



Energy Department  
Economic Affairs  
League of Arab States

# **Monitoring and Reporting Progress of Energy Efficiency For LAS Member States**

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## Monitoring and Reporting Progress of NEEAPs of LAS Member States

### Part A: The Basis

1. **Background:** The Arab Guidelines for improving energy efficiency in the generation, transmission, distribution and end use of electricity were approved at the 26<sup>th</sup> meeting of the Executive Bureau of the Arab Ministerial Council for Electricity on 23 November 2010 according to resolution number 195. An important recommendation (**Article III**) of the Guidelines is about:
  - a. Each member State prepares a National Energy Efficiency Action Plan (NEEAP);
  - b. A national **Indicative Target** for energy savings shall be identified and announced;
  - c. Assigning the responsibility for overall control and progress made in implementation of the NEEAP towards the **Indicative Target** to one or more of either existing or new national bodies.
  - d. Monitoring and Verification (M&V) of the energy savings achieved and subsequently submit a report of progress made.
2. According to the Guidelines NEEAP measures were to align with the following Articles and important Clauses provided below in an abbreviated version :
3. **Article IV: Public sector plays an exemplary role and leads by example**
  - a. Member States shall ensure that the public sector fulfils an exemplary role in the context of this Directive. To this end, they shall communicate effectively the exemplary role and actions of the public sector to citizens and/or companies, as appropriate.
  - b. Member states shall ensure the public sector application of measures for improving energy efficiency, with a focus on cost-effective actions that produce the greatest energy savings in the shortest period of time.
  - c. Member states shall facilitate this process through the publication of guidelines on energy efficiency and energy savings as a possible criterion in the evaluation of competitive bidding for public procurement.
4. **Article V: Responsibilities of energy distributors, energy system operators and energy retailers**
  - a. Providing and analyzing statistical information regarding end-user consumption to designated authorities
  - b. Entities shall refrain from any activities that would undermine the demand for EE services or supplying EE services or other services to improve EE
  - c. Member States shall ensure that energy distributors implement one or more of

- i. Provisions of energy audit services or energy saving measures;
  - ii. Provisions and tools to improve their own energy efficiency;
  - iii. Contribution to a fund or financing mechanism in support of EE services
- d. To provide the end-users with adequate information to make appropriate decisions regarding their use of energy;

**5. Article VI: Availability of information**

- a. Member states shall ensure that all information regarding the mechanisms for energy efficiency and information related to the adopted financial and legal frameworks conducive to achieving national targets reach the actors;
- b. The League of Arab States shall ensure the exchange of information on best practices for energy savings and enhancing energy efficiency in the member states on a large scale, as well as to benefit from similar national energy efficiency action programs.

**6. Article VII: Availability of qualification, accreditation and certificates schemes**

- a. Member States ensure the availability of appropriate qualifications and certification schemes
- b. Member States incentivize, or even force an EE service provider market;

**7. Article VIII: Repeal financial barriers to energy efficiency**

- a. Member states need to consider the repeal or amendment of national legislation and regulations that would lead, disproportionately and unnecessarily, to impeding or restricting the use of financial instruments for the purpose of energy savings in the energy services market or other measures to improve energy efficiency

**8. Article IX: Tariff structure of electric power**

- a. Member states need to consider restructuring the electric power tariff in such a way to encourage improving energy efficiency and conservation of energy , taking into account social aspects and protecting poorer section of the society;

**9. Article X: Financial resources and funding mechanism**

- a. A member State shall provide the necessary financial resources, but not necessarily subsidies to support and implement cost effective energy efficiency improvement programs and measures.
- b. A member State shall administer such financial resources in the manner it deems appropriate and cost effective.
- c. Member States may also establish energy efficiency fund(s) to specifically promote the implementation of electricity efficiency improvement programs and other measures.

## **Part B: Conceptual Design Considerations**

Once a NEEPA has been prepared, budgeted and a national body charged to implement, the next step is to monitor and look into progress as well as the quality of the listed actions under the NEEAP on an annual basis. This annual report shall be called “NEEAP Progress Report YYY”. Say as an example: NEEAP-PR-2015

-First of all the quality of the actions must be defined. Judging the quality of NEEAP actions requires to set indicators on “*how to spell success*”- Let this set of indicators be called our **metric**. No matter how we construct this metric, it will be always a biased metric.

- In case an indicative EE target has been announced as suggested under **Article III**, the most obvious indicator that spells success are the quantifiable MW of capacity and MWh of energy (in most cases electricity) that were “saved” and will be saved by a NEEAP measure.

- However the NEEAP is a highly diversified basket of measures. Many of these actions do not automatically lead to quantifiable energy savings. For example regulatory, legal or administrative actions, or capacity building measures, or public relations and media actions to promote energy efficiency within a society. Consequently irrespective of the structure of a national NEEAP it would be best to rearrange and classify all actions listed in the NEEAP.

### **Step -1: Rearrange and classify all actions listed in a NEEAP into four categories**

- i. Actions with a quantifiable MW and MWh “saved” impact called the group of **Q** actions ;
- ii. Actions of a legal, regulatory or administrative nature called the group of **LRA** actions;
- iii. Capacity development (**CD**) actions;
- iv. Public relations (**PR**) actions;

Not all LAS member States prepared the NEEAP using the prescribed common format. However annual NEEAP progress reports will require a common format based on a normed classification of NEEAP actions and **metric** in order to appraise progress and to properly prepare the reports’ content for encoding and further analysis by the LAS Energy Department. The format transformation is straight forward. We pick one by one all actions mentioned in a NEEAP and place it in one of the four mutually **exclusive** Tables of Q, LRA, **CD** and **PR** actions. The Guidelines will provide examples and illustrate how this task can be done easily without wasting too much time or triggering unnecessary discussions to which one of the four categories an action belongs to. This task must be done only once as long as the NEEAP is not changed.

### **Step-2: Designing a metric for Table Q**

We recall that **Table-Q** is the basket of actions with a quantifiable impact in terms of MW and/or MWh saved. In these days it is common to apply the physical units MW and MWh not only to electrical power (MW) and electric energy (MWh) but as well to any other energy source. For instance Table-Q may look like in its most complete form as shown below.

- The classification of the action is based on a possible effect on the electric power demand curve by EPRI symbols of 1972:1. Peak clipping, 2. Conservation, 3. Load Building, 4. Valley filling, 5. Demand Response, 6. Load shifting; this classification system is still the best that had been ever developed up to date by the power industry itself.

The quality of an **EE** measure is covered by the column labelled EES, EC, EM, and EE. Appropriate definitions are shown below.

#	TABLE-Q: Actions with a quantifiable impact	M&Q	EES, EC, EM, EE	MW plan	MWh plan	MW actual	MWh actual	%	1	2	3	4	5	6
1														
2														
3														

- **Energy Efficiency Savings (EES)** refers to actions of energy savings achieved by improving the technical energy efficiency of a technology or a process. Typical examples are national strategies to introduce more energy efficient refrigerators, air conditioners, electric motor, boilers, cooking stoves, fans, blowers, pumps, lights, etc.

- **Energy Conservation (EC)** refers to mandatory (rationing, forced power outages) or voluntary measures that conserve energy, say manufacturing output of a plant has been reduced and therefore also energy consumption. But also any type of “better housekeeping” measures that cost nothing or little but save energy (MWh) or reduce loads (MW).

- **Energy Modesty (EM)** refers to specific type of **EC** measures related to behavioural changes or an optimized energy management. The trade mark of **EM** is that the action does not affect quality of life, productivity or outputs negatively. Typical examples are switching off lights if not needed; or increasing room temperature to reduce AC loads;

- **Energy Efficiency (EE)** represents the sum of **EES, EC** and **EM** actions.

- The term Demand Side Management (**DSM**) is avoided in a NEEAP context because it is a reserved word coined in 1972 by EPRI in the USA and encompassing the DSM action classifications 1-6 of a power industry describing how the action is influencing a utilities power demand curve.

- The EPRI 1-6 classification of the nature of the EE measure is not a big issue since multiple choices are allowed. The latter are very common with most EE measures.

**Step-3: The quality of monitoring and quantification (M&Q) of the MW and MWh “saved “of Table-Q activities**

M&Q concepts and strategies to quantify the impact of an action listed in Table-Q are many. The first highly mathematical approach for EE savings quantification in the power sector had been published in California in 1974. Presently 6 major quantification methodologies are widely applied. The issue is not which one is better or more accurate than the others. The efforts and costs involved to apply a methodology must be weighed against the benefit of publishing a higher accuracy number. The preferred M&V methodologies to estimate and quantify EE savings are:

- i. **No serious estimate is possible, or the estimate is extremely speculative (NONE)**, because the activity itself is not directly associated to quantifiable savings but may eventually lead to savings or is considered a vital support activity associated with the EE framework and marketing of EE . The LRA, CD and PR actions fall under this category
- ii. **Deemed savings (DEEM)** . The methodology is based on an assumption about the expected energy savings in kWh over the technical sustainability in years of the energy efficiency or energy conservation measure. This methodology is popular and widely applied by energy auditors for estimating the EE or EC savings of the EE measures they recommend to a firm. A main feature of deemed savings are the lack of field data collection about the energy performance of the EE measure, except proof that the technology had been installed or sold. Often not even the operational status of the EE technology or measure is checked. **Examples:** Large scale deployments of energy efficient white goods and gadgets.
- iii. **Commissioning test based on national or international standards (COM)**. This most rigid and often costly methodology is only applied for EE measures that involve large energy intensive equipment. **Examples:** Energy efficient combined heat and power plants (CHP).
- iv. **Approved methodologies applied for verification of CER's arising from CDM projects (CDM)**. There are quite a number of M&V protocols that were and are still used for the quantification of the energy savings of CDM measures involving large numbers of highly distributed technologies. The trademark of this approach had been complicated and stringent statistical algorithms to randomly select a base group and the samples for calculating the impact. **Examples:** Energy efficient motors, LED, CFL, refrigerators, air conditioners, SWH.
- v. **International and national M&V standards (MVS)**. Presently the SANS 50010 is the only **Standard** that is applied and recognized as a legally binding M&V protocol. It is used to calculate the savings of large national EE programs that provide incentives based on certified kWh savings. Similar to CDM the methodology is relatively accurate but requires involvement of a trained and certified M&V expert that may be expensive.
- vi. **National and international energy performance standards of energy conversion technology (STA)**. There are literally hundreds of ISO and other standards that provide very precise methodologies and algorithms to test the energy performance of appliances, equipment, machinery, gadgets etc. to arrive at the energy conversion efficiency of the machinery. These standards are widely used to commission larger energy conversion equipment.

The recommendations of the international performance measurement and verification protocol (IPMVP, EVO) are good references and guidelines as well, but in most cases too unspecific and too generally formulated to be used to **calculate** an impact. The same applies for the ISO 50001 general recommendations.

The national entity and consultants charged to prepare a **NEEAP-PR-YYYY** must make a decision which one of the above methodologies has been applied to estimate the EE savings or comes closest to the applied algorithm. If none was applied "NONE" should be entered in the M&Q column. It is the authors' experience that the estimation of the impact of Q-listed EE activities is usually poor to very poor and in most cases would not even satisfy a proper **deemed** savings calculation methodology. Substantially more efforts and training support should be provided to improve on the quality of impact

quantification of EE measures. The poor image of EE to qualify as a genuine tradable source of energy similarly to oil, gas, coal and renewable energy sources is mainly caused by a lack of attention to properly quantify EE.

**Step-4: Appraising progress of LRA actions of Table-LRA**

- **Table-LRA** is a listing of all activities proposed under a NEEAP that relate to improving the legal framework for EE actions. The **legal framework** encompasses Legislative, Regulatory and Administrative actions (LRA) in support of the NEEAP. As an example, publishing an Energy Policy that also refers to EE is an Administrative action that does not carry legally binding legislative or regulatory provisions. Setting a national benchmark for say 10% less energy primary energy consumption in the year 2025 as compared to consumption in 2015 is also an administrative act that may not be binding in anyway but will certainly have to trigger EE actions to converge towards the national ambition.

- LRA actions usually develop over time. Progress can be measured by five distinctively different milestones such as a) first **draft**; b) **decided**; c) **consulted**, d) **published**, e) promulgated or **gazetted**. The latter two milestones d) and e) are always verifiable, the source of information is known and e) also implies that the LRA action has become part of the legal framework of the country. Whether this new part of the legal framework is enforced or enforceable is an altogether different issue and not part of listed actions under NEEAP. A typical example are “Energy Efficiency Buildings Codes” which are usually difficult to enforce if implementation is not incentivized. Keep only the State-of-Play code that applies to the LRA action and delete the other 4 in the State-of-Play column. Below a sample Table of LRA actions called the Legal Framework.

#	TABLE-LRA: Legal framework	State-of-Play					Concerned Entity In Charge
1	National Energy Policy: Y/N ? EE Section included: Y/N ?	DR	DE	CO	PU	GA	
2	Energy Efficiency Act/Directive/Law/Order/Regulation/Decree: Y/N ?	DR	DE	CO	PU	GA	
3	National Energy Efficiency Action Plan (NEEAP): Y/N ? ;	DR	DE	CO	PU	GA	
4	Energy Efficiency to be declared as a source of energy: Y/N ?;	DR	DE	CO	PU	GA	
5	National Energy Balance exists: Y/N ?; Includes EE: Y/N ?;	DR	DE	CO	PU	GA	
6	<b>EM</b> training: Mandated: Y/N ?; Available; Y/N; Exam/Certification: Y/N;	DR	DE	CO	PU	GA	
7	<b>EA</b> training: Mandated: Y/N ?; Available; Y/N; Exam/Certification: Y/N;	DR	DE	CO	PU	GA	
8	Designated consumer groups mandated to implement EE: Y/N	DR	DE	CO	PU	GA	
7	Public budget available for EE measures: Y/N (Million TZS _____ )	DR	DE	CO	PU	GA	
8	Fiscal and/or financial incentives available for investors in EE : Y/N ?	DR	DE	CO	PU	GA	
9	Tariff offered for kWh (saved) of energy: Y/N ?	DR	DE	CO	PU	GA	
10	Negawatt Power Plant tendering ( <u>RfP</u> ) : Y/N?	DR	DE	CO	PU	GA	

**Step-5: Capacity Development (CD) Action**

- Classify the participants of a CD action either belonging to a legal (**L**), regulatory (**R**), administrative (**A**), private sector (**PS**), or other (**OT**) entity. If possible avoid multiple choice classification. Tick off the most appropriate group providing the most number of participants.
- CD actions may also state in the main body text the number of participants attending a CD event or the number of CD events to show progress. However it is assumed that any CD action asking a fee and despite the fee attracting participants for an offered training, seminar or workshop, satisfies a **genuine and targeted** demand for the offered curricula, no matter whether the participant pays the fee out of his own pocket or is sponsored. Tick off the **FEE** box if this is the case. Furthermore any CD actions involving exams, and/or leading to a nationally or internationally recognized certification, diploma or any other degree of higher learning should tick off the **CER** box.
- Any CD action should be related to a concerned entity. The concerned entity may be a Government institution, or private sector institution, or NGO, or institute of higher learning that is managing, or coordinating, or has a natural mandate, or just feels responsible for the CD action under the NEEAP. In many instances more than one entity is involved or claims credit for CD events. State only the one that really “owns” the CD event.
- Any additional information about the CD action should be stated in the text body. The CD action may be a periodically recurring event, and/or fully institutionalized. It may be a mandatory, regulated or voluntary CD for some professionals and service providers of the public and private sector.
- CD actions should not be confused with public relation events. The latter will be accounted for under **Table-PR**.

#	TABLE-CD: Capacity Development (CD) Action	L	R	A	PS	OT	FEE	CER	Concerned Entity In Charge
1	Energy Manager Training (2014: 2,500 Person days)				X		X	X	Chamber of Commerce
2	ISO 50001 Certification Campaign (2014: 3 Firms)				X		X	X	Industry Association
3	EE Building Code Training for District Officers (2014: 300 PD)			X				X	Ministry of Local Affairs

**Step-6: Public Relation Actions Table-PR**

- PR actions should be distinguished from the CD actions of Table-CD. However they may trace back their existence to some LRA actions. A typical example would be the annual “Energy Efficiency Award” event organized and sponsored by a concerned Ministry, or the annual energy efficiency day such as the 21 May of LAS member States.
- Any PR action should be classified by the media the action it is using for communication such as Radio (**RA**), Television (**TV**), Printed matter (**PM**), recurring Public Event (**PE**). Multiple choices are allowed.



- Public relations events, whether recurring or just a onetime affair, require a budget. Provide under **BU** an estimate in local currency of the total budget needed for the PR action to be completed and state in the body text the term for the PR action and whether it is recurring over many years, or just a short lived affair;
- The concerned entity in charge is the one providing the budget for PR measures. In case there is no specific budget available or various sources finance the PR action, provide the name of the entity in charge of the PR action.
- Actions listed under **Table-PR** could be quite diverse as shown by the following examples:
  - “Energy Star” like public portal may be listed as public relations action, or if established by an administrative act in connection with a rebate system, as a LRA action;
  - Government sponsored EE related newspaper advertisements;
  - Painting contests related to EE among schools;
  - Talk shows and regular newspaper editorials about EE;
  - Transparent and easy accessible power utility webpages running a DSM investment rebate strategies for customers;
  - Annual energy efficiency day with a variety of events addressing a wide spectrum of energy consumers ;
  - Annual energy efficiency award for industry and conference sponsored by the Ministry of Energy;
  - Videos, flyers, brochures, and posters targeting different consumer groups

#	TABLE-PR: Public Relation (PR) Actions	RA	TV	PM	PE	BU	Concerned Entity In Charge
1							
2							
3							

**Step-6: Indirect non-energy net benefits**

Selected EE measures may be associated with additional savings of materials and/or monetary benefits that may be accounted for. In some cases the monetary net benefits exceed the net benefits of the EE action. Examples:

- A classical example are fuel savings measures in reheating furnaces by closely monitoring of the combustion chamber temperature, resulting in less scaling of the hot metal billet. The value of the saved metal exceeds by far the energy cost savings.
- Another very common example are **fuel switching activities** in all processes that still use electricity as fuel source and where electricity is replaced by a gaseous or liquid fuel. Such fuel switching activities are only done to reduce energy costs and may increase the energy consumption of the firm, or the society. By oversight they may enter a national statistic as an **energy saving** measure, instead of an **energy cost saving** measure that even increases energy consumption for the same level of output.

- A third very wide spread service, wrongly marketed and sold as EES measures are the power factor improvements of a firm. They either do not, or only very marginally reduce the electricity consumption of a firm. However the measure reduces the monthly kVA demand charge or metered kVARh charges depending on the billing and metering system introduced by the power supplier.

**Table-M** provides for listing such indirect monetary benefits. However to minimize speculative accounting of indirect benefits, this monetary benefit must be related to an action listed in **Table-Q**. In addition the methodology to quantify such indirect **net** benefits should be provided in an Annex. Table-M should not be misused as a basket of indirect benefits based on internalizing as benefit of the action any avoided external costs in a **cost effectiveness** analysis of an EE action. The most prominent example are non-realized CER earnings from tCO<sub>2</sub> saved.

#	TABLE-M: Indirect Net Benefits	Value	Product	Unit	Volume	Link
	Benefit Description					
1						
2						

**Step-7: The macroeconomic dimension**

The search for a convenient indicator that could measure to what extent a prolonged NEEAP strategy has had an impact at the macroeconomic level or triggering a market transformation, has been going on for 40 years since the first oil crisis 1972. The present consensus may be summarized by three observations:

- The level of EE services and EE technology introduced as the value of EE technology related investments and value of EE services is of course an excellent indicator for any successful **market transformation**. However a successful EE market transformation is a pretty poor indicator that a society follows a sustainable energy policy. The most glaring example is the per capita electricity consumption of the USA that is about twice as high as the EU average. This despite the fact that the USA has followed excellent EE policy objectives and program strategies since 1972 that have better promoted the value and self-sustaining presence of EE technologies and services as compared to the EU States. Rephrased in a more direct why that a successful market transformation is a poor stand alone indicator to spell success: *“A country can be the most energy efficient country in the world where people operate only highly efficient technologies and still consume per capita much more energy as compared to inefficient societies if **energy modesty** is missing”*.
- Two interdependent indicators that are readily available and better macro-economic indicators to what extent a NEEAP strategy has an impact are the Energy Intensity (EI) and the  $\Delta E/\Delta GDP$  Ratio, i.e the percentage rate of energy consumption over percentage rate GDP growth.
- Using the EI as an indicator has the following benefits as well as rises a few issues that were discussed in LAS workshops in Jordan and Lebanon in 2011 and 2012 on request of Jordan.

- The EI indicator is readily published. It must not be cumbersome researched through data collection and analysis by national EE programs
  - EI is calculated by dividing an energy unit (the primary energy consumption of a country) by a currency (the GDP of a country).
  - No convention exist which energy unit and which currency time series (constant value, base year, chain linked GDP) shall be used. Cited EI of countries are only comparable within the same data bank;
  - The EI indicator cannot be properly correlated with energy efficiency;
  - A decreasing EI does not imply that the energy consumers of a country apply more energy efficient technologies. Vice versa an increasing EI does not imply that energy consumers of a country are wasting more energy.
  - EI measures to what extent economic growth (GDP) has been **decoupled** from growth of energy consumption;
  - An PPA adjusted EI is window dressing and as an example makes Nepal the most energy efficient country in the world despite the fact that Nepal uses mostly energy inefficient technologies and appliances.
- The  $\Delta E/\Delta GDP$  ratio is an excellent readily available indicator to measure the level of decoupling of economic growth from growth in energy consumption. For instance 8% growth in energy consumption compared to 4% growth in GDP of some States tells us the whole story. It implies there is an urgent need for an effective NEEAP strategy and/or a need to replace energy intensive economic activities by less energy intensive economic activities. The latter task is of course an order of magnitude more complicated and more risky compared to managing a cost effective NEEAP.

The recommendation is to use at least the two interdependent indicators Energy Intensity (EI) and  $\Delta E/\Delta GDP$  as macroeconomic indicators. Both reflect on the degree a society has decoupled its economic growth from growth in energy consumption. A successful NEEAP strategy will contribute to lower both indicators. However other wanted and unwanted economic trends are also having the same effect. Adding any other useful macroeconomic indicators is subject of discussion.

#	TABLE-ID : Macro Economic Indicators	Year	Value	Reference
1	Energy Intensity: EI			
2	Ratio of Energy and GDP growth rates : $\Delta E/\Delta GDP$			
3	.....			

**Step-8: Encoding and Analysis of Data of LAS member States**

Data Collection efforts and resources needed to prepare the annual NEEAP-PR-YYYY reports are mostly wasted without a concept and a tool to analyse and compare the data provided by the annual reports. The above recommended report structure and reporting concept is already designed in such a way that it naturally leads to encoding and programmatic analysis of the data under a VBA programmed Excel Spreadsheet. Efforts to set up the Excel spreadsheet are modest compared to setting up the data authentication procedures that could catch logical, conceptual, numerical and physical data input errors.



**Annex-1: Illustration of EPRI six load curve shaping options applied for Table-Q actions**

