DATA BASE FOR ARAB POWER SYSTEMS

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ABSTRACT

Main advantages of data base use in general and to power system in specific are listed. The paper describes in brief the arab countries power system status. The necessity for information collection, processing and analysis is obvious for any serious attempts for interconnections and developments on an overall national bases. Details of a data base system is described in the paper which is suitable as a basis for such information system. Most of the relevant items for such system are included in the design. The data base was created on an HP-3000 computing system and is ready for feeding of data and output report design upon request.

1. INTRODUCTION

With the rapid expansion of power systems, it becomes necessary to deal with tremendous amount of data during planning, operation, maintenance and development of power systems. Hence the use of computing systems for dealing with such amount of data is becoming inevitable. Both off line and on line methods find large applications in power systems now a days. Complete automatic control of some power stations, load flow management, protection of power systems and other systems are in wide use.

Some big stations are computer controlled in some arab countries and in some other cases computerised dispatch centers are existing either for data acquisition or on line operation.

Exchange of power between neighbouring arab countries is done only across few boarders points.

Industrial development center of the arab league showed some interest in the past in the collection and surveys of arab power systems and energy resources. However updating of such information seems to be more difficult.

This paper gives some background on data base applications in power systems and proposed a data base system for arab power systems information.

2. WHY DATA BASE?

The primary benefit derived from the use of data base management system is time savings. These savings are typically manifested in the following areas (1):

2.1. File consolidation: Most information processing systems that serve more than one application area contain duplicate data. e.g. a substation load centre name may appear in a transmission file, a load file, and may be other files. Although the data stored in these files may vary slightly from file to file, the result actually is wasted file space as well as inconsistent program output, Redundant and inconsistent information severely dilutes any system's capacity to deal with large amount of data. File consolidation in data base eliminates most data redundancy. Through the use of pointers, logically related items of information are chained together, even if they are physically seperated. In the above example the name of substation load centre will be stored only once. Since there is only one record to retrieve and modify, the work required for data maintenance is greately reduced. Finally all reports drawn from data item of information are consistent.

2.2 Program file independence: conventional file structures tend to be rigid and inflexible. The nature of conventional file management systems require that logical application program be intricately interwoven with file design, when it becomes necessary to alter the structure of a file, a program must be written to change the file, and program that acceas the file must be changed to reflect the file change. Since change is the rule rather than the exception in data processing, a large percentage of total time and manpower is spent in reprogramming.

Data base allows the data structure to be independent of the application program. Data item relationships are independently defined. Changes in the data base structure need only be incorported into those programs that manipulate the changed data. User programs need view only that por-tion of the data base description that pertains to each program's processing requirements.

2.3. Versatility: conventional file organization techniques allow limited access to the data they contain. Most structures allow single key access with additional relational access available only through the implementation of extensive application level programing support. Data base allows data to be accessed with multiple keys as well as through a variety of other access methods.

2.4. Rapid retrieval: conventional file organization frequently requires the use of multiple file extracts, sorts and report programs to produce meaningful output data across file boundaries. One time information requests frequently require weeks to implement, during which time the usefulness of the requested data may have eroded considerably. Most data base systems have an enquiry facility or user written inquiry programs which uses the data base procedures, allow instant interrogation of the data base by individuals with access to the system.

2.5. Data security: Extremely limited security provisions are contained in conventional file

Management system. Access to computer readable date may be denied to individuals with system access only by providing physical protection for the media upon which the file is stored e.g. specified disc or magnetic tape. Date base system usually provides security at the amount, file group and data elementlevel. The implemention of security at the item level allows sensitive date to be stored on line under the control of the data base manager or designer, with minimal regard for additional security provision. Even programmer or operator may be prevented from the reach of extremly sensitive information.

3. DATE BASE IN POWER SYSTEMS

The amount of data needed for proper design, development, operation and maintenance of power systems is becoming increasingly large. Computers entered in this fieled since its early dates. Dependance on computer stored information increased rapidly. Management of such big amount of information is receiving a continuous attention from power system specialists.

Data base started to be used in such information systems. Such an integrated information system for power system planning studies has been reported(2). Data base in such system was used for preparation of power system planning models, reducing man ual data handling. A user interface was used for information retrieval in order to avoid modifications to the perscribed models. Although useful methods for detailed information storage and retrieval were achieved still a lot has to be done to use it actively in actual power system planning applications.

For the use of data base in power system simulation a system was developed(3) for implementation at the electricity supply in south africa. The system used a special coding method for components and voltages and integrated software system for power system operation. Control and planning was reported recently (4) . Such system renders a uniform communication between operator, system engineer supervisory control, security monitoring and short/medium planning softwares. However, more emphasis has been put on the operational advatages rather than long term planning. On the other hand data base for customer information has to be linked with distribution facilities for proper design and development of such system. A linkage between such systems has received some attention (5).

From the above background it is noticed that the field is still at the beginning of its development and is stimulating alot of interest.

4. ARAB POWER SYSTEMS

Electricity consumption per capita in the arab world shows a very wide range of variation. It varies from lese than 100 KWH (e.g. in north Yemen) to several thousands KWH (e. g. Kuwait and Bahrain). The overall average for 1980 was 600 KWH/capita.

Egypt shows the highest production of electricity with more than 16000 GWH for 1970 out of about 80000 for all the arab world at the same year. The average rate of increase of electrical energy consumption is about 14% now compared to about 6% for the whole world. This high increase rate would lead to a total energy consumption at the year 2000 ranging between 350000 and 500000 GWH with an installed capacity between 110000 to 160000 MW compared to around 30000 MW at 1980.
Most of electricity is generated at thermal power plants. Hydroelectric generation constitutes less than 20% of the overall generation. Sudan, Syria, Egypt and Lebanon have a good portion of its generation hydro while Tunisia, Algeria, Iraq and Morrocco have some hydro. The rest arab countries are non-hydro.

Tranamission voltages in various arab countries range from 110, 132, 220, 300, 400 to 500 KV. High voltage distribution voltages also vary alot, e.g. 3.3, 5.5, 6.6, 11, 15, 33, 66, and 90 KV. Interconnection between neighbouring arab countries do exist e.g. between syria and Jordan and Syria and Lebanon. Many other interconnections are possible. In brief arab power system is developing quite rapidly and it is quite useful to exchange, collect & analyse the information about it. Further details about arab power system may be found in reference 7 & 6 .

5. DATA BASE FOR ARAB POWER SYSTEM

The information aught to be collected and stored consist of general information about the individual countries, various generation, transmission and load centres. The data base designed for this purpose consists of four master sets and six detailed sets. Two of the master sets are automatic while the other two are mannual. The basis difference between master and detail sets is that the uniquely defined information should be contained in master sets. Those sets are described briefely below:

5.1. Country manual master set
This set contains contries names (english and arabic), and any remark about individual contries. Any item which gives detailed information about various contries may be added to this set. Such information should be of fixed type (although it may be replaced by a new value after deleting the old value).
The key to the entry to this set is country-code key item. This item may be a two figure number and is the search item for the consumption detailed set, the load-curve detailed set and the country information detailed set.

5.2. years automatic set:
This set contains the years for which the information to be stored and they are automaticelly generated upon information entry in the related detailed sets. This set is linked to the country information detailed set and to the consumption detailed set.

5.3 Dates automatic set:
This is another automatic set for dates (two digits for years, two for months, and two for days). It is linked to the transmission, Generation and load curve detailed sets.

5.4. center manual master set:
The key item to this the center-code. This code should implicitly contain a country code, and a type code (generation, load, transmission or their combinations). This center-code is the linking item to the transmission, generation and busbars detailed sets.

This master set contains all necessary information about the individual centers e.g. centre-name, country-code, longitude of the center, lattitude of the centre and any other information or remarks which uniquely define the individual centers.

5.5 country information detailed set:
This set contains any information about individual countries for specified year, such as population, GNP etc. The set is related to the country and years master sets via country-code and year respectively.

5.6. consumption detailed set:
This set contains all the information about consumption in a special country for a specific year such as peak-mw, mwh, exported-mwh, imported-mwh, peak load-date etc. This set is related to the country,years, and dates master sets.

5.7. generation detailed set:
This set contains all the information about generation centers such as generators-mw, generators-type errection-date, voltage, frequency or any other information about power stations or remarks, Any number of generators entries may be found in a single center. This set is linked to the center, and dates master sets via center-code and er-date.

5.8 transmission detailed set:
This set contains information about transmission lines characteristics such as transmission-type, transmission-mva, centers to be connected (node 1 and node 2), errection-date, voltage, length and may be lines parameters or any other detailed information. The set is linked to the center and dates master sets via node-1, node-2 and er-date items.

5.9. busbars detailed set:
This set contains all information about different busbars (such as voltage) in various centers in order to allow for any number of basbar for definite center. This set is related to the center master set via center-code item.

5.10. load-curve detailed set:
This set contains all information about load curves for various contries. Upto 24 points (or any other specified number) may be contained percurve. Information about date of occurance and any other remarks may also be contained. The set is linked to the country and dates master sets via country-code and date items.

5.11 example:
The data base for arab power system described above has been programmed on HP-3000 computer system .
This system has an efficient and simple data base facilities (IMAGE) and an enquiry system (QUERY). The information in listed form which may be obtained from the system are tremendous. They may be validated, processed, classified or reported in the required forms according to the specific application. The appendix shows the basic data base sets, items and their relations for this example.

6. CONCLUSIONS

Data b ase system is avery effecient mean for power system information processing. Power system information and data about various arab countries are needed for long term planning and future interconnections. A data base has been designed for management of such information. The system is simple, however, it contains most of the necessary information usually in use by power system specialists. There is still some room for improvement of the configuration design but the major task should be the collection of the scattered information and their updating in the future. The arab league center of industrial development or any other research center in one of the arab countries is called for taking the responsibility of data collection establishment of mechanism for data updating for the benefit of all the arab world.

7. REFERENCES

1. Hewlet packard system 3000, image/query data base man ual.
2. Peon A., cristerna R., al." An integrated information system for power planning studies - siiper" IEEE transaction on PAS, Vol. PAS-98 No. 2 march/april 1979 pp 426-435.
3. Ben yaacov G.Z "database environment for power system simulation models" IEEE transaction nn PAS, vol. PAS-100 No. 5, May 198 pp 2643-2649.
4. Fruhaf K., grafoner P. and singer K. "An integrated software system for power system operation control and planning "IEEE transaction on PAS, Vol. PAS-101, No. 1 Jan 982 PP 219 - 225.
5. Inglis D.J. Hawkins D.L. and whelan S.D., "Linking distribution facilities and customer information system data base" IEEE transaction on PAS, Vol. PAS-101. No. 2 Feb 82 PP 371-375 .
6. Khatib H. "status of power system in the arab world-current problems and standarization" winter seminar of arab school for technology, kuwait, jan 1982 .
7. Mohammed M.Z. interconnection of arab system winter seminar arab school for technology, kuwait jan 1981.

APPENDIX

Data base: Arabps Sun,Oct 24, 1982 12:56PM

Set name:
Country, manual
Items:

Country-code	JI	Key item
Country-name	X20	
Remarks,	X50	

Capacity: 23 Entries: 22

Set name:
years, automatic
Items:

Year	JI	Key item

Capacity: 20 Entries 9

Set name:
Centers, manual
Items:

Center-code.	JI	Key item
Center-name.	X50	
Country-code.	JI	
Longitude,	JI	
Lattitude.	JI	
Remarks.	X50	

Capacity: 50 Enteries : 5

Set name:
Dates, automatic
Items:

Date.	J2	Key item

Capacity: 20 Entries: 5

Set name:
Consumption,detail
Items:

Country-code.	JI	Search item
Year.	JI	Search item
MWH,	JI	
Exp-MWH	JI	
IMP-MWH	JI	
PEAK-MW	JI	
PEAK-DATE	J2	Search item

Capacity: 100 Entries 9

Set name:
Generation,Detail
Items:

Center-code	JI	Search item
GEN-MW	JI	
GEN-TYPE	JI	
ER-DATE	J2	Search item
Voltage	JI	
Frequency	JI	
Remarks	X50	

Capacity: 24 Entries: 13

Set Name:
Busbars, detail
Items:

Center-code	JI	Search item
Voltage	JI	

Capacity: 10 Entries: 0

Set name:
Load-Curve, detail
Items:

Country-code.	JI	Search item
Date	J2	Search item
MW	JI	
Remarks	X50	

Capacity: 10 Entries: 0

Set Name:
Country-inf,details
Items:

Country-code	JI	Search item
Year	JI	Search item
POP	JI	
GNP	JI	

Capacity: 36 Entries: 0

Set Name:
Transmission, detail
Items:

Trans-type	JI	
Trans-MVA	JI	
Node1	JI	Search item
Node2	JI	Search item
ER-date	J2	Search item
Voltage	JI	
Length	JI	

Capacity: 36 Entries: 0

Path identifying information

Master set name	Associate Detail set name
Country	Consumption
	Load-curve
	Country-Inf
Years	Consumption
	Country-Inf
Centers	Generation
	Busbars
	Transmission
	Transmission
Dates	Con umption
	Generation
	Load-curve
	Transmission

Search item name	Sort item name
Country-code	
Country-code	
Country-code	
Year	
Year	
Center-code	
Center-code	
NODE1	
NODE2	
Peak-date	
ER-Dtae	
Date	
ER-Date	

Detail set name	Search item name
Consumprion	!Country -code
	Year
	Peak-Date
Generation	! Center-code
	ER-Date
Busbars	! Center-Code
Load-curve	! Country-code
	Date
Country-Inf	! Country-Code
	Year
Transmission	! NODE1
	NODE2
	ER-Date

Sort item Name	Associated Master set name
	Country
	Years
	Dates
	Centers
	Dates
	Centers
	Country
	Dates
	Country
	Years
	Centers
	Centers
	Dates