

White Paper

I. Company Overview

Xelpower Co., Ltd was established in KOREA in 1992, specializing in monitoring, controlling, and protecting electric power system.

Real-time information and communication technology (ICT) based “**ADR (Automated Demand Response) system**” completed in 2001 is one of the most advanced solutions in the world for real-scale electric power energy management. The system delivered to Korea Electric Power Corporation (KEPCO) has been used for on-line monitoring and controlling electrical loads of high voltage and medium voltage customers, and it handles up to 1,357MW across the nation until the end of 2012. This product, “**VPP(Virtual Power Plant) with Direct Load Control(DLC) / Reliable Demand Response Solution(RDRS)**”, is considered one of the most proven load management systems based on the nationwide scale. Xelpower owns several original patents (IPR) and is the leading market shareholder in Korea.

II. Solution

Black out, brown out, load shedding and other load management activities are frequently occurring in the developing countries because power supply cannot timely match the increasing demand for electricity. More specifically, it is impossible to construct power plants (or transmission line & distribution line) in timely manner to keep up with the explosively increasing electricity demand due to the lead-time of power plant constructions, lack of enormous capital, environmental regulations, etc. In terms of fuel mix for generation, relatively expensive fuels such as oil or gas should be avoided from use during peak time in order to improve generation efficiency & OPEX cost in power company. Moreover, a lot of nuclear power plants in the developed countries are scheduled to be shut down after Fukushima disaster in Japan. However it shall be not so easy to find out any concrete alternative solution to secure power system reliability and be economically operated simultaneously.

In this regard, our ICT-based load management system is the optimal solution for securing power system security, minimizing the generation costs through the selective control of loads within a customer, and maximizing the transformer and generator asset values.

A key factor essential for the nationwide peak power management is the two-way automatic control technology, which ensures real time connection of demand and supply and the optimal reduction of customer loads. Power management solution of Xelpower Co., Ltd can control peak power of customers connected with the Load Dispatch Center of the power company and monitor terminal load conditions of customers directly, not only in emergency situations for power system

security but also in normal operating conditions for minimizing the tariffs. Such secured nationwide loads are aggregated in a real-time basis, which is operable any time in the country in order to reduce and manage the national energy resources efficiently.

Xelpower Co., Ltd has greatly contributed in increasing power system reliability and reducing CO² emissions in Korea through IT-based reliable demand response solution (i.e., Direct Load Control system) preferentially to Korea Electric Power Corporation (KEPCO) and Korea Energy Management Corporation (KEMCO) since 2001. Xelpower had installed for approximately 816 high voltage and medium voltage customers within the country as of 2009. KEPCO could control peak power of up to 1,357MW in 2010 in a real-time & ADR basis that had reduced infrastructure investment for power plant construction.

The demand control center in the load dispatch center of the power company can directly monitor and manage the loads of customers through Energy Management Devices within customers in a real time basis. The demand control center automatically controls the loads of the customers according to the scenario or optimization rules from the DLC/RDRS center in case of unbalance between demand and supply. The system can cooperate with the AGC (Automatic Governor Control) in EMS (Energy Management System) of the national load dispatch center of power system operator.

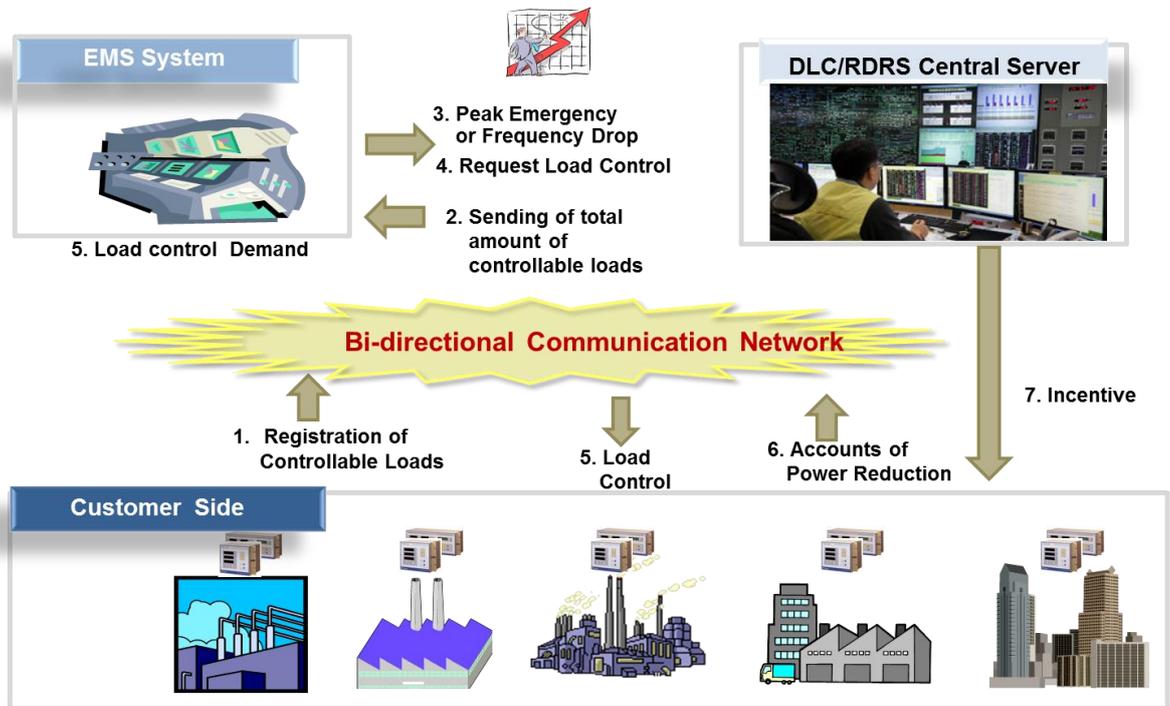
Xelpower Co., Ltd has been the market share leader in this area and has been building the know-how since 2001 by supplying, installing and operating this power load control system.

Year	Peak KW at KEPCO sites	Peak KW at KEMCO sites	Total sites
2001	290,869 KW at 21 sites	-	21 sites
2002	418,552 KW at 45 sites	290,000 KW at 228 sites	273 sites
2003	261,820 KW at 79 sites	370,000 KW at 49 sites	128 sites
2004	207,580 KW at 60 sites	268,064 KW at 122 sites	182 sites
2005	146,221 KW at 56 sites	218,792 KW at 83 sites	139 sites
2006	36,900 KW at 9 sites	15,326 KW at 38 sites	47 sites
2007	7,000 KW at 4 sites	-	4 sites
2008	1,400 KW at 2 sites	-	2 sites
2009	39,790 KW at 20 sites	-	20 sites
Accumulated Total	1,410,132KW at 296 sites	1,162,182KW at 520 sites	2,572 MW 816 sites

- Status of peak power demand management of Korea Power Corporation (KEPCO) and Korea Energy Management System (KEMCO)

On-line ADR Solution of Xelpower., Co. Ltd is composed of Central Server System

installed in the power system operators or power companies and EMD (Energy Management Device) and RCU (Remote Control Unit) installed in the customer side field.



■ Total System Configuration

➤ Central Server System

It supports various IT-based on-line communication networks (Internet, telephone and mobile communication network) and allows for management of major loads of customers in real time by connecting 'nation-wide EMS' to remote EMD installed within customers through exclusive purpose database.

Major Specifications

- ✓ Direct load control through interconnection of EMS
- ✓ Management of historical demand of customers
- ✓ Location information of customers
- ✓ Function of data analysis for each area load significance
- ✓ Function of data analysis for customer load patterns
- ✓ Optimal algorithm for customer control
- ✓ Remote setting of EMDs



■ Center Server Screen

➤ **Customer System**

The EMD device installed in the distribution panel of the customer monitors and automatically controls the loads of the customer by itself, or it enables remote control by DLC/RDRS central server in the center. In addition, the RCU devices make it possible to connect/disconnect and manage remote loads in the customer based on wire or wireless communication network and take charge of supporting the function of Measurement and Verification of power where power system protection function and power quality analysis functions can be added.

Major Specifications

- ✓ Accuracy of 0.5 class measurement
- ✓ Measurement of 3-phase voltage/current, power factor, frequency, and power (measurement and analysis of 15 times frequency harmonic wave)
- ✓ Automatic control function of power load (ADR: Automatic DR)
- ✓ Predictive Management of demand prior to peak times
- ✓ Execution of direct load control function by being connected with remote server through various communication networks
- ✓ Execution of power quality analysis function and power protection function



■ EMD (Energy Management Device)



■ RCU (Remote Control Unit)

III. Economic Comparison

One of major purposes of DLC/RDRS system is to solve your country's power unbalance or mismatch issues, and this system is capable of reducing up to 10% - 20% of your total peak demand power across the nation/region in real time and ADR base. Another purpose of DLC/RDRS is to implement "Incentive based DR" by automatic control of customer loads on normal time for DR operator or power company. It results in saving OPEX of power company in the nation.

The EPC (Engineering, Procurement, and Construction) price of Xelpower DLC/RDRS is proposed to very cost effective according to target country as whole package including engineering, feasibility study, equipment, installation, and operation training.

If you were to choose the conventional existing method such as more construction of thermal power plant by coal, its price reaches USD 2 bil., including desulfurization, denitration & ash treatment system. It would be three to six times more expensive than DLC/RDRS. In comparison with the construction of nuclear power plant, its price would be 20 times expensive. Moreover it takes 3 to 10 years until commercial operation as for construction of power plant. However, based on your situation, DLC/RDRS can take less than 1 year before commercial operation from your purchase order.

IV. Future

Recently, the role of Economical and Reliable Demand Response programs in Smart Grid has become very important to diminish CO² emissions from electricity sector, to decrease the market price of electricity, to reduce the customer bill, and to increase the power system security. The conventional load management system is evolving into the economical demand response scheme by combining ICT technologies, smart meter technologies, and other smart grid technologies. It is expected that the demand response will play a crucial role for the implementation of smart grid. Conventional demand control is introduced and operated for the purpose of securing the power system security by managing the peak demand. However, the future demand management system should be developed to conserve energy by managing the resource during the normal times. In addition, the economic demand response technology will be combined with home automation system, building automation system (BAS), advanced metering infrastructure (AMI), and various pricing options to maximize electricity energy usage optimization.

Xelpower's energy management solution can be easily expanded to the next green energy solution including innovative solutions such as effective and efficient demand response functions, integrating with the AMI system, home and building automation system, and the smart grid system.

V. Conclusion

DLC/RDRS system is a suitable solution for developed countries as well as for developing countries and follows Recent International Trends for Green Energy/CO² reduction and Smart Grid. The system is a win-win strategy that provides nationwide or region-wide benefits. As for electric power utilities, it provides '**Cost Savings in investment of generation, transmission and distribution grid**' and '**Optimal generating fuel mix in peak time & off peak time**'. And, as for customer, it provides '**Cost Savings with avoiding unexpected power interruptions**' on emergency operation and 'Optimal power usages by re-scheduling & demand control of load' on normal operation.

This is a 'Cutting-Edge IT-based Virtual Power Plant(VPP) based on Green and Smart Grid Technology and 'Economic, Reliable, Realistic Solution'. Its implementation period would be Min 1 year in comparison of supply-side solutions up to 3 - 10 years. Moreover total price is just 1/6 - 1/20 of supply-side solutions. It is also a proven technology & product by Xelpower, which has lots of expertise, experiences, reference sites in KOREA for more than past 10 years. In order to fulfil this project in your country, a financing will be available by our partners if needed. We can support you as a consortium with financing.

"Xelpower is Extensive Expert in Demand Response Virtual Power Plant solution combined with ICT infra."

Further contact :

Mr. MS Kwak,

Vice President on Oversea Sales & Marketing

Tel. +82-10-6340-6013

Email: mskwak@xelpower.com

Dr. Gi-Won Lee,

CEO & President

Tel. +82-11-9927-3632

Email: gwlee1@xelpower.com

Web: www.xelpower.com