ROCKY MOUNTAIN REGION

Western Area Power Administration

Capital Investment Program Plan

2004-2013

FY2004.2

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1 INTRODUCTION

Western Area Power Administration (Western) is committed to maintaining and operating a reliable transmission system. The capital investment program plays an important role in Western's ability to provide cost effective, reliable power delivery to our customers.

The purpose of the Capital Investment Program Plan (Plan) is to present Western Rocky Mountain Region's capital investment plan, to provide a mechanism for customer collaboration, and to clearly describe challenges, goals, strategies, and measurements for the Plan.

The Plan contains general information on the creation and maintenance of the capital investment program, the current ten year plan, and goals, challenges, strategies and success indicators for the capital program.

The Plan will be revised annually in response to changes in funding levels, unforeseen problems with the transmission system, mandates or regulations, and new contractual obligations. When changes to the Plan are made to accommodate higher priority projects, existing projects are reduced in scope, delayed, or deleted. Each year this Plan will remain similar in format, with changes to individual projects and the overall plan identified.

The Plan is divided into the following six major program areas:

- Transmission Line Improvements and Replacements
- Substation Improvements and Replacements
- Communication System Improvements and Replacements
- Control, Protection, and Metering Improvements and Replacements
- Mobile Equipment Replacements
- Programmatic Improvements and Replacements

2 PROGRAM OVERVIEW

The majority of the expenditures identified in this initial Plan are related to rebuilding wood pole transmission lines and replacing the obsolete analog communications system with new digital equipment. The data has been broken out by project.

2.1 Colorado River Storage Project Facilities (CRSP)

The CRSP substation and transmission line facilities are relatively new, and most of the transmission lines were constructed using lattice steel towers. Although these facilities are in relatively good condition, heavy system loading is impacting the system. Future plans will identify these problem areas. One that has recently emerged is the 230/138-kV transformation at Flaming Gorge. The Plan identifies the potential need to replace the two transformers with larger units, but other options and operational solutions are being evaluated.

One major expenditure over the next decade will be to replace the old analog microwave system with new digital technology. A large part of this work has already been completed on the backbone system in partnership with other utilities. The remaining work consists primarily of installing digital spur communications links from the backbone system to the individual system facilities. The other items identified in the plan are routine maintenance activities such as replacing broken, obsolete, and worn-out substation equipment, supplies to repair and replace damage to transmission lines, and equipment for the crews to accomplish maintenance of the system. One new set of facilities that has been identified are those associated with the Animas-La Plata Project. The funding source and repayment obligation for the Animas-La Plata Project are presently uncertain, but the project is under construction and has been included as an element in the plan.

2.2 Loveland Area Projects Facilities (LAP)

The Loveland Area Projects facilities are generally older, and most of the transmission lines were constructed using a wood pole H-frame configuration. As a result of the age and condition of the system, there are three major replacement projects planned for the LAP system. These projects all involve rebuilding lines (potentially to higher voltage to increase load serving and transfer capabilities) and the associated terminal facilities. Figure 1 is a map that identifies a number of projects including the major projects described below.

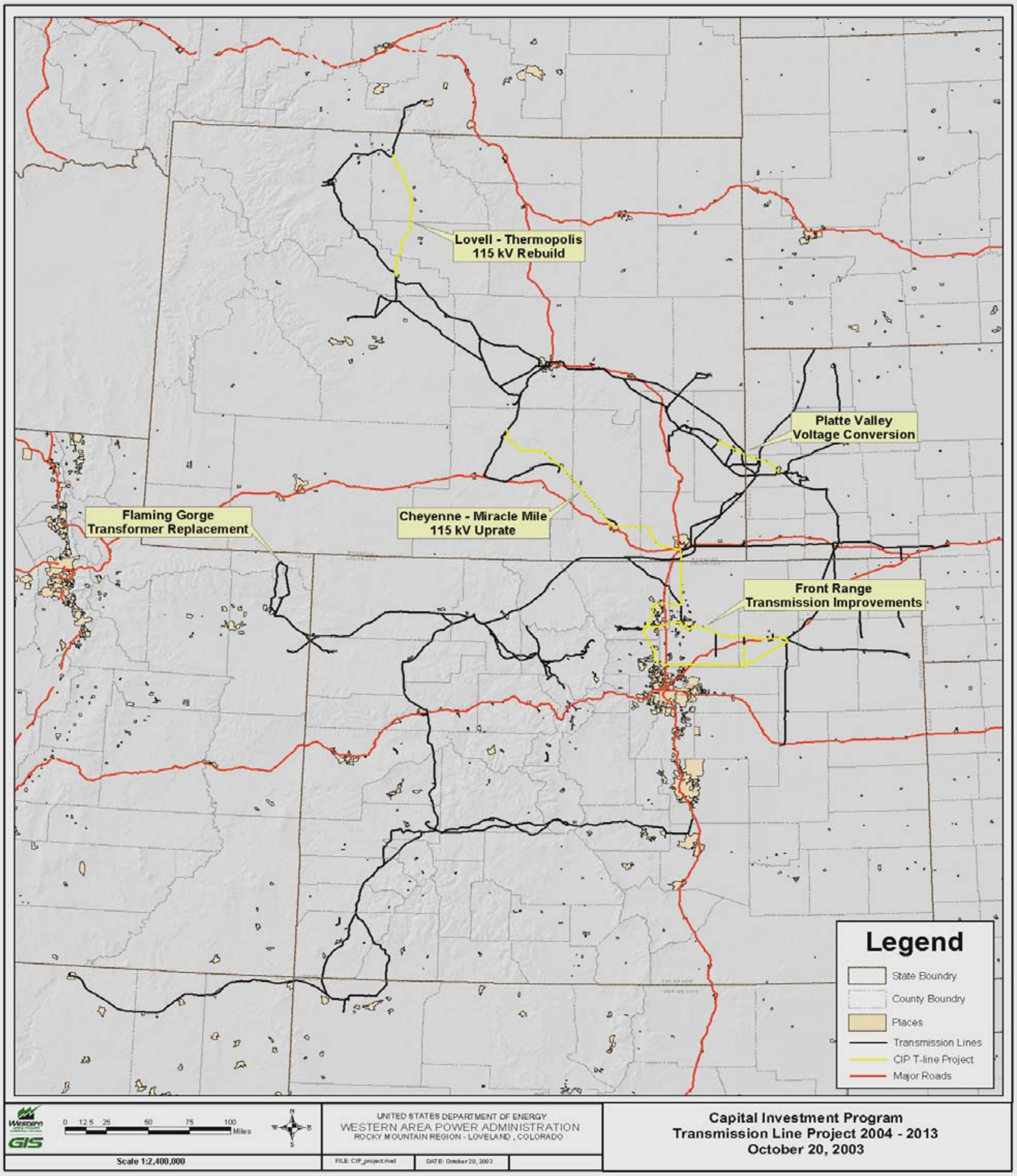
- ***Miracle Mile - Ault****:* The Cheyenne-Miracle Mile and Ault-Cheyenne 115-kV lines were constructed in the 1930's, utilize a hollow copper conductor, and at almost 65 years old, require replacement. Western proposes to replace these lines with a new 230-kV line from Miracle Mile to Ault, a 115/230-kV sectionalizing substation in the Laramie area, and a 30-MVAR capacitor bank at Cheyenne. Between Cheyenne and Ault, the existing 115-kV line will be replaced with a new 230-kV/115-kV double circuit line. These system improvements will increase the reliability in the Laramie area, increase the transfer capability across TOT3 by up to 75 MW, and increase the associated wheeling revenue from the system.

- ***Front-range T-Line Improvements:*** A second area of concern is the 115-kV loop from Beaver Creek to Weld, from there to Flatiron, through Longmont, and then back to Beaver Creek. New generation additions in the front-range area have resulted in overloading on sections of this line in the Beaver Creek area. In FY2003, Western reconductored a 0.8 mile portion of the line to avoid a reduction in TOT3 capacity. In FY2004, Western will reconductor another 9 miles of the line, again to prevent a reduction in TOT3 capacity. In addition to the overloading, significant growth is occurring in this area, and once developed, it will be extremely difficult to improve the lines. These line sections vary in age from 50-60 years old and will require increased maintenance and potentially significant replacement over the next 10-15 years. Several of the line sections have already been identified by Maintenance as candidates for rebuilding. Western proposes to rebuild the lines in a double circuit 230-kV configuration and operate one side at 115-kV, the other at 230-kV, and transition the 115-kV circuit over time to a 230-kV operation. This will provide for load growth while allowing existing load serving facilities that utilize 115-kV transformation to continue operation.
- ***Platte Valley Voltage Conversion***: The line in this area was rebuilt from 34.5-kV construction to 69-kV construction in the early 1990s. Construction of Whiterock Substation and installation of shunt capacitor banks at Lyman and McGrew provides increased support and reduces the impacts of the conversion, but starting in the 2007 timeframe additional work will be required to convert the substations between Lingle and Gering to 69-kV operation to address voltage problems on the system.

Another area that is being studied is an upgrade of the 115-kV system between Thermopolis, Lovell, and Yellowtail to have at least one contiguous 230-kV path between Yellowtail and Spence. This system enhancement will improve the transfer capability on TOT4B by between 100 and 150 MW. The Thermopolis – Lovell line was constructed in 1956, and the Lovell – Yellowtail No. 1 line was built in 1953.

The remaining items in the Plan include communications system conversion from old analog equipment to digital, rebuilding the Lovell - Thermopolis 115-kV line with Maintenance forces over an extended timeframe (if not rebuilt as outlined above) and normal replacements and additions of equipment. These projects include substation additions and improvements; wood pole testing, treatment and replacement; and other programmatic replacements such as SCADA and IT.

Figure 1



Lovell - Thermopolis
115 kV Rebuild
Platte Valley
Voltage Conversion
Flaming Gorge
Transformer Replacement
Cheyenne - Miracle Mile
115 kV Uprate
Front Range
Transmission Improvements
Legend
State Boundry
County Boundry
Places
Transmission Lines
CIP T-line Project
Major Roads
Western
GIS
0 12.5 25 50 75 100 Miles
Scale 1:2,400,000
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
ROCKY MOUNTAIN REGION - LOVELAND, COLORADO
Capital Investment Program
Transmission Line Project 2004 - 2013
October 20, 2003

3 PROGRAM SUMMARY BUDGET

The following spreadsheet summarizes Western's capital program budget estimates by major program area.

Revised: 3/18/2004

Rocky Mountain Region Capital Projects Ten Year Plan

Total Costs (x1000)

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013
Pick Sloan										
T-Line Improvements and Replacements	2,136	8,140	18,490	17,630	17,855	17,780	15,400	19,950	16,830	17,180
Substation Improvements and Replacements	8,587	16,230	2,338	4,595	4,882	4,775	9,280	5,690	7,015	6,440
Communication System Improvements and Replacements	3,014	1,547	832	720	750	600	100	100	100	100
Substation Control, Protection, and Metering	1,375	1,260	1,135	1,095	990	790	740	740	740	740
Mobile and Heavy Equipment Replacements	600	600	1,430	600	600	600	600	600	600	600
Buildings and Programmatic Investments	2,120	1,371	1,772	1,278	1,164	1,029	1,144	1,029	1,400	1,031
Total	17,832	29,148	25,997	25,918	26,241	25,574	27,264	28,109	26,685	26,091
CRSP										
T-Line Improvements and Replacements	1,900	3,650	600	90	90	490	1,570	1,250	170	90
Substation Improvements and Replacements	1,067	1,207	3,283	937	1,301	1,316	874	780	380	440
Communication System Improvements and Replacements	1,476	1,320	2,395	1,300	100	100	100	100	100	100
Substation Control, Protection, and Metering	1,220	1,135	885	845	740	740	740	740	740	740
Mobile and Heavy Equipment Replacements	365	1,200	315	425	400	400	400	400	400	400
Buildings and Programmatic Investments	2,000	1,267	1,061	975	860	725	841	726	1,097	727
Total	8,028	9,779	8,539	4,572	3,491	3,771	4,525	3,996	2,887	2,497

Western-only Costs (x1000)

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013
Pick Sloan										
T-Line Improvements and Replacements	2,136	8,140	18,490	17,630	17,855	17,780	15,400	19,950	16,830	17,180
Substation Improvements and Replacements	5,787	12,060	2,206	4,482	4,867	4,775	9,175	3,790	6,715	6,440
Communication System Improvements and Replacements	2,070	1,442	832	660	675	600	100	100	100	100
Substation Control, Protection, and Metering	1,375	1,260	1,135	1,095	990	790	740	740	740	740
Mobile and Heavy Equipment Replacements	600	600	1,430	600	600	600	600	600	600	600
Buildings and Programmatic Investments	2,120	1,371	1,772	1,278	1,164	1,029	1,144	1,029	1,400	1,031
Total	14,088	24,873	25,865	25,745	26,151	25,574	27,159	26,209	26,385	26,091
CRSP										
T-Line Improvements and Replacements	1,750	3,650	600	90	90	490	1,570	1,250	170	90
Substation Improvements and Replacements	667	1,127	3,283	937	891	734	774	780	380	440
Communication System Improvements and Replacements	1,476	1,320	2,395	1,300	100	100	100	100	100	100
Substation Control, Protection, and Metering	1,220	1,135	885	845	740	740	740	740	740	740
Mobile and Heavy Equipment Replacements	365	1,200	315	425	400	400	400	400	400	400
Buildings and Programmatic Investments	2,000	1,267	1,061	975	860	725	841	726	1,097	727
Total	7,478	9,699	8,539	4,572	3,081	3,189	4,425	3,996	2,887	2,497

4 PROGRAM SUMMARIES

The following sections summarize the goals, priorities, and significant near-term projects for Western's six major capital program areas. The investment costs shown are Western's projected estimates within the 3-year budget window for the more significant projects. It should also be noted that some of these projects have additional costs that occur either before or after the 3-year budget window.

4.1 Transmission Line Improvements and Replacements

The goal of the transmission line facilities program is to develop a practical plan based on available resources that will satisfy system-operating criteria, extend service life of existing facilities and rehabilitate an aging infrastructure with nominal rate impact.

Priorities

- Use results of long-range system operations planning studies to identify strategic replacement or uprate projects. Incorporate into capital plan in order of merit, value and priority.
- Continue existing wood pole testing, treatment and replacement program.
- Evaluate all wood structure transmission line segments relative to age, historical maintenance concerns and pole test program results to identify rebuild projects.

Major Projects	*Investment ($1k)*		
	FY04	FY05	FY06
Brush Tap-Ft. Morgan West 115kV Uprate[1]	175		
Beaver Creek-Hoyt 230kV Upgrade	100	6,050	6,300
Whitney	1,500	500	
Prospect Valley		1,250	250
Laramie Substation	170	7,038	650
Lovell-Thermopolis 115kV Rebuild	950	950	950
Cheyenne-Miracle Mile 230kV Upgrade	200	250	10,500
Hoyt-Wiggins 115kV Uprate			75
Gering/Gering Valley 34.5-kV T-Line		225	100
Animas-LaPlata Project	Trust	Trust	Trust
Wood Pole Testing & Treatment	411	465	465
Shiprock-Four Corners 345-kV Upgrade[1]	150		

[1] Major funding executed in prior year.

4.2 Substation Improvements and Replacements

The substation equipment improvement and replacement program seeks to assure the highest possible reliability of substation equipment and to adequately meet the needs of a changing power system while minimizing life-cycle costs, environmental risks, and personnel hazards.

Priorities

- Extend the service lives of major substation equipment without compromising reliability.
- Replace major substation equipment when justified by increasing maintenance costs, lack of spare parts, personnel hazards, or environmental risks.
- Replace oil breakers with SF-6 or vacuum breakers to reduce environmental risk.

Major Projects	*Investment ($1k)*		
	FY04	FY05	FY06
McGrew Shunt Capacitor Addition	56		
Wray Substation Additions[1]	800		
Silt Substation Upgrades	Trust	Trust	
Whiterock Substation - New	250	245	
Yellowtail 2nd Transformer	2,194	128	
Walden Substation – New[1]	250	2,650	250
Power Transformer Replacements			
Cheyenne KY8A	95		
Granby PP KY1A[1]		80	10
Garland KZ1A[1]		105	33
Lusk KX1A		174	68
Granby PP KY2A[1]			78
Flaming Gorge KY2A & KY2B Uprate		125	3,000
Circuit Breaker and Switch Replacements			
Archer 1566	39		
Alcova 562 & 362	95		
Gering 642	50		

Fontenelle 252	30		
Archer 2224	40	29	
Glendale 202 & 302	65	75	
Shiprock 3262, 3362, & 3462	180	60	
Chappell 144	102		
Raderville 164			70
Hayden 2272, 2476, & 2072	177	143	
Hayden 2772, 2872 & 2972		184	132
Gering/Gering Valley Switchgear		125	
Shiprock 3262, 3362, & 3462			180
Hayden 230-kV Switches	75	80	50

Reactor Replacements			
Shiprock KV1B, KV1C, & KV1D	260	317	50
Curecanti KV1A & KV1B			225

[1] Joint project; Western cost shown.

4.3 Communication System Improvements and Replacements

The goal of the communications system improvements and replacements program is to maximize the reliability and availability of the communications system by infrastructure investments while minimizing its life cycle cost and responding to changes in user requirements, technology and regulations.

Priorities

- Replace analog MW radios with digital to reduce operational costs.
- Replace wide band radios with narrow-band to meet FCC mandates.
- Install fiber optic cable to reduce long term operational costs where appropriate.

Major Projects	*Investment ($1k)*		
	FY04	FY05	FY06
Microwave Spur Replacements – (Wyoming, Nebraska, N.E. Colorado)	688	1,127	310
S. Colorado Joint MW System[1]	300		
Microwave Spurs Replacements - CRSP	948	1,138	2,238
VHF Mobile Radio Replacement	516	287	24
UHF Radio Replacement	90	90	
Cobb Lake-Poudre Fiber Optic Cable[1]	50		
Archer-Cheyenne Fiber Optic Cable[1]	130		
Cody Area Fiber Optic Cables	352		
Estes-Valley Fiber Optic Cable[1]	146		
Granby-West Portal Fiber Optic Cable[1]	326		
Ault-Cobb Lake Fiber Optic Cable[1]		105	
Airport-Weld Fiber Optic Cable			310

[1] Joint project; Western cost shown.

4.4 Control, Protection and Metering Improvements and Replacements

The goal of the Control, Protection and Metering program is to maintain and improve system reliability by the cost effective application of control, protection, and metering technologies at Western substations and meter sites.

Priorities

- Replace electromechanical relays and revenue meters with microprocessor-based equipment.
- Implement Digital Control Systems (DCS) schemes in substations as opportunities arise.
- Replace the obsolete DDI telemetry system with current technology.

Major Projects	*Investment ($1k)*		
	FY04	FY05	FY06
Glendo DCS Installation	155		
Protective Relay Replacements	1,380	1,380	1,380
RTU Replacements	750	625	250
DDI Replacements	210	290	290

4.5 Mobile Equipment Replacements

The goal of the mobile equipment replacement program is to assure that Western craftsmen have adequate reliable equipment and tools available to accomplish the maintenance program efficiently and safely.

Priorities

Maintain adequate inventory for normal and emergency maintenance activities

- Minimize life-cycle costs of equipment.

Planned Replacements	*Investment ($1k)*		
	FY04	FY05	FY06
Brush Hog - Montrose	125		
Digger Derrick/Line Truck - Cheyenne	500		
Lowboy Trailer-Craig	70		
Lowboy Trailer- Montrose	70		
Tree Shredder- Montrose		300	
Mobile Transformer- Loveland			750
Versalift, 38'- Loveland			80
Motor Grader- Craig			140
Line Truck – Thermopolis			500
Backhoe – Thermopolis			100
Frontend Loader – Montrose			150
Crane – Montrose		400	

4.6 Programmatic Improvements and Replacements

These program elements support the infrastructure of the Region that is not integrated with the transmission, substation and communication systems. In general, they involve the buildings and facility improvements, Supervisory Control and Data Acquisition (SCADA) and Information Technology (IT) programs. The current program priorities are presented by designated individual element and the projects and accomplishments are combined by fiscal year as follow:

Priorities

SCADA System:

- Install a new SCADA base system release.
- Commission RMR's Alternate Control Center.
- Develop a Common Information Model (CIM) based ability to exchange modeling topology information.

Information Technology (IT):

- Maximize resource efficiencies by consolidating systems, automating processes, and implementing process improvements.
- Implement procedures and systems to maintain and secure existing systems to ensure business continuity.
- Develop and maintain a GIS program that displays all Regional generation sources, transmission lines, substations, communication facilities, office locations, archeological and cultural sites and topographic, boundary and municipal features relative to geographic and spatial reference.

Buildings and Facilities:

- Initiate facility inspections and develop remedial actions to reduce the risk of a catastrophic failure of any one facility's intended function.
- Incorporate unique designs that provide extended service life, especially for those facilities in remote locations, without adding significantly to the cost or routine maintenance.

Major Projects	*Investment ($1k)*		
	FY04	FY05	FY06
TIGER 3.0 Project	1,303		
Implement IT Servers &Routers	200	160	175
SCADA Upgrades	427	227	488
Small Projects (Civil/C&R)	1,610	1,380	1,250
Small Projects (Electrical/RRADs)	330	621	200
Virginia Smith DC Tie HVAC Replacement			300
GIS Development	250	250	250
Storage Area Network			174
Dig/OASIS Cluster			40
PMOC Facility Replacements			134
Drawing Scanners			26

5 TEN-YEAR BUDGET PROJECTIONS

The following spreadsheets list Western's capital budget estimates by project and by fiscal year.

		Project	FY04			FY05			FY06			FY07			FY08			FY09			FY10			FY11			FY12			FY13		
PROJECT	System	Total	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL
Transmission Lines																																
Cheyenne-Miracle Mile 230kV T-Line Upgrade	PS	32,433	200		200	250		250	10500		10500	12500		12500	8500		8500	400		400												
Cheyenne-Ault 230kV T-line Upgrade	PS	15,100										350		350	4250		4250	10500		10500												
Distribution Line Repair/Replacement	PS	550																						100		100	400		400	50		50
Gering-Gering Valley 34.5-kV T-Line	PS	325				225		225	100		100																					
Troublesome-Colorado Pumps	PS	550																												550		550
Lovell - Thermopolis 115-kV line Rebuild	PS	9,100	950		950	950		950	950		950	950		950	950		950	950		950	550		550	950		950	950		950	950		950
Front Range T-Line Improvements																																
Brush Tap - Ft Morgan West 115-kV Uprate	PS	775	175		175																											
Beaver Creek - Hoyt 230-kV Upgrade	PS	12,700	100		100	6050		6050	6300		6300	250		250																		
Hoyt - Wiggins 115-kV Uprate	PS	3,150							75		75	2900		2900	175		175															
Dixon Creek-LaPorte 230-kV Upgrade	PS	3,450										150		150	3200		3200	100		100												
Weld-Flatiron 230kV Upgrade	PS	11,500													250		250	5350		5350	5400		5400	500		500						
Hoyt-Brighton 230-kV Upgrade	PS	18,450																350		350	8500		8500	9000		9000	600		600			
Brighton-Terry Street 230-kV Upgrade	PS	9,300																			350		350	8350		8350	600		600			
FMW - Kiowa Creek 230-kV Upgrade	PS	10,500																			200		200	300		300	9400		9400	600		600
Kiowa Creek - Rosedale (Xcel) 230-kV Upgrade	PS	16,150																			350		350	300		300	3900		3900	11000		11000
Rosedale (Xcel) - Weld 230-kV Upgrade	PS	10,750																									450		450	3500		3500
Wood Pole Replacements (PS)	PS	100																														
Wood Pole Test and Treatment (PS)	PS	3,797	411		411	465		465	465		465	480		480	480		480	80		80				400		400	480		480	480		480
Line Equipment Replacements - General (PS)	PS	950	300		300	200		200	100		100	50		50	50		50	50		50	50		50	50		50	50		50	50		50
Animas-Laplata Project	CRSP	6,580	1600		1600	3600		3600	500		500																					
Shiprock - Four Corners 345-kV Conversion	CRSP	400	150	150	300																											
Wood Pole Replacement (CRSP)	CRSP	2,160																			1000		1000	1080		1080	80		80			
Wood Pole Test and Treatment (CRSP)	CRSP	960																400		400	480		480	80		80						
Line Disconnect Switch Replacements (CRSP)	CRSP	280										40		40	40		40	40		40	40		40	40		40	40		40	40		40
Line Equipment Replacements - General (CRSP)	CRSP	500				50		50	100		100	50		50	50		50	50		50	50		50	50		50	50		50	50		50
T-Line SubTotal		**122,977**	**3886**	**150**	**4036**	**11790**		**11790**	**19090**		**19090**	**17720**		**17720**	**17945**		**17945**	**18270**		**18270**	**16970**		**16970**	**21200**		**21200**	**17000**		**17000**	**17270**		**17270**
Substations																																
Cheyenne Control Building	PS	855	50		50																											
Wray Substation Modifications	PS	1,300	800	300	1100																											
McGrew Shunt Capacitor Addition	PS	56	56		56																											
Prospect Valley Tap Substation	PS	4,000				1250	2500	3750	250		250																					
Whitney	PS	4,500	1500	2500	4000		500	500																								
Walden Substation - New	PS	4,150	250		250	2650	1000	3650	250		250																					
Whiterock Substation - New	PS	5,005	250		250	245		245																								
Yellowtail 2nd Transformer Addition	PS	2,374	2194		2194	128		128																								
Cheyenne-Miracle Mile Terminals																																
Laramie Substation	PS	7,858	170		170	7038		7038	650		650																					
Miracle Mile 230-kV additions	PS	4,700							600		600	3600		3600	500		500															
Cheyenne 115-kV Shunt Capacitor	PS	400										50		50	325		325	25		25												
Ault 230-kV additions	PS	2,000										250		250	1250		1250	500		500												
Front Range Transmission Improvements Terminals																																
Beaver Creek 230-kV Additions	PS	4,880																230		230	4250		4250	400		400						
Hoyt 230-kV Additions	PS	4,880																230		230	4250		4250	400		400						
Brighton 230-kV/115-kV Additions	PS	9,030																			180		180	2200		2200	6150		6150	500		500
Kiowa Creek 230-kV/115-kV Additions	PS	5,280																									280		280	4300		4300
Weld 230-kV Bay Addition	PS	1,675																									75		75	1450		1450
Platte Valley Voltage Conversion																																
Lingle Substation 69kV additions	PS	2,255										105		105	1900		1900	250		250												
Torrington Substation 69kV additions	PS	3,530													80		80	3200		3200	250		250									
Torrington - Wildcat 69kV additions	PS	3,130																			105	105	210	650	1900	2550	70	300	370			
Wildcat Substation 69-kV additions	PS																															
Gering Substation 69-kV additions	PS	50																												50		50
Alcova 362 & 562 Replacements	PS	215	95		95																											
Alcova 462, 662, 862, 1062 Replacement	PS	450													330		330	120		120												
Cheyenne KY8A Replacement	PS	95	95		95																											
Gering 642 Replacement	PS	50	50		50																											
Gering/Gering Valley Switchgear	PS	125				125		125																								
Glendale 202 & 302 Replacement	PS	140				65		65	75		75																					
Granby Pumping Plant KY1A Rebuild	PS	220				100	100	200	10	10	20																					
Granby Pumping Plant KY2A Rebuild	PS	226							100	100	200	13	13	26																		
Granby Pumping Plant KY3A Rebuild	PS	230										100	100	200	15	15	30															
Willow Creek KZ2A Replacement	PS	235													155		155	80		80												
Chappell 144 Replacement	PS	102	102		102																											
Garland KZ1A Replacement	PS	230				105	70	175	33	22	55																					
Lusk KX1A Replacement	PS	242				174		174	68		68																					
Limestone Substation Control Upgrades	PS	396										224		224	172		172															
Raderville 164 Interrupter Replacement	PS	70							70		70																					
Substation Disconnect Switch Replacements (PS)	PS	385	65		65	40		40				40		40	40		40	40		40	40		40	40		40	40		40	40		40
Battert and Charger Replacements (PS)	PS	560	60		60	100		100	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50
CCVT, PT, & CT replacement (PS)	PS	490	50		50	40		40	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50
Silt Substation Upgrades	CRSP	500		400	400		80	80																								
Battery and Charger Replacements (CRSP)	CRSP	400							50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50
CCVT, PT, & CT Replacements (CRSP)	CRSP	437	41		41	25		25	36		36	40		40	45		45	50		50	50		50	50		50	50		50	50		50
Substation Disconnect Switch Replacements (CRSP)	CRSP	385	5		5				30		30	50		50	50		50	50		50	50		50	50		50	50		50	50		50
Bushing Replacements (CRSP)	CRSP	240				60		60	60		60	60		60	60		60															
Surge Arrester Replacements (CRSP)	CRSP	378				58		58	40		40	40		40	40		40	40		40	40		40	40		40	40		40	40		40
Archer 1566 Replacement	CRSP	102	39		39																											
Archer 2224 Replacement	CRSP	69	40		40	29		29																								
Ault 1096 & 892 Replacement	CRSP	600																	500	500		100	100									
Ault 692 Replacement	CRSP	300														250	250		50	50												
Ault 696 Replacement	CRSP	300													90	160	250	18	32	50												
Flaming Gorge KY2A & KY2B Uprate	CRSP	2,456				231		231	2100		2100	125		125																		
Hayden 230-kV Switch Replacements	CRSP	205	75		75	80		80	50		50																					
Fontenelle 252 Replacement	CRSP	84	30		30																											

W Total is Western Only Costs

O Total is Trust and Joint Participation Costs

FY Total is sum of W Total and O Total

		Project	FY04			FY05			FY06			FY07			FY08			FY09			FY10			FY11			FY12			FY13		
PROJECT	System	Total	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL	W Total	O Total	FY TOTAL
Hayden 2072,2272,2476 Replacement	CRSP	320	177		177	143		143																								
Hayden 2772, 2872, 2972 Replacement	CRSP	333				184		184	149		149																					
Shiprock 3262,3362,3462 Replacement	CRSP	252							172		172	80		80																		
Midway 1886, 1562, 1662 Replacement	CRSP	302										172		172	130		130															
Blue Mesa 1066, 1162 Replacement	CRSP	206													116		116	90		90												
Blue Mesa 1362, 1462 Replacement	CRSP	206																116		116	90		90									
Vernal 1372, 1576, 1672 Replacement	CRSP	312																			172		172	140		140						
Vernal 1872, 2172 Replacement	CRSP	220																						120		120	100		100			
Collbran 362 Replacement	CRSP	110																									60		60	50		50
Rifle 282, 382 Replacement	CRSP	200																												200		200
Rifle 486, 582 Replacement	CRSP																															
Shiprock KV1C, KV1D Reactor Replacement	CRSP	627	260		260	317		317	50		50																					
Curecanti KV1A, KV1B Reactor Replacement	CRSP	586							546		546	40		40																		
Hayden KV1A, KV1B, KV2A Reactor Replacement	CRSP	938										280		280	310		310	320		320	28		28									
Midway KW1A, KW2A Reactor Replacement	CRSP	654																			294		294	330		330	30		30			
Substations SubTotal		**88,091**	**6454**	**3200**	**9654**	**13187**	**4250**	**17437**	**5489**	**132**	**5621**	**5419**	**113**	**5532**	**5758**	**425**	**6183**	**5509**	**582**	**6091**	**9949**	**205**	**10154**	**4570**	**1900**	**6470**	**7095**	**300**	**7395**	**6880**		**6880**
Communications																																
Microwave Spur Replacements (PS)	PS	2,311	688		688	1127		1127	310		310																					
VHF Mobile Radio Replacements (PS)	PS	410	288		288	110		110	12		12																					
Archer-Cheyenne Fiber Optic Installation	PS	560	130	130	260																											
Cody Area Fiber Optic Installation	PS	352	352		352																											
UHF Radio Replacements (PS)	PS	180	90		90	90		90																								
Cobb Lake-Poudre Fiber Optic Installation	PS	100	50	50	100																											
Granby-West Portal Fiber Optic Installation	PS	678	326	326	652																											
Estes-Valley Fiber Optic Installation	PS	600	146	438	584																											
Ault-Cobb Lake Fiber Optic Installation	PS	210				105	105	210																								
Airport-Weld Fiber Optic Installation	PS	310							310		310																					
Laporte-Flatiron Fiber Optic Installation	PS	150													75	75	150															
Flatiron-Terry Street Fiber Optic Installation	PS	120										60	60	120																		
Nortel Microwave Replacements	PS	1,500										500		500	500		500	500		500												
Communications Test Equipment	PS	800							100		100	100		100	100		100	100		100	100		100	100		100	100		100	100		100
RMR Technology Test Bed Project	PS	110				10		10	100		100																					
RMR Technology Test Bed Project	CRSP	50				5		5	45		45																					
Sunlight Tower Replacement	CRSP	158	158		158																											
Sunlight Bldg Replacement	CRSP	147	147		147																											
Communications Test Equipment	CRSP	800							100		100	100		100	100		100	100		100	100		100	100		100	100		100	100		100
VHF Mobile Radio Replacements (CRSP)	CRSP	674	228		228	177		177	12		12																					
Microwave Spur Replacements (CRSP)	CRSP	5,819	643		643	1138		1138	2238		2238	1200		1200																		
So. Colorado Joint Microwave Project	CRSP	1,300	300		300																											
Communications SubTotal		**17,339**	**3546**	**944**	**4490**	**2762**	**105**	**2867**	**3227**		**3227**	**1960**	**60**	**2020**	**775**	**75**	**850**	**700**		**700**	**200**		**200**	**200**		**200**	**200**		**200**	**200**		**200**
Control, Protection and Metering																																
Protective Relay Replacements (PS)	PS	6,900	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690
Glendo DCS Installation	PS	155	155		155																											
Test Equipment Replacements (PS)	PS	500	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50
RTU Replacements (PS)	PS	1,550	375		375	375		375	250		250	250		250	250		250	50		50												
DDI Replacements (PS)	PS	500	105		105	145		145	145		145	105		105																		
Protective Relay Replacements (CRSP)	CRSP	6,900	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690	690		690
Test Equipment Replacements (CRSP)	CRSP	500	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50	50		50
RTU Replacements (CRSP)	CRSP	625	375		375	250		250																								
DDI Replacements (CRSP)	CRSP	500	105		105	145		145	145		145	105		105																		
CPM Sub-total		**18,130**	**2595**		**2595**	**2395**		**2395**	**2020**		**2020**	**1940**		**1940**	**1730**		**1730**	**1530**		**1530**	**1480**		**1480**	**1480**		**1480**	**1480**		**1480**	**1480**		**1480**
Mobile & Heavy Equipment																																
Mobile transformer – Loveland	PS	750							750		750																					
Digger Derrick/Line Truck - Cheyenne	PS	500	500		500																											
Versalift, 38' - Loveland	PS	80							80		80																					
Line Truck, 110' - TH (replace Elliott)	PS	500							500		500																					
Backhoe - TH (replacement)	PS	100							100		100																					
Misc Heavy Equipment Replacements (PS)	PS	4,900	100		100	600		600				600		600	600		600	600		600	600		600	600		600	600		600	600		600
Misc Heavy Equipment Replacements (CRSP)	CRSP	2,800	100		100							300		300	400		400	400		400	400		400	400		400	400		400	400		400
Brush Hog - Montrose	CRSP	125	125		125																											
Brush Hog - Montrose	CRSP	125										125		125																		
Front End Loader - Montrose	CRSP	150							150		150																					
Crane - Montrose	CRSP	600				600		600																								
Lowboy trailer, 50 ton - Craig	CRSP	70	70		70																											
Lowboy trailer, 50 ton - Montrose	CRSP	70	70		70																											
Motor Grader - Craig	CRSP	165							165		165																					
Tree shredder – Montrose	CRSP	600				600		600																								
Mobile & Heavy Equipment Sub-total		**11,535**	**965**		**965**	**1800**		**1800**	**1745**		**1745**	**1025**		**1025**	**1000**		**1000**	**1000**		**1000**	**1000**		**1000**	**1000**		**1000**	**1000**		**1000**	**1000**		**1000**
Programmatic Improvements																																
Virginia Smith DC Tie HVAC Replacement	PS	300							300		300																					
SCADA Upgrades (PS)	PS	1,899	214		214	114		114	244		244	314		314	200		200	65		65	180		180	65		65	436		436	67		67
RRADS Small Projects (PS)	PS	1,270	220		220	250		250	100		100	100		100	100		100	100		100	100		100	100		100	100		100	100		100
GIS Development (PS)	PS	635	150		150	150		150	150		150																					
Small Projects (Civil - PS)	PS	7,865	750		750	750		750	750		750	750		750	750		750	750		750	750		750	750		750	750		750	750		750
IT Server and Router Replacements (PS)	PS	1,153	134		134	107		107	114		114	114		114	114		114	114		114	114		114	114		114	114		114	114		114
Tiger 3.0 Project (PS)	PS	973	652		652																											
WIN Project (PS)	PS	114							114		114																					
WIN Project (CRSP)	CRSP	56							56		56																					
Tiger 3.0 Project (CRSP)	CRSP	972	651		651																											
IT Server and Router Replacements (CRSP)	CRSP	612	66		66	53		53	61		61	61		61	61		61	61		61	61		61	61		61	61		61	61		61
SCADA Upgrades (CRSP)	CRSP	1,894	213		213	113		113	244		244	314		314	199		199	64		64	180		180	65		65	436		436	66		66
RRADS Small Projects (CRSP)	CRSP	1,281	110		110	371		371	100		100	100		100	100		100	100		100	100		100	100		100	100		100	100		100
GIS Development (CRSP)	CRSP	485	100		100	100		100	100		100																					
Small Projects (Civil - CRSP)	CRSP	5,690	860		860	630		630	500		500	500		500	500		500	500		500	500		500	500		500	500		500	500		500
Misc. SubTotal		**25,199**	**4120**		**4120**	**2638**		**2638**	**2833**		**2833**	**2253**		**2253**	**2024**		**2024**	**1754**		**1754**	**1985**		**1985**	**1755**		**1755**	**2497**		**2497**	**1758**		**1758**
CIP 10 Year Grand Total		**283,271**	**21,566**	**4,294**	**25,860**	**34,572**	**4,355**	**38,927**	**34,404**	**132**	**34,536**	**30,317**	**173**	**30,490**	**29,232**	**500**	**29,732**	**28,763**	**582**	**29,345**	**31,584**	**205**	**31,789**	**30,205**	**1,900**	**32,105**	**29,272**	**300**	**29,572**	**28,588**	**-**	**28,588**

W Total is Western Only Costs

O Total is Trust and Joint Participation Costs

FY Total is sum of W Total and O Total

5.1 Success Indicators

The goal of Western's Plan is to assure the most cost-effective use of available capital resources to assure long-term electric system reliability and availability. The following sections summarize the inventory of major power system equipment and indicators for measuring the success of our capital program.

Facilities

Western operates and maintains an extensive system of interconnected substations, transmission lines, and communication sites. The Region owns and operates 118 substations in the states of Wyoming, Nebraska, Colorado, and Utah. The substations comprise the majority of the maintained equipment in the Region including 460 high voltage circuit breakers and 121 power transformers.

The substations are interconnected by 5,286 miles of transmission lines operating at voltages between 12,500 and 345,000 volts. The majority of the transmission lines (3,324 miles) were built using wood pole structures, with the remainder (1,962 miles) being of steel structure construction. The breakdown of line miles by voltage and construction is shown below:

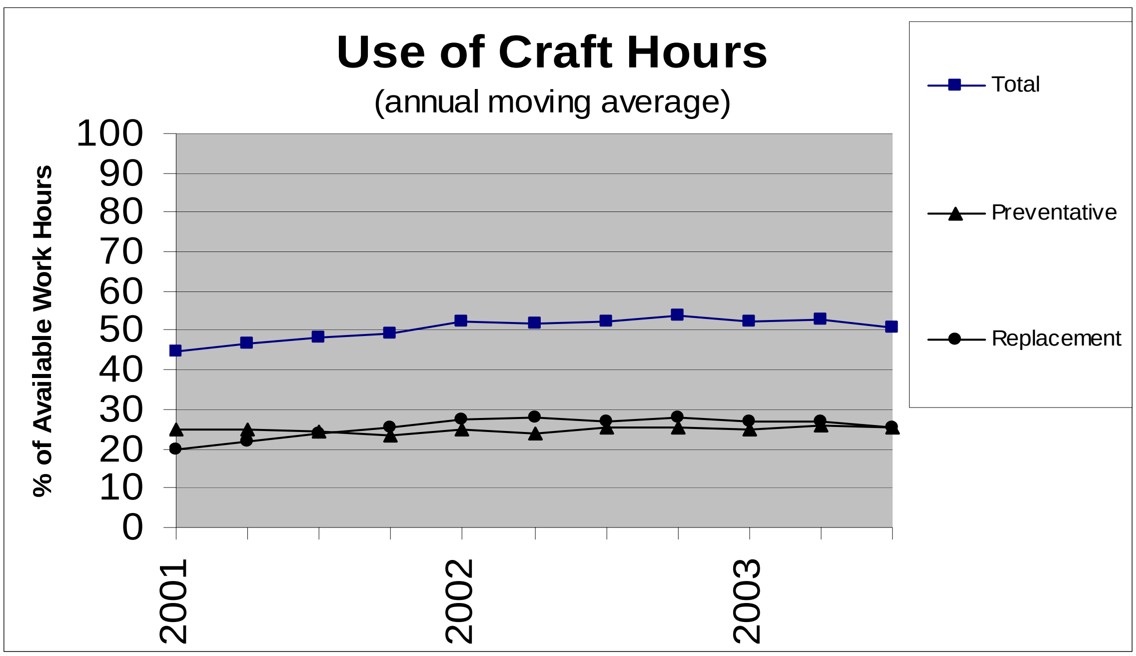
Voltage	*Miles of Wood Construction*	*Miles of Steel Construction*	*Total*
345-kV	0	383	383
230-kV	127	1,434	1,561
138-kV	306	24	330
115-kV	2,347	92	2,439
69-kV	243	25	268
<69-kV	301	4	305
Total	3,324	1,962	5,286

The electrical system is operated from the Loveland control center by means of an extensive communications network consisting of microwave, radio, and fiber optic links. The links are connected through 142 Western-owned communications sites.

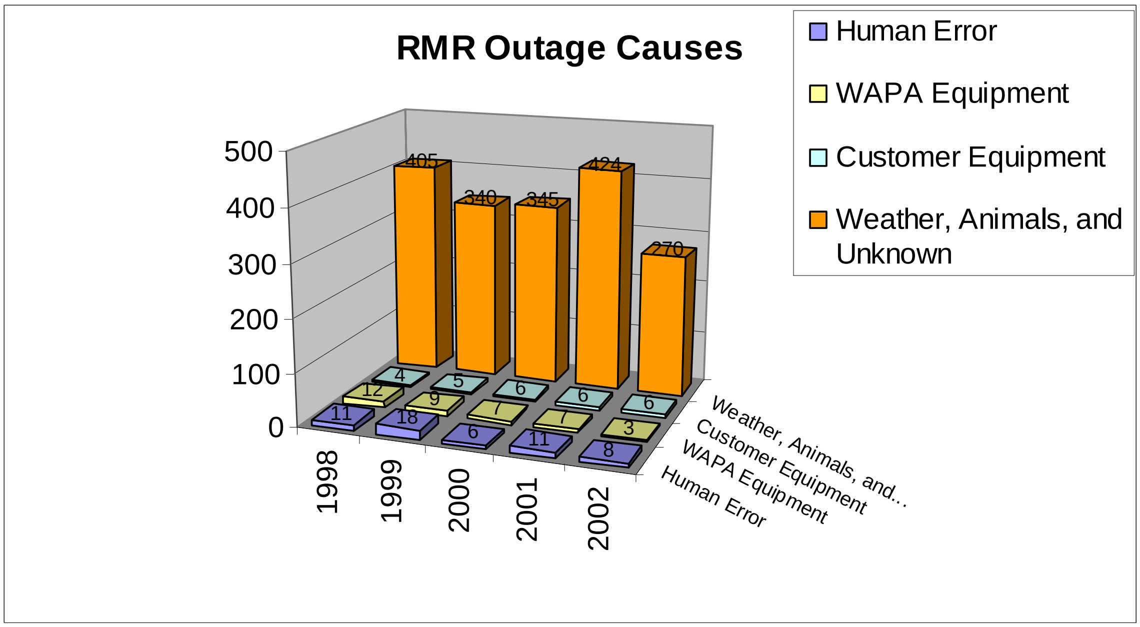
Indicators

We can measure the success of our efforts in several ways:

- ***Leading Indicators***. Measurable activities that result in positive outcomes are considered to be leading indicators. For example, increasing the amount of resources allocated to preventative maintenance activities on equipment should result in a reduction of critical equipment failures. Similarly, increasing the amount of resources allocated to equipment improvement and replacement activities should result in fewer equipment related outages. The following chart shows RMR's percentage allocation of craft labor to preventative maintenance and replacement activities over the last three years.

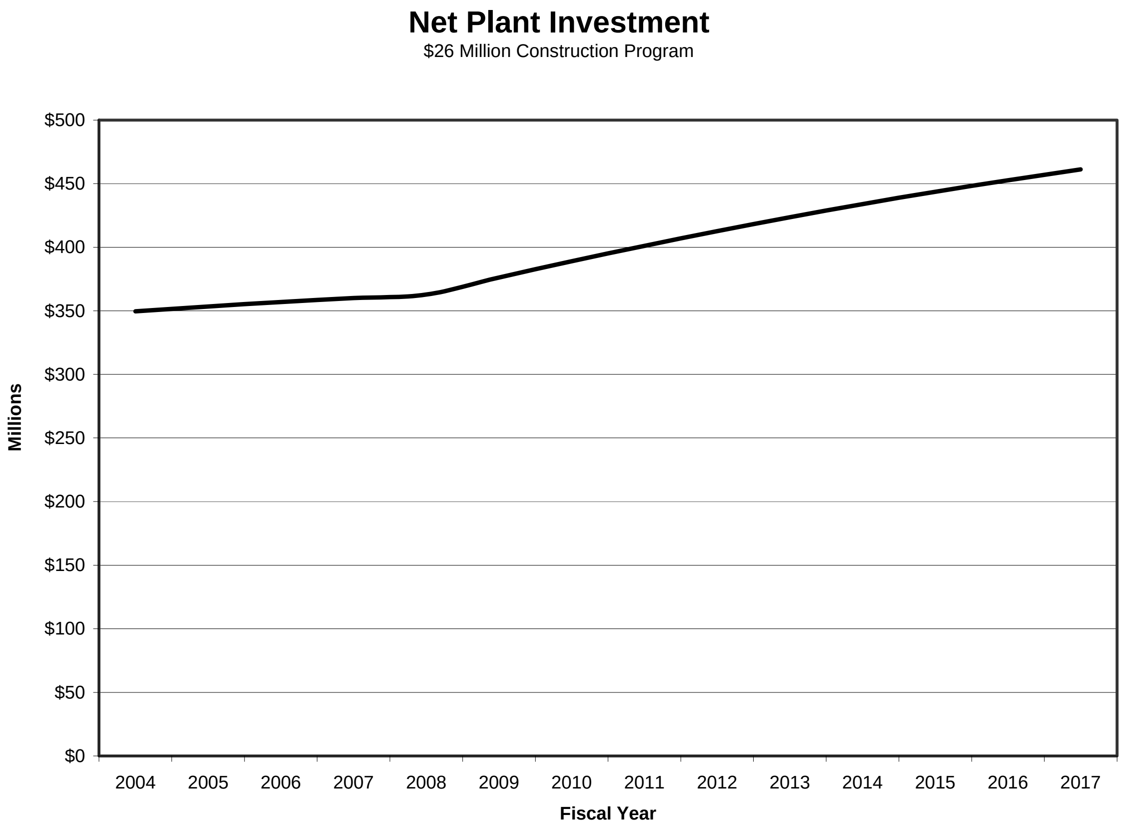


- ***Lagging Indicators***. The ultimate goal of the Capital Investment Program is to assure electric system reliability. Therefore, the result of an effective program should be fewer power outages due to equipment failures. Since the results of a poorly maintained or managed power system won't be apparent for several years, equipment outage rates tend to be a lagging performance indicator. The following chart shows the annual number of outages in the control system due to all causes including weather, equipment failures, and human error.

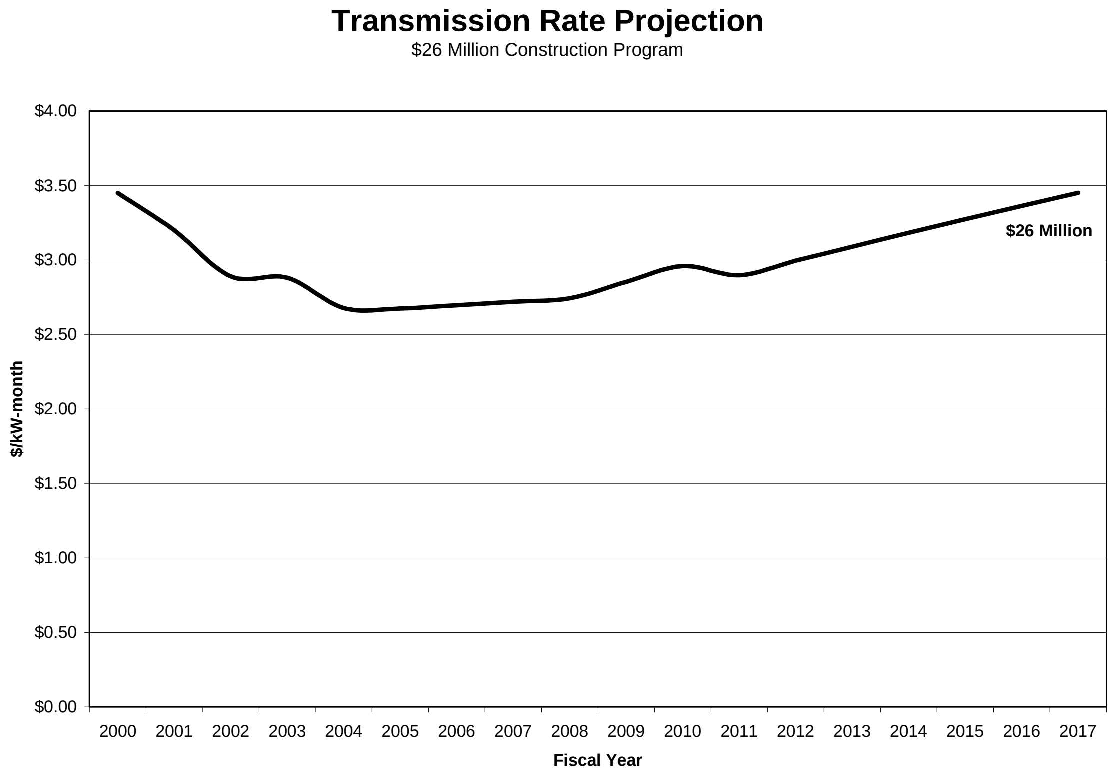


- ***Financial Indicators.*** Western has identified two financial measures that reflect a cost-effective investment program: Net Plant Investment and Rate Impact. Western does not believe that it is possible to maintain system reliability under current load and generation growth conditions without increasing Net Plant Investment. A flat or declining Net Plant Investment is an indicator of a deteriorating system. On the opposite side is the impact on the transmission rate of increasing the Net Plant Investment at too rapid a pace. That will result in an unacceptable growth in the rate. As the graphs below indicate, Western's proposed Plan strikes a middle ground.

The Plan results in an annual growth rate in plant investment for the LAP system of approximately 2% from 2004 through 2017.



The Rate Impact of these investments also shows an annual growth rate of 2% per year. However, the estimated rate in 2017 is identical to the rate that Western put into place in 2000.



In determining the estimated rate impact, Western used a conservative load growth rate of 1% per year. An increase of 0.5% per year in load projections will result in a net decrease in the transmission rate of 6%.

As Western updates its Plan it will collaborate with CRSP to develop similar financial indicators for the CRSP transmission system.

6 APPENDIX

6.1 Program Descriptions

6.1.1 Transmission Line Improvements and Replacements

Background

Western owns, operates and maintains 5,286 miles of high voltage transmission line, mostly in the states of Colorado and Wyoming. Of this total, there are 3,324 miles of wood pole structures and 1,962 miles of steel structures. Recognizing Western has wood pole structure supported lines that were installed some 40 to 70 years ago, a need exists to develop and implement a plan for the rehabilitation or replacement of these lines.

Program Goal

The goal of the transmission line facilities program is to develop a practical plan based on available resources that will satisfy system operating criteria, extend service life of existing facilities and rehabilitate an aging infrastructure with nominal rate impact.

Challenges

- *Extend service life and defer extraordinary costs of rebuilding.* For the past twenty years, there has been success, through testing and treatment programs and routine maintenance, extending the life and deferring the costs of rebuilding these aging lines. As a result, significant sections of transmission line are operating with hardware and conductor that have far exceeded normal service life expectations. These older lines require more maintenance, and the likelihood of an extended outage in the event of a failure in a significant line section becomes greater. For these reasons, many of the aging components are becoming the highest risk to the reliability, integrity and safety of Western's power transmission system.
- *Consider system operating criteria.* Coincident with the need to assess aging transmission lines is consideration of long-range system operating criteria regarding constraints, capacity, revenue, and reliability. As specific line sections are considered for replacement, equal consideration (using power system planning study results) will be given to the future operating needs of the element and any integrated facilities. Through these processes will evolve a number of uniquely defined projects with needs that require capital program resources.

Strategies

- Provide Western sufficient information to make informed decisions and recommendations regarding the need to repair, modify, or replace components of its transmission system:

- Develop wide-range planning studies to determine immediate and long-range (10 year) system operating needs and propose the best, most cost effective projects.
- Evaluate each transmission line segment that is built using wood pole structures relative to its age, historical maintenance concerns, pole testing-treatment program records, and results of specific power system studies.
- Corroborate data of these efforts and initiate transmission line projects that can be identified in an order of merit, value, and priority.

6.1.2 Substation Improvements and Replacements

Background

Western has an ongoing electrical equipment replacement program designed to continually evaluate and replace aging electrical equipment. Decisions on equipment replacement are based on multiple factors including age, maintenance history, operation and fault history, availability of spare parts, and criticality to the system.

Program Goal

The substation equipment improvement and replacement program seeks to assure the highest possible reliability of substation equipment while minimizing life-cycle costs, environmental risks, and personnel hazards.

Challenges

- *Ensure substation equipment availability and reliability.* The power system has expanded and is being loaded to its full capacity in many cases. There are major pieces of electrical equipment that can not be taken out of service to perform major maintenance.
- *Minimize environmental risks and personnel hazards.* Design standards and codes have changed over time, and older substations sometimes require modifications to ensure the safety of personnel maintaining the facilities. Such modifications include raising buswork and other energized equipment to increase safety clearances and replacing equipment of outdated design.

  Power transformers and many of the older breakers contain oil for use as electrical insulation. Some of the transformer and breaker components may also contain PCB contaminated oil, but are sealed and cannot be tested. There are many regulations relating to the storage, handling, and disposal of both "clean" and PCB contaminated oil. Equipment containing oil is a particular concern where located near lakes and streams.
- *Maximize equipment life.* As Western's power system ages, special attention is given to the condition of power transformers and circuit breakers. The replacement of a large power transformer can represent a significant percentage of the annual capital program budget and require as much as two years lead time. The challenge in managing expensive assets like

transformers and breakers is to obtain maximum service life without jeopardizing reliability.

Strategies

Ensure substation equipment availability and reliability by:

- Conducting periodic substation checks to evaluate overall equipment condition and ensure adequate safety and security of facility and the equipment appears to be in good service condition.
- Carrying a small inventory of spare power circuit breakers to use in emergency replacements. The spare breakers are periodically rotated into the power system, so they do not become obsolete.
- Maintaining a Region-wide spare power transformer and mobile transformers for use in an emergency.

Minimize environmental risks and personnel hazards by:

- Replacing aging oil breakers with SF-6 gas breakers.
- Testing and disposing of remaining PCB contaminated components.
- Replacing buswork and equipment in older substations with modern designs.
- Installing and maintaining oil containment structures where oil-containing equipment is located or stored.

Optimize maintenance costs by:

- Continued implementation of a Reliability Centered Maintenance (RCM) program to ensure maintenance dollars are being used in the most efficient ways. RCM can often delay the need for equipment replacement due to more effective maintenance strategies.

Maximize equipment life by:

- Regular testing of critical equipment parameters. Each power transformer receives regular testing of dissolved gasses, which is one indication of transformer health. Also, when the age of a transformer exceeds 40 years, careful evaluation is done to determine the health of the transformer and its risk of failure. In some instances of parallel transformer installation, the determination may be made to run a transformer to failure, rather than replace it before necessary. Other instances require close evaluation and possible ordering of new transformers. Through the RCM program, the Region carefully tracks and monitors major electrical equipment to ensure the equipment is replaced at the optimal time before failure, while obtaining the maximum life possible.
- Implementing a prioritized major equipment replacement strategy.   Each transformer and breaker is scored and ranked on multiple factors including age, maintenance history, operation and fault history, availability of spare

parts, and criticality to the system. The highest scoring units are evaluated each year for possible replacement.

6.1.3 Communication System Improvements and Replacements

Background

Western operates and maintains an extensive communications network to support system operations, maintenance, and administrative functions. Most of the major substations and transmission lines are remotely monitored and operated from its Loveland Power Marketing and Operations Center (PMOC) using this communications network. Contact with field workers is also maintained using the VHF mobile radio system. In addition, the communications network provides wide area network connections to support e-mail and corporate business computer applications between the PMOC and field maintenance offices.

Program Goal

The goal of the communications system improvements and replacements program is to maximize the reliability and availability of the communications system by infrastructure investments while minimizing its life cycle cost and responding to changes in user requirements, technology and regulations.

Challenges

- *Provide adequate communications for increasing operational needs.* As power facilities become more automated with increased utilization of Intelligent Electronic Devices (IED's) used in network-based substation control and protection schemes, data requirements are changing. Usage of the data provided by these devices is expected to expand across the organization. For example, remote access to relays and RTU's is needed to allow visibility of fault data for troubleshooting and maintenance. This has resulted in an increasing demand for communications bandwidth, network capacity, and high speed data links throughout the Region. The communication program must anticipate and accommodate increased bandwidth in a timely and cost-effective manner.
- *Ensure communication system availability.* The effective maintenance of electronic equipment relies on the availability of manufacturers' technical support and spare parts. Because the technology of telecommunications is evolving rapidly, the effective useful life of electronic equipment is usually much less than other types of power system equipment. Spare parts and replacement components for electronic equipment often become obsolete or unavailable in as few as 10 years after introduction. Western's challenge is to maximize the useful lives of its electronic equipment while minimizing impacts on reliability due to equipment obsolescence or lack of availability of replacement parts.
- *Respond to changing regulations.* As a Federal agency, Western is obligated to comply with regulatory changes concerning radio frequency

allocations and utilization. Recent changes in Federal regulations require Western to vacate its 2 gigahertz analog microwave frequencies and move to the 8 gigahertz band. Since the existing microwave equipment cannot be modified to accomplish this, new equipment must be purchased. Other regulatory changes require Western to move to narrow-band technologies in its VHF mobile radio system. This requires replacement of existing wide-band VHF equipment.

- *Minimize life-cycle costs.* The technology of communications has become very complex. The increasing complexity of electronic systems usually results in increased maintenance costs. At the same time rapidly advancing technology often results in early equipment obsolescence. Some new technologies, like fiber optics, promise reliable, high capacity voice and data communications with lower infrastructure maintenance requirements. Western must stay abreast of new technologies and evaluate their usefulness for extending the useful lives of communication systems and reducing maintenance and replacement costs.

Strategies

Provide for increasing operational needs by:

- Replacing analog MW radios with high capacity 8 gigahertz digital radios.
- Utilizing fiber optics in place of radio links where economically feasible.
- Installing OPGW fiber optic cables on selected Western transmission lines during new construction or when they are rebuilt.

Ensure communications system availability by:

- Replacing analog MW radios with high capacity 8 gigahertz digital radios.
- Utilizing fiber optics in place of radio links where economically feasible.
- Implementing and utilizing remote management tools for monitoring and maintenance of communications equipment.

Respond to changing regulations by:

- Replacing wide-band VHF mobile radios with narrow-band radios.
- Replacing wide-band analog UHF radios with narrow-band digital UHF radios.
- Replacing analog MW radios with high capacity 8 gigahertz digital radios.

Minimize life cycle costs by:

- Utilizing fiber optics in place of radio links where economically feasible.
- Installing OPGW fiber optic cables on selected Western transmission lines during new construction or when they are rebuilt.

- Implementing and utilizing remote management tools for monitoring and maintenance of communications equipment.
- Where feasible, partnering with other utilities to minimize ownership costs by sharing communication paths and assets.
- Evaluating and utilizing alternative communication technologies such as cell and satellite phones.

6.1.4 Control, Protection, and Metering Improvements and Replacements

Background

Western operates and maintains an extensive control, protection and metering system. Remote control of the power system is accomplished from the PMOC using the communications network and substation control system. The control system provides for remote and local control of operable equipment and for the collection of equipment trending data.

The protection system provides for equipment monitoring and alarming, fault clearing and location, and outage analysis. Western's Digital Control System (DCS) concept allows for effective interleaving of remote and local control of substation equipment on a digital platform along with protection functions. DCS realizes a number of benefits including less physical wiring, lower space requirements and automatic data and information exchange.

Revenue metering is accomplished by local meters installed at meter points that are for the most part remotely interrogated on a monthly basis, although there are some meter points that are still being read manually. As a control area operator, Western also monitors and meters all control area boundaries.

The remote collection of control, protection, and metering information has opened up new opportunities for more effective and reliable system operation and maintenance, and Western is actively exploring the use of these technologies.

Program Goal

The goal of the Control, Protection, and Metering program is to maintain and improve system reliability by the cost effective application of control, protection, and metering technologies at Western substations and meter sites.

Challenges

- *Expand, upgrade and improve substation controls.* A large number of Western's substation control equipment is in need of replacement due to age and spare parts obsolescence. There is a proliferation of Intelligent Electronic Devices available on the market today. The challenge is to assure uniformity across the Region in the implementation and configuration of control devices and strategies and to efficiently satisfy the changing data and information needs of the organization.

- *Upgrade and replace protective relaying.* Western has already embarked on a relay replacement program. Many older devices are obsolete and no longer being supported by the manufacturers and replacement parts are often as expensive as new microprocessor relays. A number of older relays also contain PCBs in the relay coils and capacitors. Older fault recording, alarming and sequence of event recording equipment has been unreliable and expensive to maintain.
- *Upgrade and improve remote metering packages.* Due to the increasing cost of power on the wholesale market, accurate and timely metering has become increasingly important. Real-time metering needs to be extended to almost every part of the power system including revenue and boundary metering. Older metering devices need to be replaced with modern computer-based meters which can support multiple remote connections in order for Western and its customers to access the data.

  Real-time and hourly data is necessary for area interchange control, automatic generation control, and energy imbalance calculations. This metering is currently accomplished using a Western-created Digital Data Interface (DDI) system. Because of increasing requirements for new metering points, the DDI system has almost reached its full capacity. In addition, it is becoming increasingly difficult to obtain spare and replacement parts for the DDI equipment.
- *Respond to changing regulations.* Western is a member of NERC and WECC and is required to abide by the rules and regulations they set forth.
- *Minimize life-cycle costs.* Western must stay abreast of new technologies and evaluate their usefulness for extending the useful lives of control, protection, and metering systems and to reduce maintenance and replacement costs.

Strategies

Expand, upgrade and improve substation controls by:

- Continuing standardization of DCS designs using newer microprocessor based relays which require less space, replace multiple older discrete devices, significantly reduce wiring, and utilize modern communication methods.
- Installing complete DCS in new or re-built substations.
- Defining and implementing a migration strategy to upgrade existing substation controls to a digital platform during relay replacement projects.
- Utilizing a networked approach in these facilities for remote engineering and maintenance access to fault and outage information and alarm trending data.
- Continuing evaluation of data/information management infrastructure.

Upgrade and replace protective relaying by:

- Replacing older electro-mechanical and solid state relays with newer micro-processor based devices which provide for fault location, programming flexibility and remote connection capabilities. The newer microprocessor based relays require less space, replace many older discrete devices and therefore require less wiring and utilize more modern communication methods for transfer trip schemes.
- Replacing relays containing hazardous PCBs with newer micro-processor based devices.
- Upgrading relaying on important tie lines as identified by WECC with newer micro-processor based devices.
- Utilizing newer communication methods afforded by modern relays in order to eliminate the need for expensive external communication gear.
- Removing older fault recording and sequence of event recording devices as modern relays with recording capability are populated throughout the power system.

Upgrade and improve remote metering packages by:

- Replacing older metering packages with newer digital devices which can provide improved multiple remote connections.
- Expanding “totalized” metering quantities into individual metering points for higher resolution.
- Installing new metering packages with remote communication capability into locations where metering was estimated or where data could not be remotely collected.
- Replacing the DDI system with a commercially available hardware/software platform compatible with back-end systems.

Respond to changing regulations by:

- Upgrading control, protection and metering on bulk transfer paths as defined by WECC.
- Installing and maintaining a modern control, protection and metering system as defined by NERC and WECC.

Minimize life-cycle costs by:

- Implementing tools for remote diagnostics and troubleshooting of control, protection, and metering equipment.
- Replacing electromechanical and older electronic devices with microprocessor-based equipment which requires less maintenance and which can be monitored and diagnosed remotely.
- Utilizing a networked approach for remote engineering access to fault and outage information and alarm trending data.

- Continuing standardization of DCS designs in the Region.

6.1.5 Mobile Equipment Replacements

Background

Effective maintenance operations require the utilization of a variety of types of common and specialized mobile equipment. Equipment includes bucket trucks, cranes, tractor-trailers, mobile transformers, equipment trailers, oil processors, oil tankers, backhoes, fork lifts, crawlers, as well as more common utility pickups and vans. Some equipment, such as backhoes, crawlers, and tractor trailers are common in the construction industry. Others, such as line trucks, oil processors, and mobile transformers, are specifically designed for use in the electric power field. All are important for efficient maintenance and emergency repair operations.

Program Goal

The goal of the mobile equipment replacement program is to assure that Western craftsmen have adequate reliable equipment and tools available to accomplish the maintenance program efficiently and safely.

Challenges

- *Maintain adequate inventory for normal and emergency maintenance activities*. Since its power system facilities are widely distributed over four states, Western has chosen to locate its maintenance crews in locations convenient for rapid response to facility problems, rather than in a central location. Western strives to maintain an adequate inventory of mobile equipment for each field location and crew that is appropriate for the size of the crew and the nature of the work to be performed. Other factors that influence the selection and quantity of equipment at each location include the availability of lease equipment, the planned level of utilization of each item, and the viability of sharing equipment between crews and locations.
- *Determine optimal criteria for replacing equipment.* The decision to replace a particular item of equipment must be based on all appropriate factors, including but not limited to age, hours of use, projected future use, maintenance costs, potential for sharing among multiple crews, and availability of lease equipment.
- *Minimize life-cycle costs.* An important challenge of the mobile equipment program is minimizing the total cost of ownership. This analysis includes the costs of initial acquisition, future salvage value, maintenance, taxes, etc. The goal should be to minimize the overall life cycle cost of mobile equipment without degrading the capability for emergency response.

Strategies

Maintain adequate inventory by:

- Periodically reviewing the equipment needs at each manned location.
- Reviewing the justification for replacing each item based on existing and projected maintenance work and criticality to mission.

- Reviewing the cost and availability of leased equipment.

Use optimal criteria for equipment replacement decisions. Some of the relevant criteria include:

- *Usage.* How many hours or miles has the item been used?
- *Maintenance costs.* Are maintenance costs increasing? Compare annual maintenance costs with projected annual cost of replacement.
- *Replacement parts.* Are replacement parts available at a reasonable cost?
- *Obsolescence.* Is the equipment functionally outdated?
- *Safety.* Has the item become a safety hazard?
- *Location.* Can the item be better used in a different location?

Minimize life cycle costs by:

- Determining effective replacement decision criteria.
- Leasing an equivalent item if it is available at a reasonable cost and when needed.
- Sharing expensive equipment where practical.

6.1.6 Programmatic Improvements and Replacements

6.1.7 SCADA System

Background

Western operates and maintains a Supervisory Control and Data Acquisition (SCADA) computer system to support power system operations. All of the substations and transmission lines are remotely monitored and controlled from the PMOC using the SCADA system. The SCADA system supports Western's goal of reliable power deliveries. The SCADA system is also used by the Bureau of Reclamation to monitor and control power plants. The WECC also utilizes the SCADA system to monitor the electrical inter-connected system over a seven state area.

Program Goal

The goal of the SCADA system improvements and replacements program is to maximize the reliability and availability of the SCADA system by investments in system hardware upgrades, new system releases, new power system software products and training to respond to changes in technology and regulations.

Challenges

- *Meet increasing power system control requirements.* New requirements from NERC, FERC, WECC, and DOE are mandating increased security for infrastructure control systems. These new requirements will require hardware and software systems, personnel training and upgrade and maintenance programs. Coordinated management of the electrical grid requires increased communications and data sharing with neighboring utilities. Monitoring and modeling of the inter-connection by WECC requires data from adjacent control areas and high voltage data from across the inter-connected power system.
- *Ensure SCADA system availability.* The effective maintenance of electronic equipment relies on the availability of manufacturers' technical support and spare parts. Because the technology of computer systems is evolving rapidly, the effective useful life of electronic equipment is usually much less than other types of power system equipment. Spare parts and replacement components for electronic equipment often become obsolete or unavailable before the equipment itself is functionally obsolete. Western's challenge is to maximize the useful lives of its computer and control equipment while minimizing impacts on reliability due to equipment obsolescence or lack of availability of replacement parts.
- *Respond to changing regulations.* As a Federal agency, Western is obligated to comply with regulatory changes and guidelines concerning power system operations. Meeting new reliability requirements will necessitate new software systems to monitor and report control area compliance with new regulations.

Minimize life-cycle costs. Complete replacement of SCADA systems has become prohibitively expensive. System upgrades required to stay current with supported operating system releases and system functionality require that new system releases be purchased and installed periodically. The increasing complexity of SCADA control equipment usually results in increased maintenance costs. At the same time rapidly advancing hardware and software often results in early equipment obsolescence. Western must continue to perform incremental upgrades to avoid unsupported, obsolete system components.

Strategies

Provide for increasing operational needs by:

- Purchasing and installing new power system software products.
- Purchasing and installing new SCADA base system releases from the current vendor.
- Developing software in house when it is cost effective.

Ensure SCADA system availability by:

- Periodic hardware upgrades to backbone servers.
- Deployment of an alternate (backup) control center.

Respond to changing regulations by:

- Procurement or development of new software products.

Minimize life cycle costs by:

- Performing periodic incremental software upgrades.
- Performing periodic hardware upgrades.
- In house software development when it is economically advantageous.

6.1.7.1 Information Technology Improvements and Replacements

Background

Western operates and maintains an extensive Information Technology (IT) infrastructure to support all functional areas. Software development services are also provided by the IT staff. The IT major program areas are: 1) Systems Support including Customer Services, 2) Systems Engineering, and, 3) Cyber Security and Networking.

Program Goal

The goal of the IT system improvement and replacement program is to maximize the reliability and availability of the IT infrastructure while controlling, managing, and reducing IT investments and maintenance costs. Another goal of the IT program is to provide innovative technical solutions to improve business processes while minimizing total cost of ownership and responding to changes in technology and regulations.

Challenges

- *Improve the operational effectiveness and efficiency of Western's IT functions.* As business functions become more automated, an increased need for IT resources exists. Within Western's IT divisions, a greater emphasis has been placed on IT consolidation, centralization, and standardization. Many activities in this area will reduce minimize life-cycle costs and decrease Total Cost of Ownership. In addition, Federal programs such as the Presidential Management Agenda and the E-GOV initiative has placed a greater emphasis on managing and consolidating IT infrastructures and resources.
- *Deliver customer-focused products and services.* This challenge incorporates several aspects. One aspect is to implement procedures and systems to maintain existing systems to ensure business continuity. This often involves day to day operational activities. Another aspect is to implement technology to rapidly respond to changing regulations impacting our customers. Meeting these changing regulations often necessitates new IT infrastructure and/or system engineering changes to custom-developed software.
- *Protect cyber security assets.* Increased emphasis on protecting IT resources from cyber security threats and intrusions has increased the need to procure and implement cyber security infrastructure. The Federal Information Security Management Act (FISMA) and the National Institute of Standards and Technology (NIST) provide policies and guidelines for implementing cyber security protection measures. Meeting these policies and guidelines often means procuring and implementing computer hardware and software such as remote access software, firewalls, screening routers, network/host/application intrusion detection, encryption, virus protection, vulnerability scanning, and user authentication.

Strategies

Improve the operational effectiveness and efficiency of Western's IT functions.

- Maximize resource efficiencies by consolidating systems, automating processes, and implementing process improvements.
- Support and continue implementation of a Western-wide Enterprise Architecture
- Continue to work on the Desert Southwest Region And Rocky Mountain Region Technology Sharing (DARTS) program. This effort continuously works towards a common environment between the two regions.

Deliver customer-focused products and services.

- Implement procedures and systems to maintain and secure existing systems to ensure business continuity.
- Use IT that readily accommodates industry changes.
- Advocate and implement E-government initiatives.

Protect cyber security assets.

- Advocate and implement NIST accredited and certified systems.
- Provide peer review audits that contribute to improved protection of cyber security assets.
- Ensure the security of Western's IT assets.

6.1.7.2 Buildings and Facility Improvements

Background

Western owns, operates and maintains more than 240 buildings and property in support of power system operations. These buildings house electrical equipment used in power system control, protection and communication; as well as equipment and personnel throughout the states of Colorado, Wyoming, Utah, Montana, and Nebraska. Since the buildings house equipment and personnel critical to successful system operations, the condition of these buildings directly affects the reliability of the power system. Additionally, these buildings and property represent a significant capital plant investment.

Program Goal

The goal of the Buildings and Facility Improvement program is to ensure all buildings and properties in the Region provide adequate function, protection, safety and security in support of reliable power system operations. This requires the construction, maintenance and refurbishment of facilities in a manner that assures peak power system efficiency and protection of long-term capital investments.

Challenges

- *Aging facilities require upgrading and refurbishment.* Many buildings were constructed in the early development years of the power system. As such, many are not protected by some of the more recent technology advances in systems like roofing, pavements, exterior siding, HVAC equipment and controls, fire detection and suppression, energy efficient glazing and lighting, etc. and are in a deteriorating state. The advanced design standards and technology of today present opportunities to make facility improvements that will extend service life and mitigate concern for functional performance.
- *Remote location and limited access increase reliability concern.* Communication facilities typically reside in remote, environmentally harsh, mountain top and seasonally accessible locations. This situation most often causes accelerated deterioration of exposed building components, limits the ability to monitor physical conditions, and makes the need to assure the protective integrity of the facility most critical.
- *Deferring maintenance results in higher risk and cost associated with reliability and refurbishment.* It is most efficient to provide timely detection and correction of deteriorating buildings and facilities before they escalate, over time, to an eventual expensive emergency repair or replacement project. A program that includes routine maintenance of buildings, periodic inspection and assessment of aging facilities, upgrading of building systems, and

planning and budgeting of repair or refurbishment projects will provide significant corrective measures that extend the service life of facilities. This approach should best ensure equipment protection, system reliability, and optimal service life with the least amount of financial impact.

- *Ancillary projects can add additional cost to the capital program.* Mandated or regulated requirements concerning energy conservation, safety, security, and environmental compliance (i.e. asbestos abatement, lead based paint, wood preservatives, spill containment, erosion control, etc.) will continue to require capital funds for facility upgrades and replacements. The impacts will continue to be mitigated by addressing environmental and energy conservation needs in all facility design and construction projects; whether they are refurbishing, upgrades, replacement or new requirements type projects.

Strategies

Perform physical inspection, condition reporting, data collection and remediation recommendations for all buildings and property in a prescribed format and time period.

- Perform periodic inspections that mitigate deferred maintenance and undetected problems that accelerate the aging process of building components and systems.
- Report and monitor conditions that may lead to extensive deterioration of the facility.
- Identify and initiate projects in a manner that plan and program funding in a long-term budget without high cost impacts.
- Continue the current roof inspection, maintenance, and replacement program.
- Implement a program unique to the needs of remote locations in harsh environments.
- Identify unique design standards that provide extended service life without adding substantial cost or routine maintenance.

6.2 Project Initiation Documents

The Project Initiation Documents (PIDs) are prepared for the initial description, justification, and scheduling of capital projects and do not necessarily show the current status of each project. PIDs are created for specific capital projects and equipment replacements shown in the Plan, but are not provided for generic line items such as “Battery and Charger Replacements,” etc.

Copies of PIDs for specific projects listed in the Plan are not included in this document, but are available upon request from Western