Paper Title: Continuous Value Improving Processes - Building a Learning Organization

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BIOGRAPHY

Stephen J. Kirk, PhD, FAIA, FSAVE, CVS-Life, LEED® AP is Partner and Chief Executive Officer of Kirk Value Planners, which specializes in VE services. He has over 35 years of experience in applying value based design decision-making techniques. Dr. Kirk is a registered architect, a Fellow of the AIA, a CVS Life, and is a LEED AP. Steve is a Senior Fulbright Scholar in architecture and received his doctorate degree at the University of Michigan. He is the author/co-author of nine books related to VE & LCC. Dr. Kirk received the prestigious Gold Award which recognizes the Michigan "Engineer of the Year." Steve served as President of SAVE and currently serves as SAVE's VP of Education and Director and VP of Education for the Miles Value Foundation. Dr. Kirk is a Fellow of SAVE International and is the Dean of the College of Fellows.

Stephen Garrett, CVS is Partner and Chief Operating Officer of Kirk Value Planners, which specializes in VE services. Steve has over 25 years of professional experience including extensive skills in value based decision making, project criteria development, costing, strategic planning, and program management for large, complex projects for national and international clients. Steve received his Bachelor of Architecture degree from Lawrence Technological University. He is a guest instructor for Lawrence Technological University and the University of Michigan. He is a Certified Value Specialist (CVS), has been a member of SAVE International for over 10 years, teaches certified SAVE International courses and currently serves on the SAVE Certification Board. He is also past President of the Greater Michigan Chapter.

Abstract:

A "learning organization" is one that continues to challenge itself to improve its organizational processes, procedures, and its design standards. The Saudi Electric Company (SEC) Distribution Business has selected value improving processes such as "Value Management" (VM) to challenge itself to continuously add value to everything it does for its customers, its shareholders, and its employees. A VM program and organization has been established within SEC to apply value improving processes on a continuous basis. A recent VM Study of Meter Assemblies and Billing will be presented as an example of how value improving processes identified significant improvements to SEC.

Background:

A “learning organization” is one that continues to challenge itself to improve its organizational processes, procedures, and its design standards. The Saudi Electric Company (SEC) Distribution Business has selected value improving processes such as “Value Management” (VM) to challenge itself to continuously add value to everything it does for its customers, its shareholders, and its employees. A VM program and organization has been established within SEC to apply value improving processes on a continuous basis.

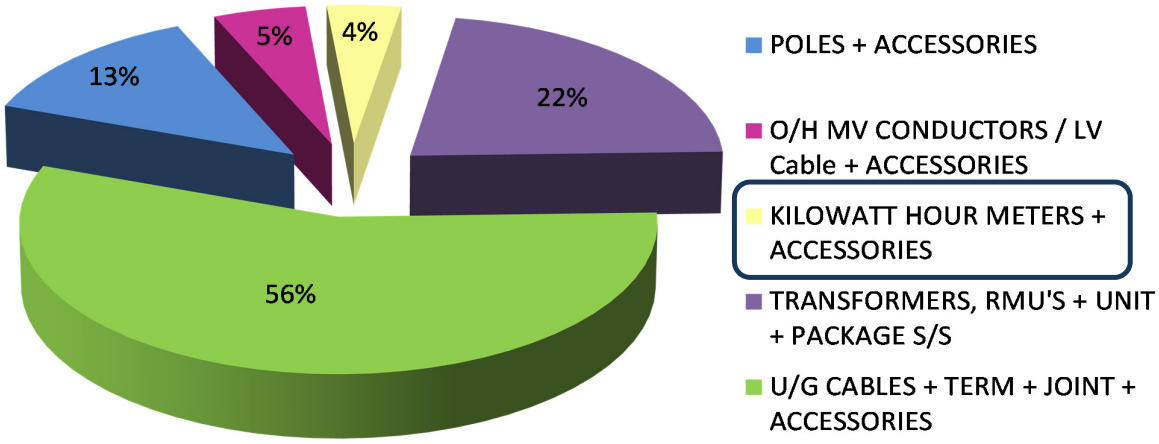
A recent VM Study of Meter Assemblies and Billing was conducted in 2013 and is presented as an example of how value improving processes identified significant improvements to SEC. The study focused on:

- Review of the most common meter assemblies for low voltage and medium voltage distribution.
- The customer billing process.
- Recommendations for value improvements. This included:
    1. meter type and implementation,
    2. customer satisfaction, billing, staff qualifications,
    3. operations & maintenance, installation, staff qualifications, and
    4. electricity losses.

Project Description:

The following chart reflects the summary cost of the distribution material issued to SEC for the year 2012. The focus of the workshop represented 4% of the overall 2012 costs.

Graphic 1: Summary of 2012 SEC Costs by Assembly



Information made available by the 2011 ECRA Report helped the VE Team understand the mix of current SEC customers and their respective use of the total electricity produced by SEC.

Review of the most common meter assemblies for low voltage and medium voltage distribution:

The meter assembly included components associated with the measuring of electrical use by the Saudi Electricity Company customers. The baseline assembly for meters included the following items along with the agreed upon unit of measure for the components:

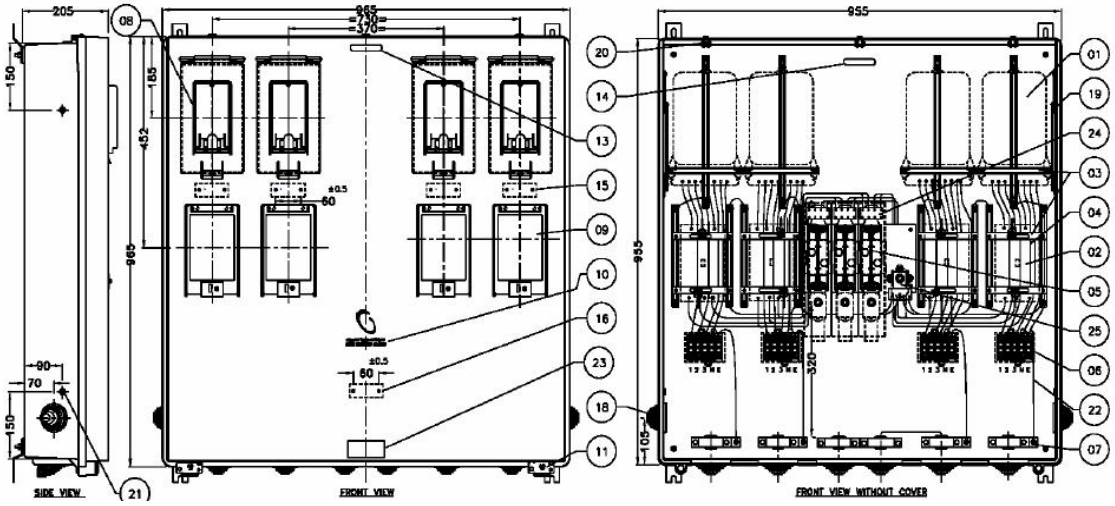
- Kilowatt Meter (all customers)	Quantity 1; (part of the billing system)
- Meter Box (all customers)	Quantity 1;
- Current Transformer (only bulk users)	Quantity 1; (part of the billing system)
- Breaker	Quantity 1.

The most common customer for the meter assembly is the residential, which represents approximately 79% of all SEC customers using 49% of the total electricity sold per year in the Kingdom of Saudi Arabia. The total amount of metered customers is approximately 6.2 million. All of these customers have mechanical meters, with the exception of approximately 8,000 meters which are electronic meters. All of the electronic meters are not connected to a wireless network that communications its data back to the SEC, except for a trial area in the diplomatic area in Riyadh.

The current meter practice for customers is as follows:

- Residential customers, government, and agriculture:
    - New and replaced meters are mechanical.
- All medium voltage users, commercial bulk users, industrial, government, or areas that uses time of use tariffs:
    - Have Electronic Meter or they will have one in the future.

Graphic 2: Multiple Meter Example



The customer billing process:

During the pre-workshop activities, this area was mentioned as a Key Performance Indicator identified by the 2011 ECRA Report and SEC staff. Further discussions with key SEC staff during the pre-workshop activities identified the following items for the VE Team to consider during the workshop:

- Mistake in multiplication factor applied to usage
- Mistakes in reading meter
- Theft of electricity (unsecure meter)
- Loss of revenue associated with billing problems
- Customer service areas associated with the billing processes at SEC.

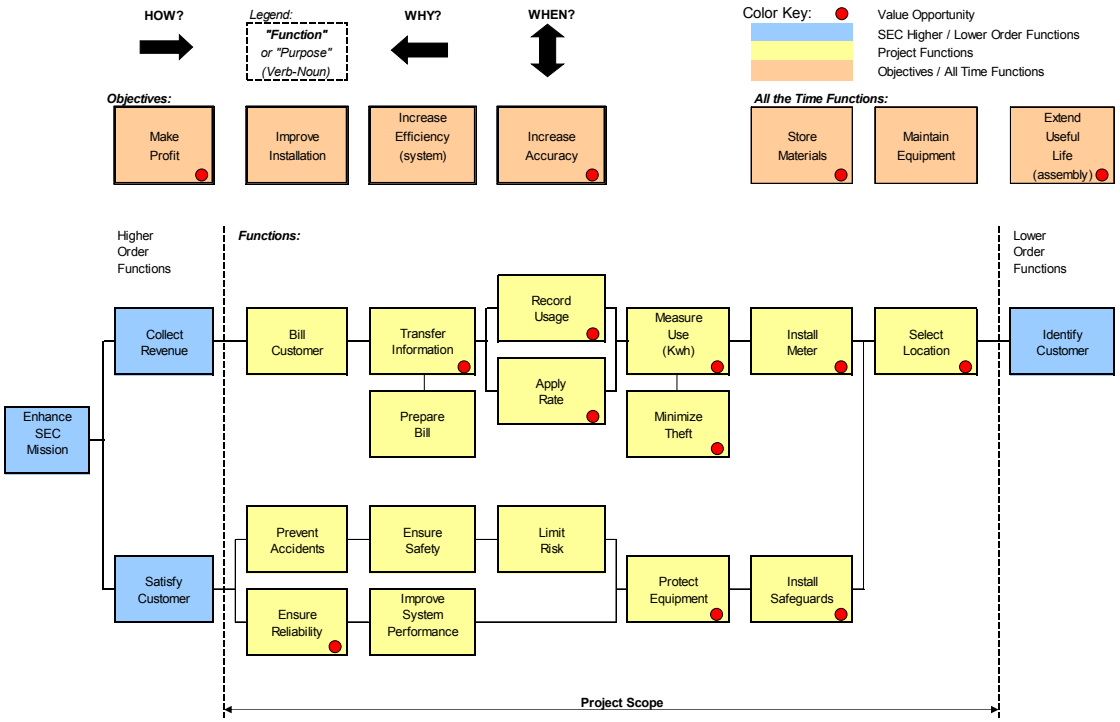
These and other issues would help guide the VE Team in focusing its efforts to improve customer service and billing issues within SEC Distribution.

Value Models:

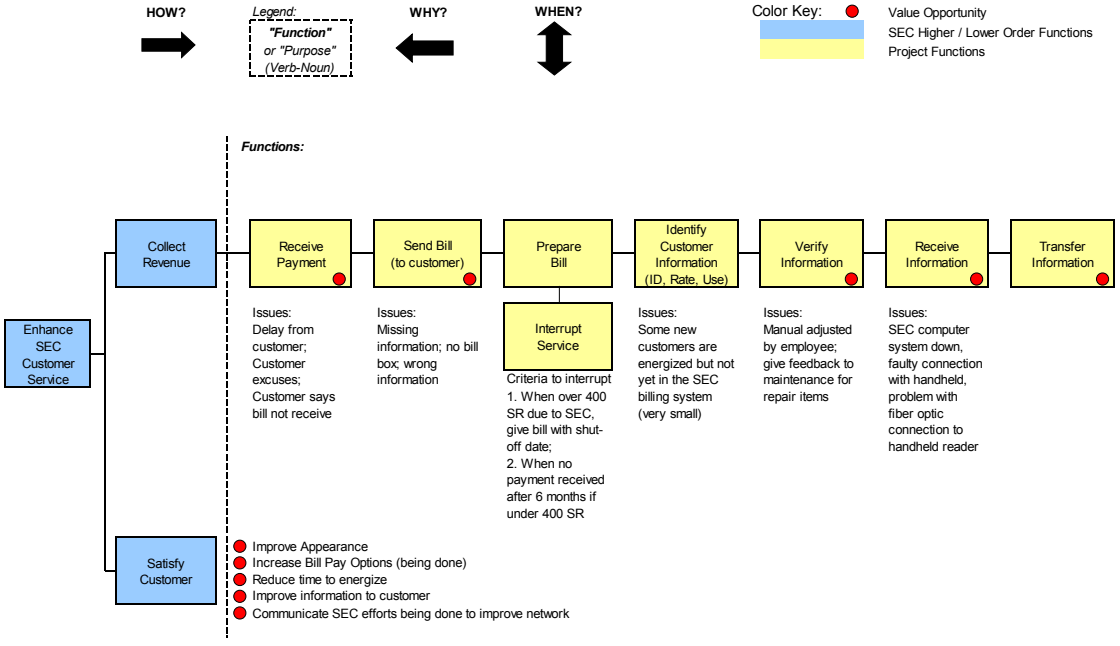
Value Techniques used in this study included Function Analysis Systems Technique (FAST) Diagramming, Cost Modeling, Performance Modeling, Force Field Analysis, Brainstorming, and Life Cycle Costing (LCC).

Function analysis is core to any value study. For this project, the value study team prepared two Function Analysis Systems Technique (FAST) diagrams to help understand the overall purposes of the Meter Assemblies and the Billing functions. The first FAST diagram describes the primary functions of the Meter Assembly that will “Bill Customer, Prevent Accidents, and Ensure Reliability” to “Satisfy Customers” in Saudi Arabia. The second FAST diagram is a customer oriented diagram that describes the primary functions of the Bill Pay System that will “Collect Revenue” and “Satisfy Customer.”

Graphic 3: Meter Assembly Technical FAST Diagram

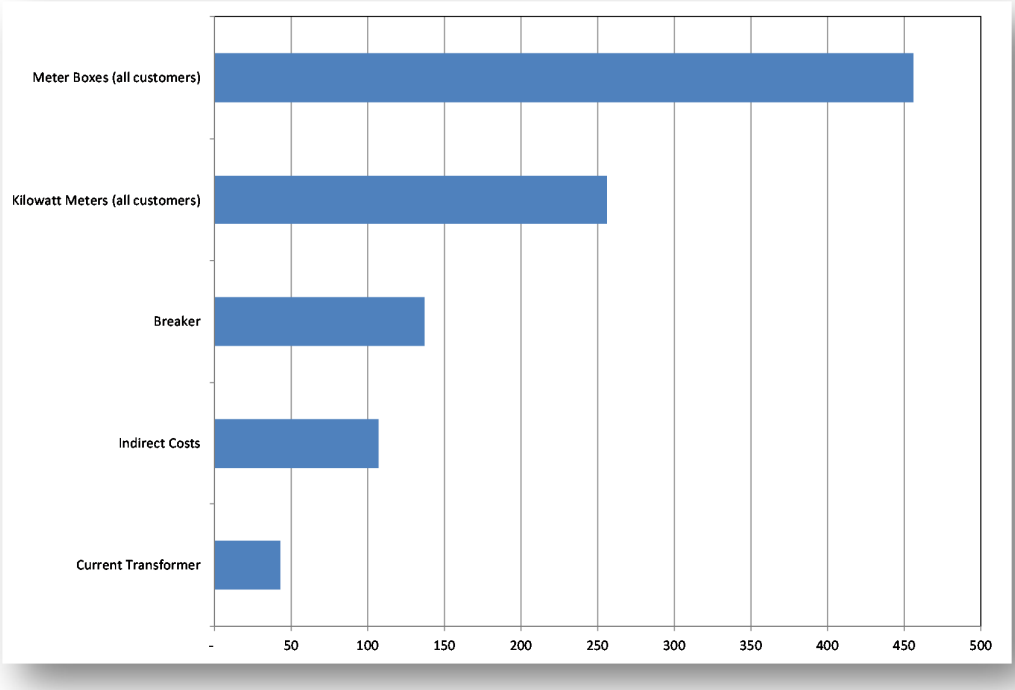


Graphic 4: Bill Pay System Customer FAST Diagram



To understand the cost of construction for the project, a Cost Model was prepared during the workshop and distributed to the VE Team. The VM team prepared a distribution cost model for the meter assembly, based on 2012 cost information from SEC. The following chart is a breakdown of the most common assemblies included in the meter assembly. The team focused on the high cost indicated for transformers and overhead cabinets.

Graphic 5: Cost Model Pareto Diagram



A performance model was prepared by the VE team to identify opportunities for project improvement. Following are categories captured in the performance model:

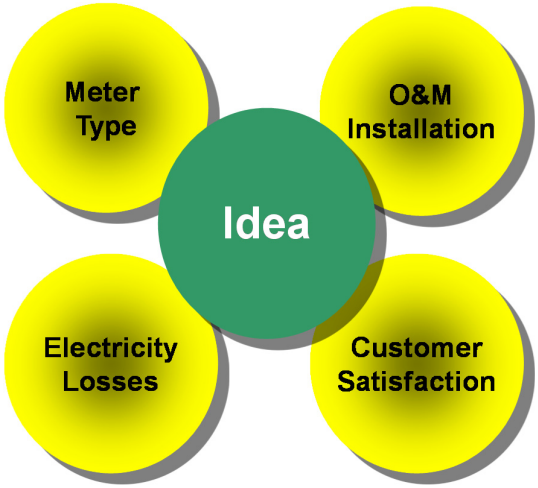
- Safety (life, property)
- Functional – Materials (durability, source, reliability, dynamic)
- Sensible – Equipment (aesthetics, assembly environment, community values, measurable)
- Practical - Operations (personnel, interface, schedule, constructability, operational effectiveness, energy)

The VM Team developed a Force Field Analysis that listed the current engineering design “best features” and “weak features” as identified by the project team. The best features were to be preserved while the weak features became areas the VE team would seek to improve. The VE team then brainstormed ideas to address the weak features of the current assembly.

The VE team generated over 280 creative ideas during the "brainstorming" portion of the workshop. The first effort involved splitting the VE team into cross functional groups made up of many subject matter experts. The next step was to evaluate the ideas in order to focus on those representing the best opportunity for value improvement. During this effort the VE team was re-arranged to represent specific groups of subject matter experts. An example of these groups is captured in the following images.

Graphic 6:
Image for Cross Functional Groups

Graphic 7:
Image for Specific Subject Matter Experts



The following facility economic data was used to generate the life cycle costs in the VM recommendations. This data was established by SEC.

Life Cycle (Analysis Period):	25 years
Discount Rate (Time Value of Money):	5.0 %
Escalation Rate: Electricity:	0.0 %
Escalation Rate: Maintenance:	0.0 %

Recommendations:

These Value Models led the VM Team to a series of specific recommendations. The highlights of the recommendations are as follows:

Recommendations for meter type and implementation:

The VM Team recommended the use of electronic meters with Automated Meter Reading (AMR) in Commercial, Government and Industrial Users. This will address key performance criteria, such as safety, durability, and reliability, but will also provide additional information key to the improvement of the SEC network. It was also recommended that the SEC expedite the implementation of these meters to better manage their network and help improve their customer satisfaction. This would require an investment from SEC but the benefits to the operations of SEC would be substantial.

Graphic 8: Example of Potential Electronic Meter with ARM Component

Recommendations for customer satisfaction, billing, staff qualifications:

Key recommendations made by the VM Team included adding the use of electronic invoicing and payment options to cancel the need for paper invoices for a key portion of their customer base. This went far beyond a simple transition and would require time and training for the SEC staff. When completed this would also improve / update customer information. Another recommendation was to provide training and increase salaries for meter reader staff. This would lead to increase report of violations and manipulations of the SEC network and would improve the networks reliability for its typical customers. This represented significant savings to SEC.

Recommendations for operations & maintenance, installation, staff qualifications:

The overall design within the meter itself were recommended that made significant improvements, of which included a 30% reduction on the possibility of fire. Specific wiring recommendations were also included that would help correct equipment damage from poor installation. This represented some savings to SEC.

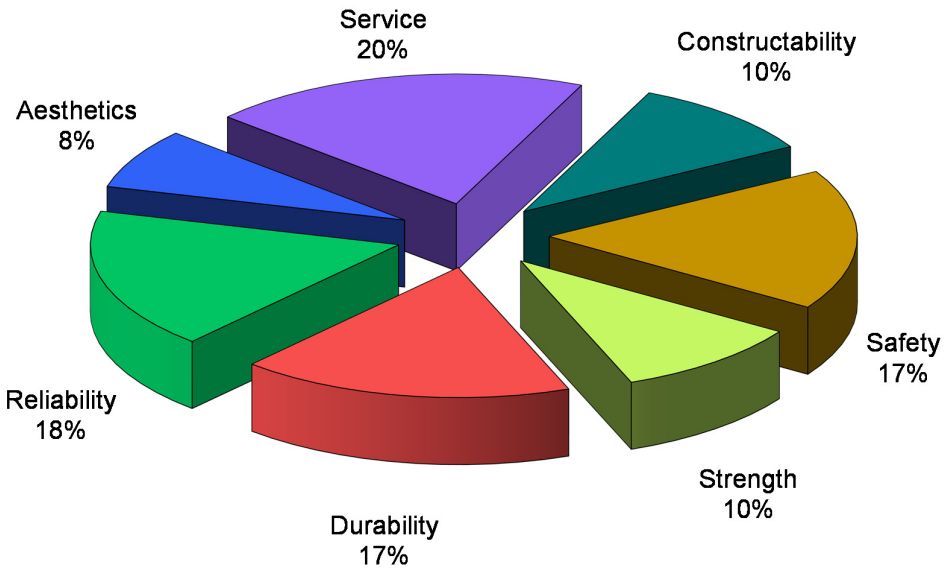
Recommendations for electricity losses:

Changes were recommended in the circuit breaker that would make it easy for SEC staff to discover tampering. Another recommendation included replacing the current meter assembly with a redesigned meter assembly when any tampering was discovered to reduce the problem in the future. A final recommendation included creating larger fines for tampering with electricity when discovered by SEC staff. This represented very substantial savings to SEC.

Conclusion:

Leveraging the Value Methodology led our team in providing both substantial cost and performance improvements for SEC. Based on the VE proposals developed in the workshop, the team identified a potential initial cost savings of 33.6 million Saudi Riyals (SR). The potential life cycle cost savings are 4,114.1 million SR. Although it is recognized that the owner will benefit from reduced initial and life costs, this is not the only interest in conducting Value Management workshops. The following chart identifies the percentage of ideas that improved each owner identified performance category as well:

Graphic 9: Summary of Performance Improvements



Future for SEC:

Beginning in 2014, the VM program will expand into use of additional value improving processes to become a learning organization. This will include techniques such as Value Stream Mapping, Lean Production, Fishbone Diagramming, Six Sigma, LEED, Choosing By Advantages (CBA), and Post Occupancy Evaluation (POE).

Value Stream Mapping shows the sequence and movement of information, materials, and actions to help identify where value is produced and where waste occurs. Lean Production is the identification and reduction of 7 types of waste associated with overproduction, waiting, transport, extra processing, inventory, motion, and defects. Fishbone Diagramming allows a team to identify, explore, and graphically display all the root causes of a problem or condition. Six Sigma is a statistical concept that represents the amount of variation present in a process relative to customer requirements (defects per million opportunities). LEED (Leadership in Energy and Environmental Design) is a score sheet approach which encourages organization environmental sustainability. Choosing By Advantages is a decisionmaking methodology for selecting the best alternative among choices considering both life cycle costing and non-monetary considerations. And finally, Post Occupancy Evaluation is an approach that assesses the success of a project after its completion. It creates a learning organization by continuing to assess past performance and making adjustments to maximize value.

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