

# OOREDOO KUWAIT WIRELESS NETWORK ASSESSMENT -RAN ENERGY EFFICIENCY OPTIMIZATION

05 February 2026

RAN Energy Efficiency Optimization



# RAN Energy Efficiency Optimization Scoring (Current)

Process Flow	Cognitive Activity	Service Capability	Method: Average															
			Criteria				Sub-scenario 1		Percentage	20%	Sub-scenario 2		Percentage	40%	Sub-scenario 3		Percentage	40%
			Option A	Option B	Option C	Option D	Answer	Original score	Compensated score	Overall Score	Answer	Original score	Compensated score	Overall Score	Answer	Original score	Compensated score	Overall Score
RAN Energy Efficiency Optimization	Intent	Intent Translation	4	3	0	0	B	3	3	3.69	B	3	3	3.82	B	3	3	3.26
		Intent Fulfillment & Evaluation	4	3	0	0	B	3	3		A	4	4		B	3	3	
	Awareness	RAN Energy Saving Information Collection	3	2	1	0	A	3	4		A	3	4		A	3	3	
	Analysis	RAN Energy Saving Issues Identification	4	3	2	0	A	4	4		A	4	4		A	4	4	
		RAN Traffic & Performance Prediction	4	3	2	0	A	4	4		A	4	4		B	3	3	
		RAN Energy Saving Issues Demarcation & Root Cause Analysis	4	3	2	0	A	4	4		A	4	4		A	4	4	
		Solution Generation	4	3	2	0	A	4	4		A	4	4		B	3	3	
	Decision	Solution Evaluation & Decision Making	4	3	2	0	A	4	4		A	4	4		B	3	3	
	Execution	Solution Implementation	2	1	0	0	A	2	4		A	2	4		A	2	3	
	Note 1: Scores are automatically calculated by formulas, which cannot be changed.							Individual Sub-scenario scoring			3.69				3.82			
							High Value Scenario Scoring		3.57									





# Cognitive Activity Intent (Intent Fulfillment & Evaluation)

Question:

How does the System evaluate RAN energy saving intent fulfillment?

Answer:

Through a dashboard to monitor our energy saving gains fulfillment

Evidence:



# Cognitive Activity Awareness (RAN Energy Saving Information Collection)

## Question:

How does the System collect RAN energy saving related information?

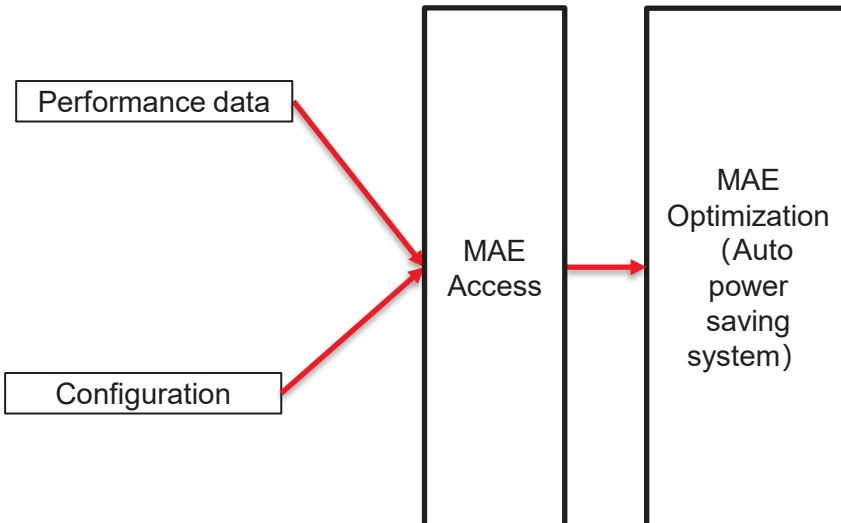
## Answer:

After a task is set, the iPowerStar automatically obtains and analyzes RAN data. Engineering parameters can also be automatically obtained from our MAE server through FTP.

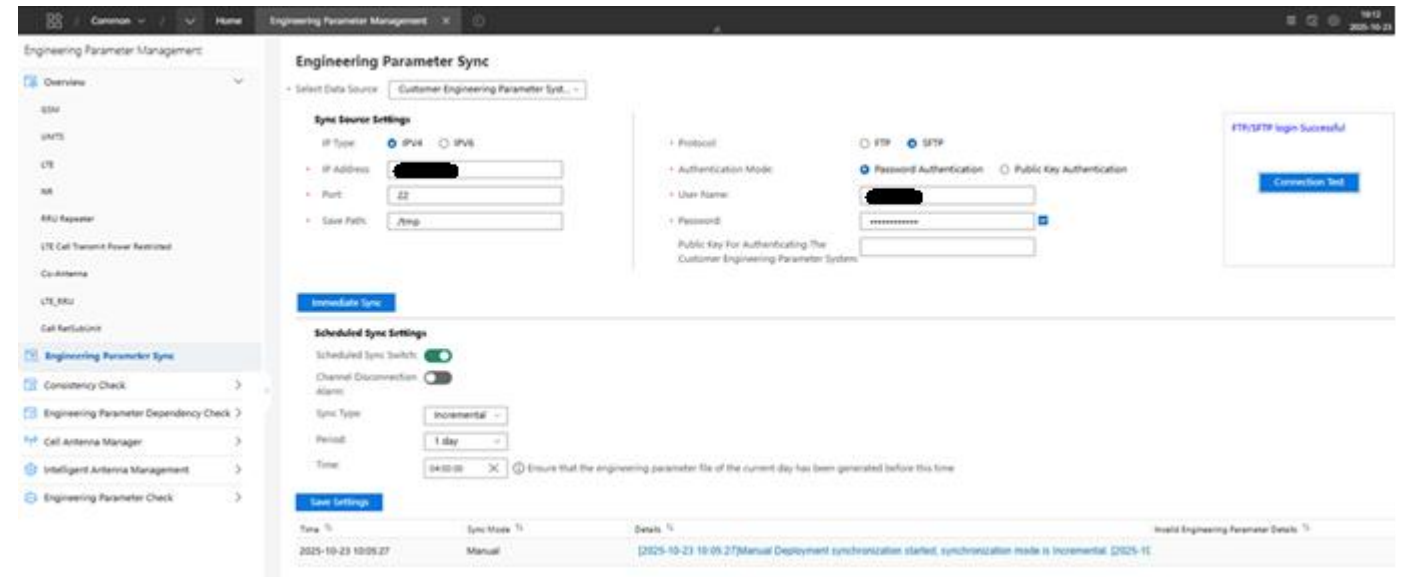
## Evidence:

### RAN data auto collection

NE sites performance data (counters) and configuration will Periodically (minutes or hourly) update to MAE access sever, and the auto power saving system ( ipowerstar) will collect these data periodically (minutes or hourly)



### Engineer parameters auto collection



# Cognitive Activity Awareness (RAN Energy Saving Information Collection)

Question:

How does the System collect RAN energy saving related information?

Answer:

After a task is set, the iPowerStar automatically obtains and analyzes RAN data. PM Data is also collected from MAE

Evidence:

The screenshot displays the iMaster MAE Optimization interface. A 'Data Diagnosis' dialog box is open, showing a table of PM Data Collection results. The table has the following columns: NE Name, Data Type, Status, Check Time, Result, Diagnosis Advice, and Module. All entries show a 'Normal' status and a check time of '2025-10-23 09:00:00'. The dialog also includes an 'Export Data' button and a 'Close' button. The background interface shows various optimization settings and a navigation menu on the left.

NE Name	Data Type	Status	Check Time	Result	Diagnosis Advice	Module
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			
[REDACTED]	PM Data	Normal	2025-10-23 09:00:00			

# Cognitive Activity Analysis (RAN Energy Saving Issues Identification)

## Question:

How does the System identify RAN energy saving issues? e.g. insufficient energy saving issue, high energy consumption, low energy efficiency and performance issues caused by energy savings actions.

## Answer:

The System intelligently identifies energy saving issues, without human intervention.

## Evidence:

### ➤ RAN Energy Saving Issues --Insufficient energy saving issue

#### • Preliminary Selection of Energy Saving Cells

The algorithm calculates the overlapping coverage rate between cells based on the collected CHR/MR data, and computes the changes in coverage for each cell under different levels of energy-saving measures. It then identifies the most aggressive energy-saving measure that still meets basic coverage requirements as the initial range.

#### • Energy saving effect simulation

The system builds AI models for key KPIs such as energy consumption and DL throughput, which can predict changes in these KPIs after parameter adjustments. For cells where energy consumption is reduced and other key KPIs still remain unchanged after implementing energy-saving measures, the algorithm will identify potential energy-saving opportunities and attempt different levels of energy-saving strategies.

### ➤ RAN Energy Saving Issues -- Performance issues caused by energy saving

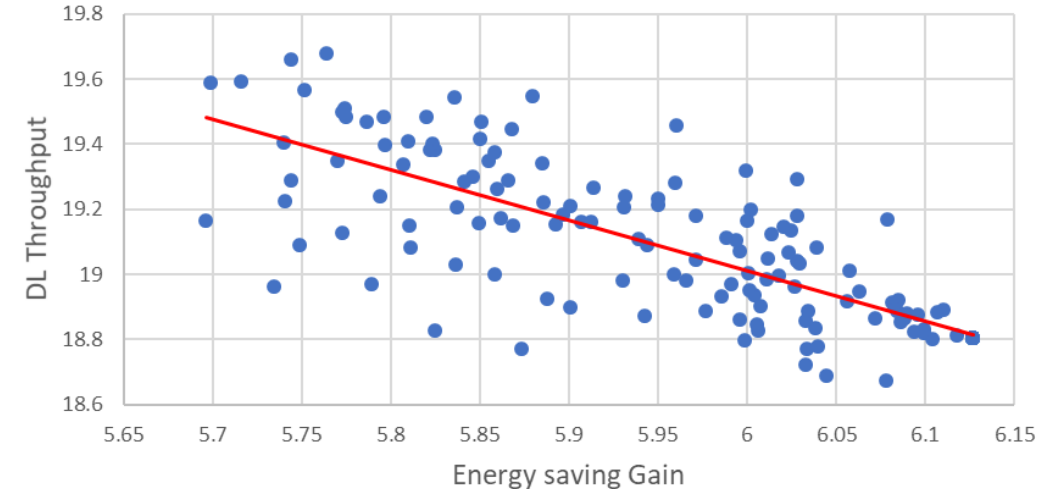
#### • Performance issues identify action caused by energy saving

When searching for suitable energy-saving parameters, the algorithm calls upon AI models to simulate changes in key KPIs. If inappropriate energy-saving measures cause the cell's performance to fall below the set target value, the algorithm will return a significant penalty term. The system will then determine whether the cell performance has deteriorated based on the magnitude of the penalty term and adjust the extent of the energy-saving measures accordingly.

#### • Cells and KPI monitor

The system automatically monitors the KPI changes of the cells which energy-saving optimization actions are applied and their neighboring cells (The KPIs monitored could be selected on the system GUI).

DL Throughput Change vs Energy Saving Gain



Comparison of simulation results for energy-saving gains and DL throughput changes under different levels of energy-saving parameters. When the energy-saving strategy is too aggressive, the rate simulation results will significantly decrease.

# Cognitive Activity Analysis (RAN Energy Saving Issues Demarcation & Root Cause Analysis)

## Question:

How does the System demarcate energy saving & performance issues and analyze their root cause (e.g., performance issues caused by which energy saving actions)?

## Answer:

The System intelligently demarcates energy saving & performance issues and analyze their root cause, without human intervention

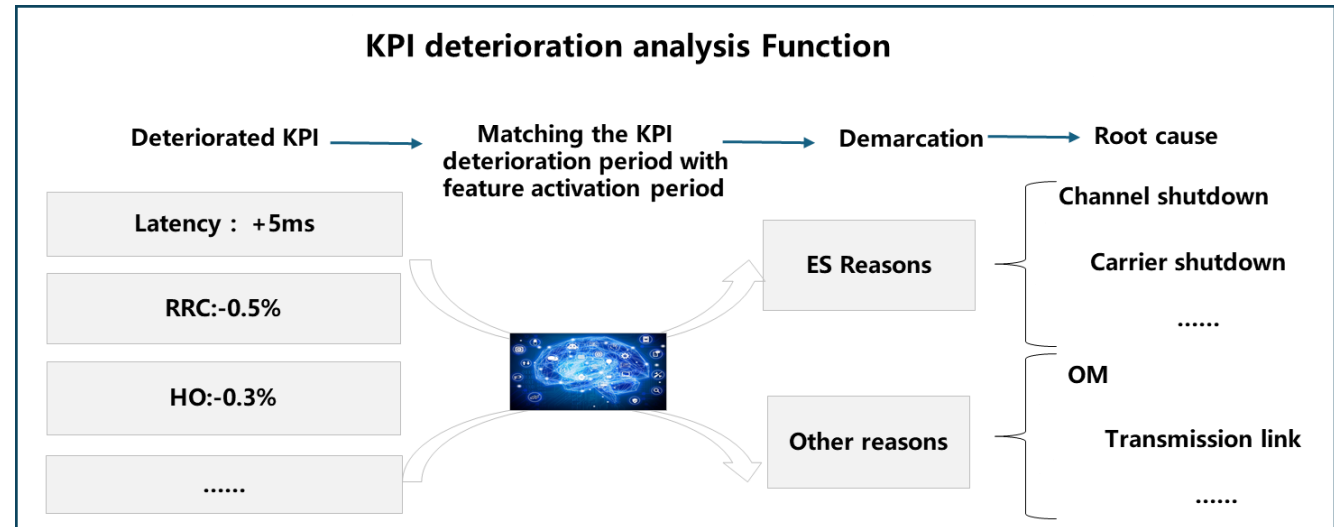
## Evidence:

### ➤ RAN Energy Saving Issues Demarcation

If it is identified that a cell has insufficient energy-saving potential (i.e., there is a possibility to further reduce energy consumption while achieving user downlink rate and weak coverage targets), AI algorithms will be used to optimize the energy-saving parameters for these cells.

### ➤ Performance issues caused by energy saving

The system has a built-in KPI deterioration analysis mode that establishes the correlation between KPIs and energy-saving features. The system can identify whether the KPI deterioration is caused by specific energy saving actions by analyzing the correlation between the KPI deteriorated time and the activation time periods of energy-saving features implemented the previous day that may affect these KPIs.



# Cognitive Activity Analysis (RAN Traffic & Performance Prediction)

## Question:

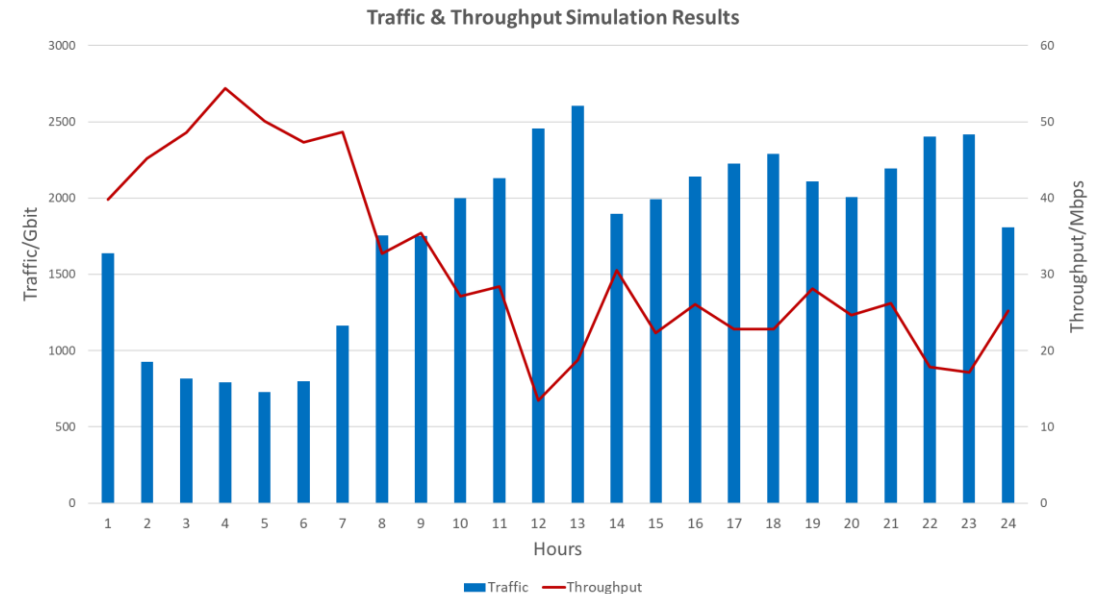
How does the System predict traffic load and network performance that can be used for RAN energy saving solutions? Traffic load includes but not limited to PRB utilization rate. Network performance includes but not limited to RAN UE throughput

## Answer:

The System intelligently predicts traffic load & network performance that can be used for energy saving solution at the minimum granularity that data is available from the source, without human intervention.

## Evidence:

- The core principle of predicting future load and performance (including user throughput) is to build machine learning regression models based on historical network data (e.g., MR, CHR, PM, DT), modeling key features that influence throughput, thereby achieving accurate simulation predictions of user throughput, spectral efficiency, and cell load.
- Prediction Granularity Aligned with the Data Source: RDTs performs hourly-level simulation predictions using raw data such as CHR and MR (with sampling intervals as low as 10 seconds), covering cell-level indicators including coverage quality, energy consumption, and experienced throughput. Its minimum temporal granularity strictly matches the native data collection frequency. For example, energy consumption predictions are derived from hourly-aggregated PRB utilization metrics, not daily or coarser aggregations.
- The figure below illustrates an example of 24-hour throughput and traffic simulations. Based on optimization recommendations, the system generates the predicted 24-hour intra-cell throughput and traffic profiles. Energy-saving measures—such as power reduction—are then selected according to the identified headroom for performance degradation, enabling targeted energy conservation without compromising user experience.



# Cognitive Activity Analysis (Solution Generation)

## Question:

How does the System generate the recommended RAN energy saving solutions to solve the identified energy saving issues?

## Answer:

The system generates multiple rounds of solutions based on predictive results and customer needs using AI algorithms, and selects the optimal solution according to profitability.

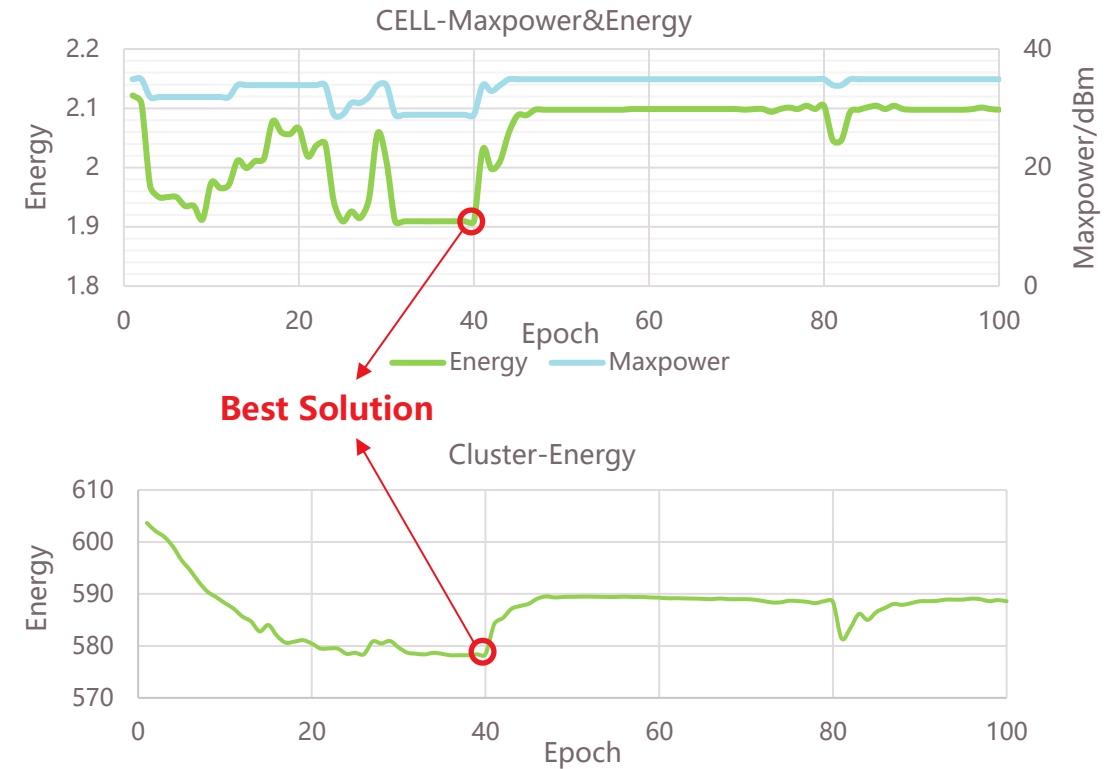
## Evidence:

- The system generates multiple rounds of solutions iteratively using AI optimization algorithms based on predicted traffic load and network performance, combined with customer demand scenarios (e.g., scenarios prioritizing optimal rate while considering traffic or energy efficiency while balancing rate, traffic, and coverage). The final solution is selected based on the benefits of each option. The entire process is fully automated and requires no manual intervention.

### Optimization Scenarios

NO.	Optimization Scenarios	Optimization Target	Optimization Target Constraint
1	L2 scheduling parameter	Throughput	Traffic
2	L3 handover parameter	Throughput	Traffic
3	Power parameter	Energy	Throughput&Traffic&Coverage
4	RF parameter	Coverage	Throughput&Traffic&Energy&User
...	...	...	...

- AI Optimization Algorithms:
  - Network Model gradient optimization;
  - Region Model PSO iterative optimization
  - .....



# Cognitive Activity Decision (Solution Evaluation & Decision Making)

## Question:

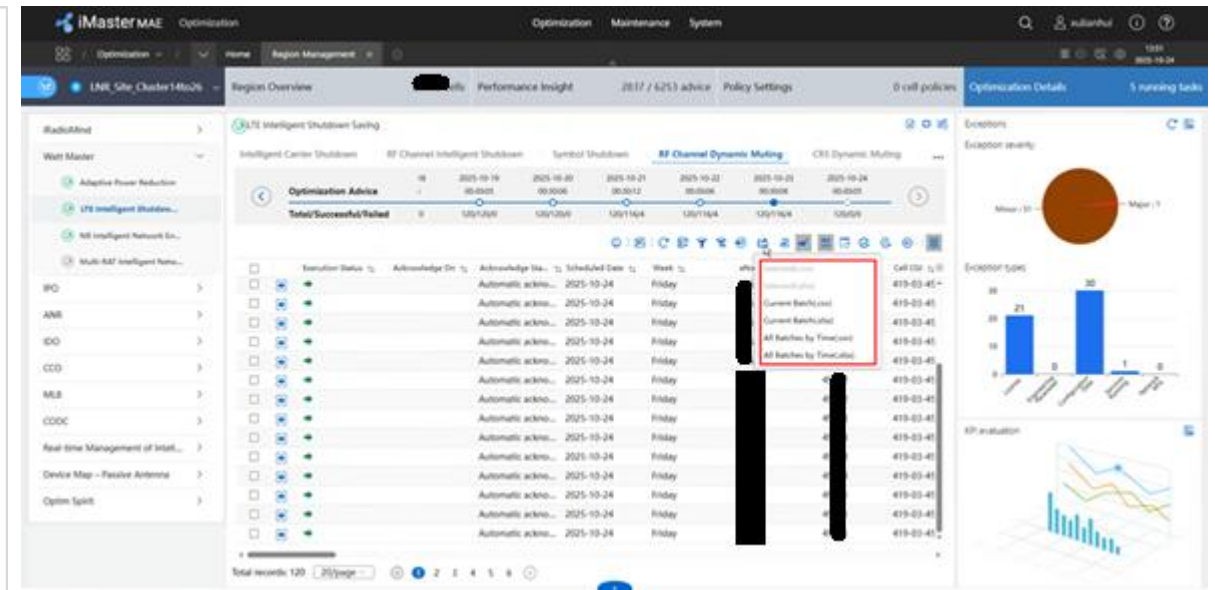
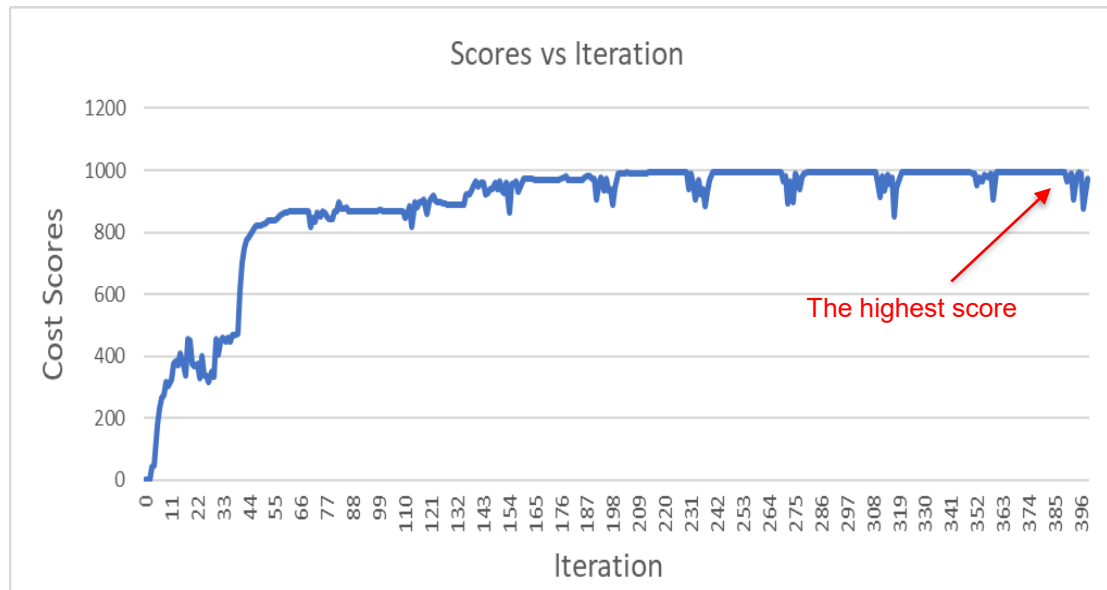
How does the System evaluate energy saving solutions and decide on the best solution to be implemented?

## Answer:

The System intelligently evaluates energy saving solution and selects the best solution, but requires human confirmation

## Evidence:

- When generating alternative solutions, the algorithm calls the simulation prediction module to simulate the parameters of each solution, and then generates predicted values for corresponding KPIs such as DL throughput, traffic, and poor coverage ratio.
- The algorithm calculates and records the comprehensive score for each alternative based on the predicted values and weights of key KPIs.
- The algorithm makes decisions based on scores, selecting the solution with the highest score as the final advice and displaying it on the GUI.



# Cognitive Activity Decision (Solution Evaluation & Decision Making)

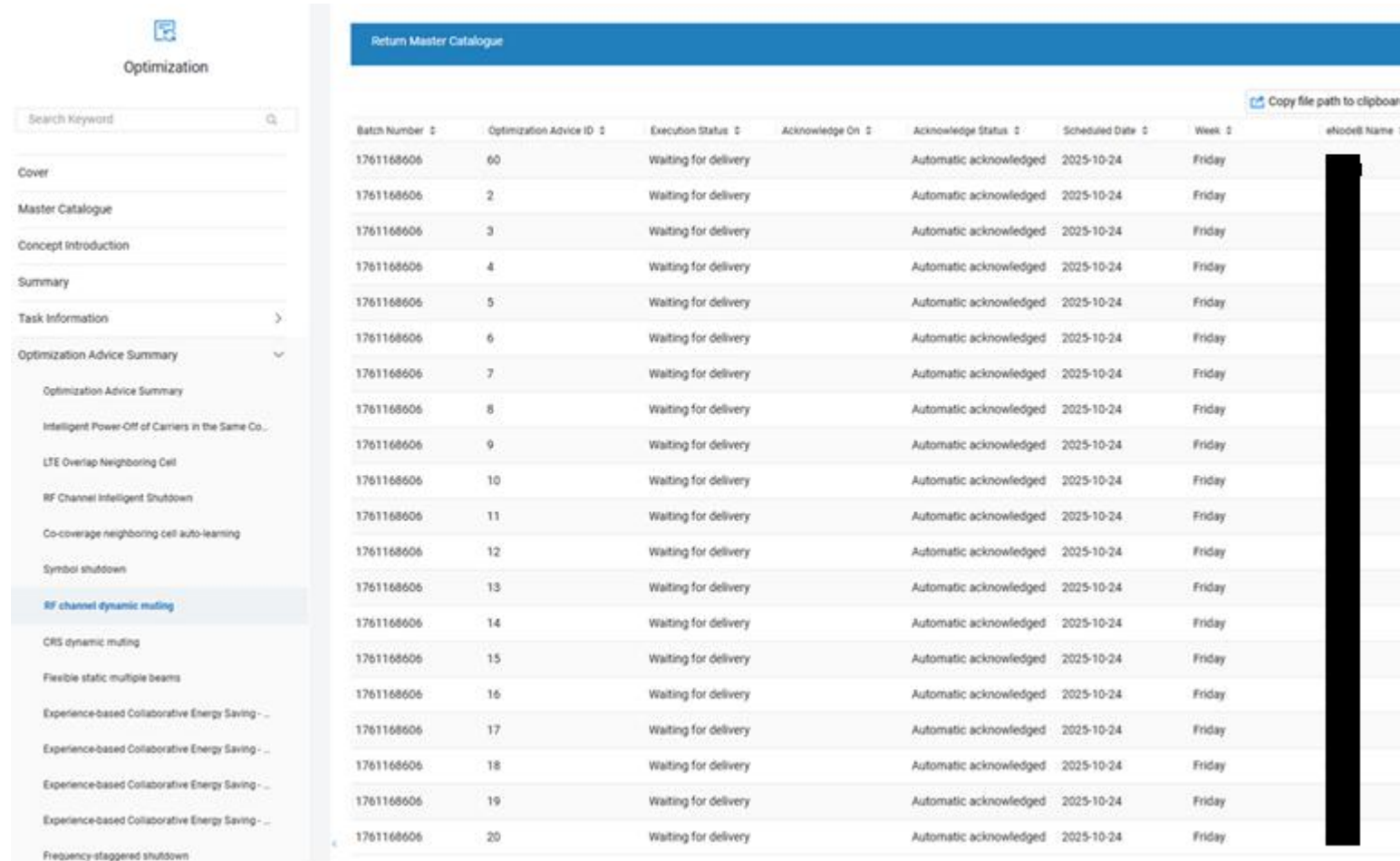
## Question:

How does the System evaluate energy saving solutions and decide on the best solution to be implemented?

## Answer:

Export energy-saving suggestions and execute them after manual confirmation.

## Evidence:



The screenshot displays the 'Return Master Catalogue' interface. On the left is a navigation menu with options like 'Cover', 'Master Catalogue', 'Concept Introduction', 'Summary', 'Task Information', and 'Optimization Advice Summary'. The 'Optimization Advice Summary' is expanded, showing a list of energy-saving solutions such as 'Intelligent Power-Off of Carriers in the Same Co...', 'LTE Overlap Neighboring Cell', 'RF Channel Intelligent Shutdown', 'Co-coverage neighboring cell auto-learning', 'Symbol shutdown', 'RF channel dynamic muting', 'CRS dynamic muting', 'Flexible static multiple beams', and several 'Experience-based Collaborative Energy Saving' items. The main area shows a table of optimization advice items.

Batch Number	Optimization Advice ID	Execution Status	Acknowledge On	Acknowledge Status	Scheduled Date	Week	eNodeB Name
1761168606	60	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	2	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	3	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	4	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	5	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	6	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	7	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	8	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	9	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	10	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	11	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	12	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	13	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	14	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	15	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	16	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	17	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	18	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	19	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	
1761168606	20	Waiting for delivery		Automatic acknowledged	2025-10-24	Friday	

# Cognitive Activity Execution (Solution Implementation)

**Question:**

How does the System implement solution that can resolve identified energy saving issues?

**Answer :**

Automatic execution of energy-saving recommendations.

**Evidence:**

The image illustrates the implementation of energy-saving solutions through a cognitive system. It is divided into three main sections:

- Network Architecture Diagram:** Shows the interaction between an Operator, MAE-Optimization, MAE-Access, RNC/BSC, and various network elements (gNodeB, eNodeB, NBTS).
- Configuration Interface:** A screenshot of the 'LTE Intelligent Network Energy Saving' settings. It shows options for 'Operational Policy', 'Optimization Policy', and 'System Policy'. Under 'Service', it lists parameters like 'LTE mode', 'Start mode', and 'Stop mode'. Under 'Optimization', it shows 'Advise execution mode' with 'Automatic' selected.
- Monitoring Dashboard:** A screenshot of the 'Intelligent Power Control Energy Saving' dashboard. It displays a timeline for 'Optimization Advice' from 2025-10-18 to 2025-10-25, with a 'Total/Success/Fail' ratio of 44/0/0. Below the timeline is a table of execution events.

Execution Status	Acknowledge On	Acknowledge On	Scheduled Date	Week	affected ID	affected Name	Cell ID
Waiting acknowledge...	2025-10-24		Friday				415-03-45
Waiting acknowledge...	2025-10-24		Friday				415-03-45
Waiting acknowledge...	2025-10-24		Friday				415-03-45
Waiting acknowledge...	2025-10-24		Friday				415-03-45

**THANK  
YOU**

**ooredoo<sup>o</sup>**