unit with full operating hours less than 10% has no target.

3.1.2.3. Steam Turbine clustering criteria and EE requirements

The following criteria were used to cluster the Steam Turbine assets and ensure the assets within the same cluster are comparable:

Table 4 - EE clustering criteria for existing Steam Turbine assets

Generation type	Primary fuel type	Net Capacity	Full Load Operating Hours
Steam Turbines	Natural Gas & Diesel	0-300 MW	0-50%
			>50%
		300-500 MW	0-50%
			>50%
		500+ MW	0-50%
			>50%
	ALCO, HFO & AHCO	0-300 MW	0-50%
			>50%
		300-500 MW	0-50%
			>50%
		500+ MW	0-50%
			>50%

3.1.2.4. Combined Cycle Gas Turbine clustering criteria and EE requirements

The following criteria were used to cluster the Combined Cycle assets and ensure that the assets within the same cluster are comparable:

Table 5 - EE clustering criteria for existing Combined Cycle assets

Generation type	Primary fuel type	Net Capacity (MW)	Cooling type	Full Load Operating Hours
Combined Cycle Gas Turbines	Natural Gas & Diesel	350 - 850 MW	Water	>50%
			Air	
		850+ MW	Air	0-50%
	ALCO, HFO & AHCO	350 - 850 MW	Water	0-50%
			Air	

3.1.3. Cogeneration

3.1.3.1. Cogeneration clustering criteria

The clustering criteria used for cogeneration assets are the following:

- Cogeneration type
- Primary fuel type used
- Net capacity at last performance test
- Steam generation pressure
- Heat to Power ratio

The segmentation is separate for each cogeneration type to reflect fundamental differences in the asset's characteristics. The full segmentation is available in the following sections.
For each cluster, the benchmark was calculated as the breakpoint between the 2nd and 3rd quartiles. Each asset is associated to a single cluster. The assets are required to meet (or outperform) the benchmark of their own cluster. Below are the benchmarks calculated for each cluster.

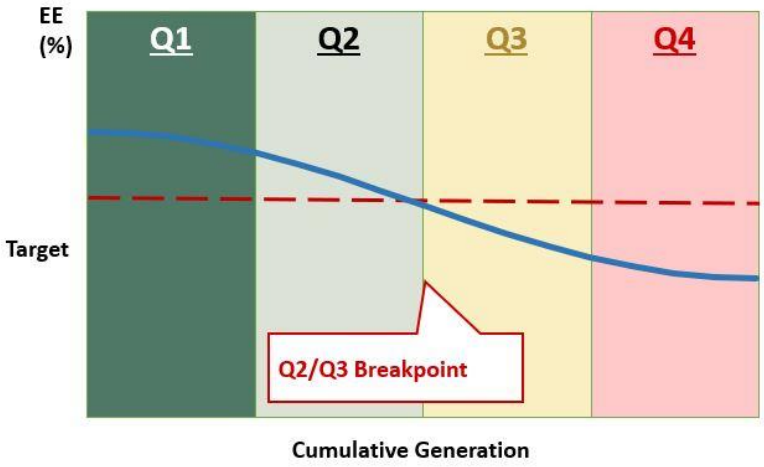

Figure 16 – Cogeneration clusters breakpoint

3.1.3.2. Cogeneration – Gas Turbines clustering criteria and EE requirements

The following criteria were used to cluster the Cogen-GT assets and ensure that the assets within the same cluster are comparable:

Table 6 - EE clustering criteria for Cogen-GT assets

Cogeneration type	Fuel type	Net Capacity	Steam generation Pressure	Heat to power ratio
Cogen-GT	Natural Gas	0-50 MW	0-25 BarA	0-1.4
				1.4 +
			25+ BarA	0-1.4
				1.4 +
		50-140 MW	0-25 BarA	0-1.4
				1.4 +
			25+ BarA	0-1.4
				1.4 +
		140+ MW	0-25 BarA	0-1.4
				1.4+
			25+ BarA	0-1.4
				1.4+

3.1.3.3. Cogeneration – Steam Turbines clustering criteria and EE requirements

The following criteria were used to cluster the Cogen-ST assets and ensure that the assets within the same cluster are comparable:

Table 7 - EE clustering criteria for Cogen-ST assets

Cogeneration type	Net Capacity
Cogen-ST	0-75 MW
	75+ MW

3.1.3.4. Cogeneration – Combined Cycle Gas Turbines clustering criteria and EE requirements

The following criteria were used to cluster the Cogen-CCGT assets and ensure that the assets within the same cluster are comparable:

Table 8 - EE clustering criteria for Cogen-CCGT assets

Cogeneration type	Primary fuel type	Net Capacity	Steam generation Pressure
Cogen-CCGT	Natural Gas	0 - 350 MW	0-15 BarA
			15+ BarA
		350 – 850 MW	0-15 BarA
			15+ BarA
		850+ MW	0-15 BarA
			15+ BarA

3.1.4. Water desalination

3.1.4.1. Water desalination clustering criteria

The clustering criteria used for water desalination assets are the following:

- Desalination type
- Output Total Dissolved Solids (TDS)
- Net capacity

The segmentation criteria are the same for all desalination types. However, the clustering and benchmarking are done at different levels for different process types:

- Reverse Osmosis: asset level
- Thermal processes (MED and MSF): asset level

For each cluster, the benchmark was calculated as the breakpoint between the 2nd and 3rd quartiles. Each asset is associated to a single cluster. The assets are required to meet (or outperform) the benchmark of their own cluster. Below are the benchmarks calculated for each cluster.

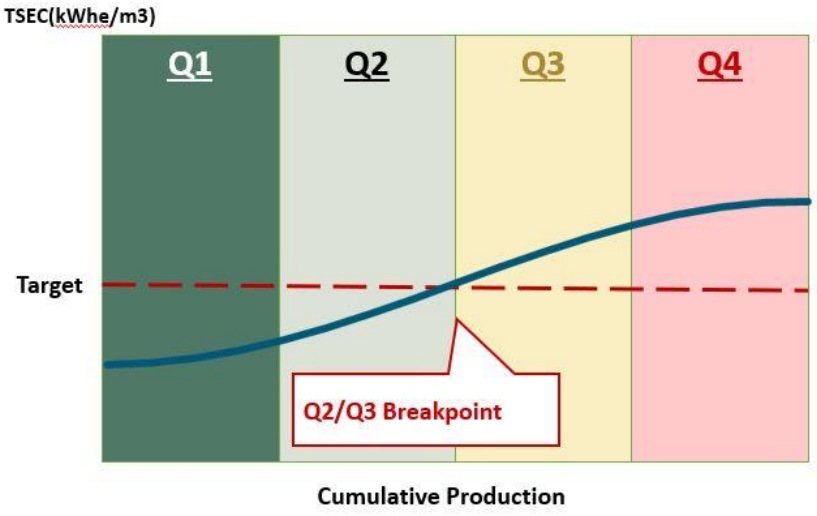

Figure 17 – Water desalination clusters breakpoint

Table 9 - EE clustering criteria for Water Desalination assets

Clustering criteria	Desalination type	Output TDS	Net capacity
Segmentation values	RO	TDS > 10 ppm	0-10,000 m^3/day
			10,000-100,000 m^3/day
		TDS ≤ 10 ppm	>100,000 m^3/day
	MED	NA	0-10,000 m^3/day
			>10,000 m^3/day
	MSF	NA	0-10,000 m^3/day
			>10,000 m^3/day

3.2. New assets

The Energy Efficiency (EE) requirements for new assets apply to all the new assets defined in the section 2.2.2.2. Assets qualification – New assets. The EE requirements are set by SEEC in 2021 and will be periodically reviewed and potentially updated to reflect the latest technology trends that affect EE. If SEEC updates the new assets' EE requirements, SEEC will notify the relevant stakeholders. The communication protocol is detailed in section 8.6.

3.2.1. New power generation assets

3.2.1.1. Methodology to set EE requirements for new assets

SEEC will study each new power generation asset. Overall asset design must be set to optimize the energy efficiency. Therefore, companies shall submit the conceptual design for their new power generation assets to SEEC. Upon review, SEEC will issue a conditional approval of the conceptual design to allow the project owner to start the detailed design phase. The detailed design shall be submitted to SEEC in order to obtain the final approval. The assets that optimize the energy efficiency at the conceptual design and detailed design stages will be approved by SEEC in a written format. The reporting requirements for new assets are detailed in section 5.2. The KPIs used for the EE requirements for the new assets are the following:

- CCGT Gross Efficiency at ISO condition
- SC Gross Efficiency at ISO condition
- ST Net Efficiency at KSA reference site condition

EE requirements for new power generation assets were developed based on the following criteria:

- Fuel type
- Load type
- Generation type
- Capacity
- Cooling type

Within each criteria, the top 10% Net Heat Rate performance of the existing asset in the scope for the year 2018 was defined as the minimum EE requirement. The following requirements shall be met by all new power generation assets with taking into consideration that these requirements will be updated frequently. Companies shall communicate with SEEC regarding the new assets. Reporting requirements for new assets are detailed in section 5.2.

Table 1 - EE requirements for new power assets

Fuel type	Load type	Generation type	Capacity brackets	Cooling type	
				Water cooled	Air cooled
Natural Gas	Base load	CCGT	All capacities	58%	53%
	Peak load	SC	0-100 MW	33%	
			100+ MW	33%	
Liquid fuels	Base load	CCGT	All capacities	47%	43%
		ST	0-400 MW	38%	N.A.
			400+ MW	39%	
	Peak load	SC	0-100 MW	31%	

3.2.2. New cogeneration assets

3.2.2.1. Methodology to evaluate new assets

SEEC will evaluate new cogeneration assets on a case-by-case basis as the efficiency of the cogeneration plants depends on the heat and power requirements. Overall asset design must be set to optimize the energy efficiency. Therefore, companies shall submit the conceptual design of their new cogeneration assets with SEEC. Upon review, SEEC will issue a conditional approval of the conceptual design to allow the project owner to start the detailed design phase. The detailed design shall be submitted to SEEC in order to obtain the final approval. The assets that optimize the energy efficiency at the concept and the detailed design stages will be approved by SEEC in a written format. The reporting requirements for new assets are detailed in section 5.2.

3.2.1. New water desalination assets

3.2.1.1. Methodology to set EE requirements for new assets

SEEC will evaluate each new seawater desalination asset[11] with capacity more than 10,000 m^3/day. Overall asset design must be set to optimize the energy efficiency. Therefore, companies are requested to share the conceptual and detailed design for their new seawater desalination assets with SEEC. Upon review, SEEC will issue a conditional approval of the conceptual design to allow the project owner to start the detailed design phase. The assets that optimize energy efficiency at the conceptual design and detailed design stages will be approved by SEEC in a written format. The reporting requirements for new assets are detailed in section 5.1.
The KPI used for the EE requirements is the TSEC – Total Specific Electricity Consumption.

EE requirements for new water desalination assets were defined by process type:

- Membrane process: based on the performance of the most recent contracted projects
- Thermal process: the top 10% TSEC performance of the existing asset in the scope for the year 2018

The following EE requirements shall be met by all the new seawater desalination assets in scope. The below requirements are applicable for all new seawater desalination assets with capacity greater than 10,000 m^3/day

Table 2 – Minimum EE requirements for new water desalination assets as of 2020

Process type	Maximum TSEC (kWh_e/m^3)
Membrane process	3.5
Thermal process	14.7

*Represented numbers are the bare minimum EE requirement. However, the requirements are subjected to frequent updates. Companies shall communicate with SEEC regarding the new assets. Reporting requirements for new assets are detailed in section 5.2.

[11] Companies shall submit the details for the new water desalination plants to SEEC to confirm the eligibility according to SEEC scope.

3.3. Electricity transmission and distribution networks

3.3.1. Methodology to set EE requirements

Various methods for targets setting were explored and the internal simulation based target approach was selected and agreed upon with relevant stakeholders due to the unique characteristics of the electricity transmission and distribution networks in the Kingdom, i.e. network topology, demand projections, expansions, etc. Companies are required to follow this methodology to propose the internal simulation based targets. In the case if the companies have neither major network expansions nor technology update the companies are required to maintain their baseline performance.

For the current cycle:

- Companies forecasted the electricity transmission network losses considering the following:
    - The future demand forecast based on the power sector plan base GDP scenario /other available demand load forecast
    - Internal network simulation / any other suitable method considering the planned expansion and improvement projects
- Companies forecasted the electricity distribution network losses considering the following:
    - Historical demand variation while considering power sector plan growth
    - Average percentage reduction in losses for the previous years
    - Planned expansion and improvement projects
- Companies submitted all the assumptions considered and the related results to SEEC. SEEC validated the high-level assumptions and agreed on the targets in coordination with relevant stakeholders.

For the next cycle, SEEC will conduct the following to set the EE targets for the electricity transmission and the distribution network losses:

- SEEC will request **relevant data from companies** (Incl. energy efficiency improvement plans, projected losses based on historical data and assumptions considered, as well as planned expansions and improvement projects) required for targets validation exercise
- SEEC will conduct an **in-depth technical analysis** in coordination with relevant stakeholders of the submitted data, in order to set the appropriate network losses targets

Further details on reporting requirements are covered in section 5. Reporting requirements

4. Compliance with EE requirements in the target year of the first cycle

4.1. EE performance of existing assets / Network losses assessment in the target year

SEEC will conduct a detailed data collection for the target year. The collected data will include various elements aiming to:

- Calculate the EE of existing assets / network losses performance in target year
- Validate the plausibility of the data reported
- Ensure that measurement and verification requirements are met

The reporting requirements are detailed in the section 5. Reporting requirements

4.2. Flexibility mechanism

The energy efficiency requirements are set at the asset level / network level depending on the type of asset and network. Even though the main objective is that individual assets / networks should meet their EE requirements, some assets / networks might face challenges due to certain limitations (e.g. outdated technology, etc.).
Consequently, a flexibility mechanism was designed to ensure that the targets are achievable for each company, while maintaining the overall energy efficiency improvement ambition for the Kingdom.

The flexibility mechanism aims to encourage companies to focus their efforts and resources on the assets / networks with the most energy savings' potential, as they see fit, as long as they maintain the overall energy savings targets at the company level.

Assets / networks that achieve savings beyond the EE requirements will generate a savings credit in the target year, whereas assets / networks that perform below the EE requirements will generate a savings deficit. The sum of credits and deficits for all assets within a company will determine whether the company has met the EE requirements.

The Assets that retire during the cycle will also contribute to credits generation, based on the overall improvement in the efficiency through retirement, at the company level. These credits will help offset the overall deficit at the company level, if any.

4.2.1. Credit / deficit calculations at the asset / network level

Credit / deficit calculation methodologies depend on the current EE performance of the asset, / individual networks. Each asset / network can be in one of the following situations:

- *Case 1:* the baseline EE performance of the asset is lower than the targeted EE performance, or the network losses are higher than the targeted losses. i.e. the asset / network is required to improve
- *Case 2:* the baseline EE performance of the asset is higher than the targeted EE performance or the network losses are lower than the targeted losses

4.2.1.1. Case 1: The asset / network is required to improve

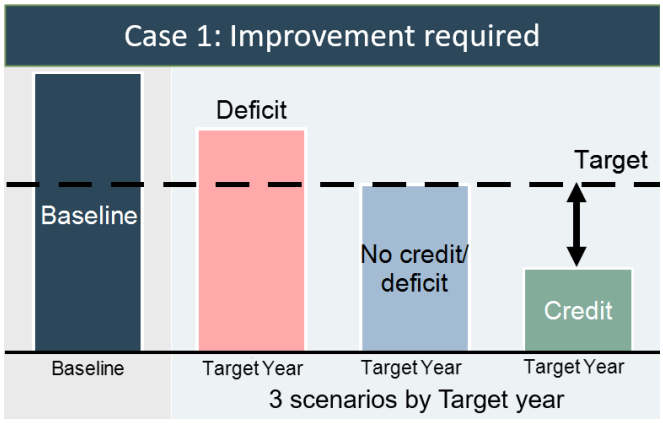

Figure 18 – Credit/deficit mechanism for assets/network required to improve

* The baseline for the electricity transmission and distribution is based on the network losses of the year 2019 and on the 2018 performance related data for power generation, cogeneration and water desalination

For example: If the baseline heat rate / network losses are higher than the targeted heat rate / network losses, then:

- The asset / network gets a deficit if the actual heat rate / network losses are still higher than the target
- The asset / network gets a credit if the actual heat rate / network losses are lower than the target

4.2.1.2. Case 2: The asset / network is not required to improve

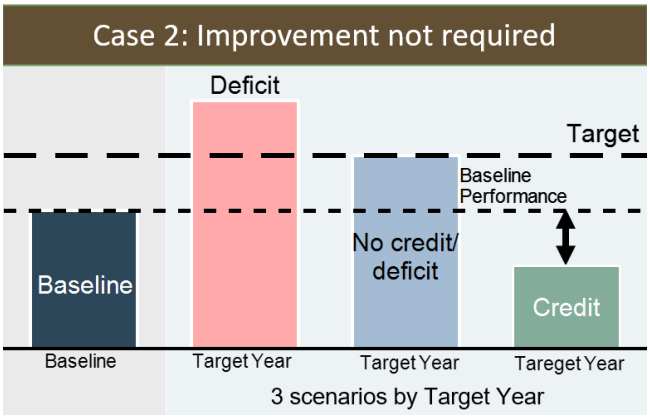

Figure 19 – Credit/deficit mechanism for assets/networks not required to improve

*The baseline for the electricity transmission and distribution is based on the network losses of the year 2019 and on the 2018 performance related data for power generation, cogeneration and water desalination.

For example: If the baseline heat rate / network losses are lower than the targeted heat rate/network losses, then:

- The asset / network gets a deficit if the actual heat rate / network losses are higher than the target
- The asset / network does not get a credit nor a deficit if the actual heat rate / network losses are higher than the baseline but still lower than the target
- The asset gets a credit if the actual heat rate / network losses is lower than the baseline

4.2.1.3. Credit / deficit formulas for power generation and cogeneration

Mechanism	Baseline year: 2018	Credit / deficit for Target year
Credit Generation	$HR_{2018} > HR_{target}$	If $HR_{actual} < HR_{target}$ then: $Credit_{actual} = (HR_{target} - HR_{actual}) \times P_{actual}$
	$HR_{2018} < HR_{target}$	If $HR_{actual} < HR_{2018}$ then: $Credit_{actual} = (HR_{2018} - HR_{actual}) \times P_{actual}$
Deficit Generation	Any HR_{2018}	If $HR_{actual} > HR_{target}$ then: $Deficit_{actual} = (HR_{actual} - HR_{target}) \times P_{actual}$

Where:

- HR_{2018} is the net heat rate of the asset in 2018 (baseline)
- HR_{target} is the net heat rate requirement for the asset
- HR_{actual} is the net heat rate of the asset in actual
- $Credit_{actual}$ is the amount of credits generated by the asset in the target year actual
- $Deficit_{actual}$ is the amount of deficits generated by the asset in the target year
- P_{actual} is total output; i.e. the sum of the Actual Net Generation and the Virtual Power Generation from steam extraction

4.2.1.4. Credit / deficit formulas for water desalination

Mechanism	Baseline year: 2018	Credit/deficit for Target year
Credit Generation	$TSEC_{2018} > TSEC_{target}$	If $TSEC_{actual} < TSEC_{target}$ then: $Credit_{actual} = (TSEC_{target} - TSEC_{actual}) \times P_{actual} \times SHR_{actual}$
	$TSEC_{2018} < TSEC_{target}$	If $TSEC_{actual} < TSEC_{2018}$ then: $Credit_{actual} = (TSEC_{2018} - TSEC_{actual}) \times P_{actual} \times SHR_{actual}$
Deficit Generation	Any $TSEC_{2018}$	If $TSEC_{actual} > TSEC_{target}$ then: $Deficit_{actual} = (TSEC_{actual} - TSEC_{target}) \times P_{actual} \times SHR_{actual}$

Where:

- $TSEC_{2018}$ is the total specific energy consumption in 2018 (baseline)
- $TSEC_{target}$ is the total specific energy consumption requirement
- $TSEC_{actual}$ is the total specific energy consumption in actual
- SHR_{actual} is the system net heat rate in actual
- $Credit_{actual}$ is the amount of credits generated by the asset in the target year actual
- $Deficit_{actual}$ is the amount of deficits generated by the asset in the target year actual
- P_{actual} is the total desalinated water produced in actual

4.2.1.5. Credit / deficit formulas for electricity transmission and distribution networks

Mechanism	Baseline year: 2019	Credit/deficit for Target year
Credit Generation	$TL_{2019} > TL_{target}$ $DL_{2019} > DL_{target}$	If $TL_{actual} < TL_{target}$ then: $Credit_{actual} = (TL_{target} - TL_{actual}) \times IE_{T\,actual}$ If $DL_{actual} < DL_{target}$ then: $Credit_{actual} = (DL_{target} - DL_{actual}) \times IE_{D\,actual}$
	$TL_{2019} < TL_{target}$ $DL_{2019} < DL_{target}$	If $TL_{actual} < TL_{2019}$ then: $Credit_{actual} = (TL_{2019} - TL_{actual}) \times IE_{T\,actual}$ If $DL_{actual} < DL_{2019}$ then: $Credit_{actual} = (DL_{2019} - DL_{actual}) \times IE_{D\,actual}$
Deficit Generation	Any TL_{2019} Any DL_{2019}	If $TL_{actual} > TL_{target}$ then: $Deficit_{actual} = (TL_{actual} - TL_{target}) \times IE_{T\,actual}$ If $DL_{actual} > DL_{target}$ then: $Deficit_{actual} = (DL_{actual} - DL_{target}) \times IE_{D\,actual}$

Where:

- TL_{2019} is the actual electricity transmission network losses in 2019 (baseline)
- TL_{target} is the targeted electricity transmission network losses percentage
- TL_{actual} is the actual electricity transmission network losses percentage
- DL_{2019} is the actual electricity distribution network losses in 2019 (baseline)
- DL_{target} is the targeted electricity distribution network losses percentage
- DL_{actual} is the actual electricity distribution network losses percentage
- $Credit_{actual}$ is the amount of credits generated by the individual network in the target year
- $Deficit_{actual}$ is the amount of deficits generated by the individual network in the target year
- $IE_{T\ actual}$ is the total actual injected energy in the electricity transmission network in the target year
- $IE_{D\ actual}$ is the total actual injected energy in the electricity distribution network in the target year

The sum of credits of all the assets / networks within a company will determine the total generated credits at the company level.
The sum of deficits of all the assets / networks within a company will determine the total generated deficits at the company level.

4.2.2. Compliance with EE requirements

The credit / deficit calculations only apply to the existing assets and electricity transmission and distribution networks in scope as defined in section 2.2.
For the first cycle, the EE requirements are applicable for the target year only. No credits or deficit will be generated for the intermediate years, i.e. the years between framework announcement and target year.

In the target year, the companies can be in one of the situations below:

- If the sum of credits is higher than or equal to the sum of deficits generated in the target year, the company is compliant with the EE requirements
- If the sum of credits is lower than the sum of deficits generated in the target year, the company is not compliant with the EE requirements and an enforcement mechanism will be applied on the assets / networks with a deficit

EE performance will still be monitored on a yearly basis by SEEC, and companies are required to share any relevant data requested by SEEC for this purpose. Further details on data requirements are available in the following section.

5. Reporting requirements

5.1. Existing Assets / Electricity transmission and distribution networks

5.1.1. Annual data reporting

The annual energy efficiency performance and operational data of all existing assets and electricity transmission and distribution networks in scope shall be submitted to SEEC. Communication protocol is covered in section 8.6.

There are four data reporting related activities:

- **Data collection**: Companies shall submit required data using data collection templates shared by SEEC. Templates shall not be altered and the content should be approved by the management of the assets / electricity transmission and distribution service providers. Companies are encouraged to request any clarifications regarding the data required.

- **Data validation:** SEEC will validate the submitted data to ensure its completeness and plausibility. SEEC will request further details/clarifications, if necessary. SEEC will also highlight the data reporting gaps for corrective actions.

- **EE Performance gaps identification**: SEEC will analyze the EE performance based on the data submitted and will highlight the gaps in the performance with respect to the EE targets. SEEC will issue the initial gap analysis report for companies to review and provide comments, if any.

- **Final report development**: After incorporating the eligible comments, if any, SEEC will issue a final report highlighting the annual EE performance compared to the baseline and targets

5.1.2. Energy Efficiency Improvement plan (EEIP)

All companies[12] shall submit an Energy Efficiency Improvement Plan (EEIP) to SEEC. The EEIP should detail companies' measures to ensure compliance with energy efficiency requirements throughout the cycle.
The EEIP can focus only on the assets / networks requiring enhancement or also cover the compliant ones if the company plans to leverage the flexibility mechanism.
The EEIP should include the following:

- Energy efficiency improvement measures
- Brief description of each measure
- Implementation roadmap and details
- Expected annual energy savings or losses reduction
- Percentage of energy savings with reference to the baseline energy consumption
- Expected energy efficiency KPIs, as per the nature of the asset / network
- Total capital expenditure and incremental operational costs of each measure (in SAR)

Companies shall submit the draft EEIP after 3 months of official target communication and a final EEIP by 6 months.

Companies are required to submit a refreshed EEIP on a yearly basis after the submission of the final EEIP, which includes, in addition to the submitted EEIP the following:

- New energy efficiency improvement measures, if any
- Status update on the previously identified energy efficiency improvement measures (i.e. completed, ongoing, postponed or canceled)
- Further details on reasons of postponing or cancelling any energy efficiency measure
- Further details on implemented measures including photographs

The EEIP is not binding (i.e. the energy efficiency improvement measures can be changed by the asset / network service provider at his discretion). The purpose of the EEIP is to provide SEEC to ensure that companies have credible plans to close energy efficiency gaps.

[12] Including the companies already meeting the EE targets to demonstrate the sustenance of the performance equal to or better than the targets till the target year.

5.2. Power generation, cogeneration and water desalination new assets

5.2.1. Process requirements for the new assets

As per the requirements of the Saudi energy efficiency program, new assets are required to comply with optimal energy efficiency requirements to avoid potential repercussions at a later stage. Hence, to ensure that the new assets are designed and built according to the energy efficiency requirements, SEEC has introduced specific requirements at various stages of the lifecycle of the project, from pre-conceptual design phase until assets' operational phase.

5.2.2. Pre-conceptual design stage

Companies planning to build a new asset are required to:

- Notify SEEC about the intent to build a new asset, before starting the conceptual design phase
- Submit general information about the new asset (incl. asset type, capacity and any other relevant information requested by SEEC)
- Based on the type of the asset, SEEC will then communicate to the company the detailed list of requirements for the following stage

5.2.3. Conceptual design stage

SEEC will evaluate the new asset at the conceptual design stage to ensure that the energy efficiency aspects are considered at the early stages of the asset development.

- **If the energy efficiency[13] targets are available for the new asset,** then the company shall submit the concept design of the new asset with an expected energy performance calculation report, based on the prescribed methodology. This is generally done in the pre-tendering stage. SEEC will review the submission to confirm whether the asset is meeting the energy efficiency targets for the new assets:
    - If the design is not compliant with the energy efficiency requirements, SEEC will inform the company to improve the design
    - If the design is meeting the energy efficiency requirements, SEEC will issue the conceptual certificate to proceed to the next step, i.e. FEED (Front End Engineering Design) / detailed design stage

[13] Net heat rate for standalone power asset, equivalent net heat rate for cogeneration asset and TSEC for water desalination asset

- **If the energy efficiency targets are not available for the new asset,** then the company shall submit the concept design of the new asset with an estimated energy performance report based on the prescribed methodology. SEEC will evaluate the submission on a case-by-case basis, to ensure that energy efficiency has been considered during the design phase. SEEC will potentially ask for additional documents depending on the company's submission:
    - If the design is not compliant with the energy efficiency requirements, SEEC will inform the company to improve the design
    - If the design is meeting the energy efficiency requirements, SEEC will issue the conceptual certificate to proceed to the next step, i.e. FEED (Front End Engineering Design) / detailed design stage

5.2.4. Detailed design stage

After obtaining the conceptual design certificate, companies will proceed to the detailed design stage. Detailed design review will be conducted at this stage, which consists of validating the design during the detailed engineering[14] and procurement stage, to ensure that energy efficiency is considered during the design stage and optimal energy efficiency will be achieved.
This step will ensure that best practices related to energy efficiency enhancements are adopted before proceeding to the construction phase of the asset. SEEC will either provide the company With the "detailed design certificate" or request a modification / update of the design to meet the energy efficiency requirements.

[14] The critical equipment is generally selected during FEED (front end engineering design)

5.2.5. Energy Efficiency Certificate terms and conditions

SEEC provides two certificates during the design phase of a new asset under SEEP scope:

- Conceptual Design Certificate
- Detailed Design Certificate

SEEC certificates are mandatory requirements to obtain the power generation, cogeneration and / or desalination license from WERA.

These certificates are issued based on data / information provided by the companies and relevant analysis conducted by SEEC. Hence, companies are responsible for the following:

- Confirming the accuracy of all data and documents submitted to SEEC
- Informing SEEC immediately of any changes in the assets design
- Submitting any information requested by SEEC before the defined deadlines

Obtaining the Conceptual Design Certificate does not automatically lead to the delivery of the Detailed Design Certificate.
The Detailed Design Certificate is only valid for four years, from the issuance date. Companies are required to apply for extension by providing the justification for the same.

5.2.6. Operational stage

- The company must inform SEEC once it successfully completes the Performance Guarantee (PG) test with its EPC (Engineering, procurement, and construction) contractor or other relevant stakeholders
- After the PG test, the asset shall operate better or equal to the energy efficiency performance requirements within two years of operation (for three consecutive quarters). SEEC will collect quarterly EE performance and generation data for two years.
- The asset will be then classified as an “existing asset”, managed by existing assets’ related requirements.
- If the new asset does not achieve the energy efficiency target within two years of the PG test, the case will be evaluated and the asset will subject to enforcement mechanism.

5.3. Electricity transmission and distribution networks' new assets

There are no separate requirements for the new / expansion of the existing electricity transmission and distribution networks as all the expansions are already covered in the existing electricity transmission and distribution networks' framework. Further details are available in section 2.2.

5.4. Measurement and verification

A robust measurement, reporting and verification process is essential to ensure effective and credible assessment of energy efficiency performance of assets / networks. Hence, the success of the scheme depends upon a cohesive and transparent measurement, reporting and verification (M&V) system.

Measurement and Verification (M&V) is the process to assess the energy efficiency of each asset / network during the cycle, and in the target year. The verification means a thorough and independent evaluation of the activities undertaken by the companies to comply with energy efficiency targets, in the target year, and to assess the entitlement to energy credits to benefit from under the flexibility mechanism.

SEEC will conduct Energy Efficiency Measurement and Verification (EE M&V) audits for both cycles of the framework. The methodology of the audits will be shared with companies by SEEC prior to the audits dates. SEEC, along with government entities, will collaborate in this effort. Third parties' contribution may take place, when necessary, if decided by SEEC.

The underlying principles for measurement and verification include:

- **Consistency:** Applying uniform criteria to meet the requirements throughout the cycle
- **Measurability:** Measurement is a fundamental starting point for any kind of data related to energy efficiency enhancement program
- **Confidentiality:** Safeguarding the confidentiality of all information obtained or generated during verification exercise
- **Traceability:** Ensuring that supporting documents used are verifiable and traceable
- **Transparency:** Ensuring that information included in the verification reports is presented in an open, clear, factual, neutral and coherent manner, based on documented evidence

Individual assets / networks are required to meet the following M&V requirements:

- **Reporting as per the SEEC boundary guidelines:** The energy consumption and generation data should be reported as per the prescribed boundaries in the data collection user manual. During the verification process, the reporting boundaries will be assessed to ensure that they are in line with the SEEC guidelines. For the electricity transmission and distribution, the entire network will be considered as the boundary.

- **Data Quality:** The reported data (electricity, steam and water generation, auxiliary consumption, fuel consumption, injected energy, delivered energy, etc.) used in heat rates and network losses calculation shall be free from material omissions, misrepresentations and errors. The parameters provided in the data input templates shall be taken from the measured logs with supporting documentation. In case the data used is not taken from the basic measurements at field, the calculation methodology including engineering assumptions and reconciliation method used shall be documented. All the primary and secondary sources used as supporting documentation will be checked and verified during the verification process.

- **Data Measurement:** As measurement is key to any energy efficiency enhancement program, companies are required to use appropriate measurement devices and maintain their calibration records as per the industry practice / manufacturer requirements. This will be checked and verified during the verification exercise. For the electricity transmission and distribution losses, the requirement set out in grid and distribution codes shall be met.

- **Reporting of energy savings realized through implementation of Energy efficiency enhancement measures:** Facilities shall report the energy savings achieved from the individual energy efficiency improvement measures implemented (in the current cycle) during the verification exercise. The energy savings should be determined by comparing measured parameters before and after the implementation of underlying energy efficiency measures and making appropriate adjustments for changes in conditions. This should be demonstrated during the verification exercise. Facilities are required to keep the records of the energy savings achieved based on the individual energy efficiency measures' implementation. For the electricity transmission and distribution networks, the losses at the company level shall be measured and documented. The losses reduction (improvement) based on the individual measure is not required to be reported.

Important documents required to be maintained for M&V audits

Following documents (but not limited to) are required to be presented during the verification process, as applicable. Hence, companies are advised to keep all related records according to a proper filing structure:

- Data collection templates for all previous and current year
- Primary and secondary source documentation for each input
- Calibration certificates / records
- Details of the energy efficiency measures implemented
- Fuel consumption and related purchase records
- Electricity, steam and water related export records
- Electricity, steam and water related purchase records
- Annual performance test records
- Design documents
- Injected energy with the breakup of individual parameter
- Delivered energy with the breakup of individual parameter
- Auxiliary consumption for electricity transmission and distribution
- Energy exchange through international interconnections
- Other useful data required for performance evaluation and verification

6. Mitigation Plan

The energy efficiency targets are set in such a manner that most of the companies shall be able to meet them directly or through the flexibility mechanism. However, in case the companies are not able to meet these targets by implementing the economically feasible[15] EE measures, SEEC will evaluate the individual submissions by the companies on the same.

SEEC will request the companies to submit relevant cases of inability to meet the energy efficiency targets economically (considering SEEC pre-requisites mentioned below).

Pre-requisites:

- Flexibility mechanism / retirement options explored and appropriately implemented
- All the possible operational excellence initiatives identified and implemented
- All the possible economical viable capex measures identified and considered
- Possible technical viable options presented with the cost-benefit analysis
- Other pre-requisites may be added later

SEEC will review the case in two steps:

- First, checking if all the pre-requisites are met
- Once the pre-requisites are verified, further evaluation of the case will be conducted to assess if the companies are able to demonstrate that energy efficiency targets cannot be met economically, and may negatively impact the cost to serve and/or have other similar impacts

For the companies that are able to demonstrate that the targets cannot be met economically, following mitigation plan can be used individually or combined, depending on the case assessment.

[15] The parameters to calculate the economic feasibility will be provided by SEEC.

7. Factors impacting the energy efficiency

In the event that the assets' operational conditions are impacted by external factors out of the utility company's control, the EE performance may be normalized.
The external factors eligible include:

-Full load operating hours in the target year are outside of the benchmarking cluster's range due to a change in power generation dispatching.
-The primary fuel type in the target year is different than the primary fuel type in baseline due to a supply shortage.
- other factors

Suitable adjusted factors will then be derived and applied. This adjustment will be considered only to offset the deficit and will not generate any credit at the company level.
The adjustment will also be conducted if the assumptions used is changed.
Companies are required to communicate to SEEC these scenarios / external factors potentially affecting the energy efficiency, along with the expected impact.

8. Communication

8.1. Focal points

For the Utilities framework related communications, SEEC shall coordinate with a single point of contact per company, the companies shall assign one main contact and one back-up contact in case of absence of the main contact for power generation, cogeneration and water desalination assets.
In addition, for the electricity transmission and distribution networks, a single focal point shall be assigned per network service provider. Focal points will manage communications, coordination, and ensure fulfillment of SEEC requirements.

8.2. Responsibilities of focal points

Each assigned focal point is in charge of the following responsibilities:

- Follow-up to ensure the company / network service provider fulfills SEEC EE requirements
- Provide data, information, and / or clarifications requested by SEEC
- Communicate all SEEC activities / requirements to the management of the company
- In case of focal point's non-compliance, an escalation will be sent to both the focal point and the management of the company

8.3. Changing focal points

When a company decides to change the assigned focal point, it must inform SEEC with the replacement decision in advance.
The process that companies shall follow in order to change focal points is described below.

8.4. Notification of change

To inform SEEC, the company shall follow the communication protocol mentioned in section 8.6. The communication should contain the following details of the new focal point:

- Full name
- Position/role at the company
- Contact details:
  - Official Email address
  - Phone number

8.5. Handover process

When changing assigned focal point, each company must ensure proper handover from the previous focal point to the newly appointed one, where role and responsibilities are explained in details and all communications / materials relevant to the framework are shared with the newly appointed focal point.

8.6. Communication protocol

Companies are required to submit data and / or information requested by SEEC. Common communication methods used by SEEC are emails and / or letters.
Responses from companies should follow the same communication protocol unless directed otherwise by SEEC. The description of common interactions with SEEC is covered below.

8.7. Data collection

SEEC will request companies to submit performance data on annual basis along with the supporting documents[16] as requested by SEEC. In addition, for the electricity transmission and distribution sector, the network losses data shall be reported on annual basis and or quarterly basis.

[16] The example of the supporting documents includes the simulation/modelling for estimating/ forecasting the network losses, fuel invoice, etc.

The data request will be communicated by SEEC via email with a proposed timeline. The requested data is communicated in standard templates attached to the email to be shared, or as mentioned in the communication method. Companies must provide the data and information as instructed. Upon receipt of the data collection request from SEEC, the company should confirm back in writing the proper receipt of the template and adherence to the proposed timeline.

8.8. Data submissions

Companies shall collect and submit the data leveraging data collection templates / tools shared by SEEC, and adhere to the instructions and timeline stated in the initial request. SEEC prohibits any amendment to the templates.
Data submissions shall occur on time. Any delay in submission shall be escalated to the company's management.

8.9. Validation and clarifications

SEEC will run a validation check upon reception of data submitted by companies. SEEC will issue a clarification request during the validation exercise and may request additional supporting documents to ensure data integrity and validity. Companies are requested to respond within specified timeline mentioned during the clarification requests.

8.10. Site visits

SEEC shall conduct site visits to companies as needed, for the following purposes:

- Validation and verification
- Following-up on the execution and progress of energy improvement plans
- Discussing low performances, as applicable
- Monitoring initial performance tests

8.11. Additional requests

In some cases, SEEC may request companies to provide additional data or information. Companies shall fulfill the requirements and provide the additional data or information to SEEC on a timely manner.

8.12. Data security and confidentiality

SEEC classifies all data submitted by companies as confidential. Employees having access to this data, treat submitted data carefully and are aware of its confidentiality.