THE UNIVERSITY OF NORTH DAKOTA

Facilities Management

# Integrated Resource Plan

Submitted to the

Western Area Power Administration

August 10, 2012

UNIVERSITY OF UND NORTH DAKOTA

FACILITIES MANAGEMENT
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August 10, 2012

Amanda Schlosser
Western Area Power Administration
2900 4th Ave. North
Billings, Mt 59107-5800

Dear Ms. Schlosser

The University of North Dakota to Western Area Power Administration respectively submits the Integrated Resource Plan five year report. The data in this report is based on the University of North Dakota's fiscal year 2011/2012. UND's fiscal year is July 01 to June 30th.

Once you receive the update please review and comment. I will be at your disposal for questions and/or additions as required.

Sincerely

Larry Zitzow, Director of Facilities

Cc: James Bach, Western Area Power Administration
Randall Bohlman, University of North Dakota

UND is an equal opportunity/affirmative action institution

# University of North Dakota
# Integrated Resource Plan

## 5 Year Report
## For
## UND Fiscal Year 2011/2012

## Submitted to the
## Western Area Power Association
## August 10, 2012

**Report Prepared by:**
**Randall Bohlman; CEM, CMVP, CDSM**

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# Introduction

The University of North Dakota as a member of the North Dakota University System serves the state, the country, and the world community through teaching, research, creative activities and service. Within the University, the Facilities Department is responsible for the utility management for the entire campus. The Facilities Department provides the utility services to over 239 buildings with a combined square footage of 6,432,502. UND's 547.83-acre campus is regarded as one of the most beautiful in the region.

This Integrated Resource Plan (IRP) includes the resource and load management options that best fit the University's forecasted energy and economic requirements. This IRP does discuss how to maintain and/or improve electrical service to the University community, sustain the most economical electrical rates, reduce energy usage through energy management, and minimize environmental impacts.

The University of North Dakota's utility type is classified as a state agency and is a Western Area Power end-use customer. This document has been prepared to fulfill the IRP requirement of the Western Area Power Administration.

# Brief Description of UND

The University of North Dakota (UND) is located in Grand Forks on the North Dakota-Minnesota border. Established in 1883, six years before statehood, UND is a coeducational, state-supported institution with an enrollment of 14,697 (fall of 2011) students. 41% come from North Dakota; the rest represent all other states, eight Canadian provinces and more than 50 nations. The University is the state's most comprehensive research university and the primary center for professional education and training.

The University was founded on and still maintains its solid foundation of the liberal arts along with professional and specialized programs. It is one of only 47 public universities in the nation with both accredited graduate schools of law and medicine. The University has earned an international reputation for its academic and research programs; earning the title as one of the top 100 doctoral research universities in the nation.

Research, scholarship and creative activity make up an important part of life at UND. External grants received by UND in 2011-2012 totaled more than $100 million.

Undergraduate and graduate programs are offered in 224 fields of study with 2,615 courses. Colleges and schools include Arts and Sciences, Aerospace Sciences, Business and Public Administration, Education and Human Development, Engineering and Mines, Graduate School, Law, Medicine and Health Sciences, Nursing. The Division of Continuing Education offers correspondence courses, work force development, degree after hours programs, distance degree programs, and professional development programs.

The University has 342 tenured and 177 tenure-track faculty, 990 professional and research staff, and 2,868 general staff. This makes it the largest employer in the region.

# University of North Dakota's

# Mission Statement

The University of North Dakota, as a member of the North Dakota University System, serves the state, the country, and the world community through teaching, research, creative activities, and service. State-assisted, the University's work depends also on federal, private, and corporate sources. With other research universities, the University shares a distinctive responsibility for the discovery, development, preservation, and dissemination of knowledge. Through its sponsorship and encouragement of basic and applied research, scholarship, and creative endeavor, the University contributes to the public well-being.

The University maintains its original mission in liberal arts, business, education, law, medicine, engineering and mines; and has also developed special missions in nursing, fine arts, aerospace, energy, human resources, and international studies. It provides a wide range of challenging academic programs for undergraduate, professional and graduate students through the doctoral level. The University encourages students to make informed choices, to communicate effectively, to be intellectually curious and creative, to commit themselves to lifelong learning and the services of others, and to share responsibility both for their own communities and for the world. The University promotes cultural diversity among its students, staff and faculty.

In addition to its on-campus instructional and research programs, the University of North Dakota separately and cooperatively provides extensive continuing education and public service programs for all areas of the state and region

# University of North Dakota Master Organizational Chart

## President

President of the University: *Robert O. Kelley*

Vice President for Academic Affairs and Provost: *Paul LeBel*

Vice President for Finance and Operations: *Alice Brekke*

Vice President for Health Affairs and Dean of the School of Medicine and Health Sciences: *Joshua Wynne*

Vice President for Research and Economic Development: *Phyllis E. Johnson*

Vice President for Student Affairs: *Lori Reesor*

Vice President for University and Public Affairs: *Susan Balcom Walton*

**Reporting Directly to President Kelley**

Athletics: *Brian Faison*

Energy & Environmental Research Center: *Gerald Groenewold*

General Counsel: *Julie Evans*

Internal Auditor: *Tim Rerick*

*Effective July 1, 2012*

## Academic Affairs

Vice President for Academic Affairs and Provost: *Paul LeBel*

Associate Vice President for Academic Affairs: *Steven Light*

John D. Odegard School of Aerospace Sciences: *Bruce Smith*

College of Arts and Sciences: Kathleen Tiemann *(interim)*

College of Business and Public Administration: *Dennis Elbert*

College of Education and Human Development: *Dennis Caine (interim)*

College of Engineering and Mines: *Hesham El-Rewini*

Graduate School: *Wayne Swisher (interim)*

School of Law: *Kathryn Rand*

College of Nursing: *Denise Korniewicz*

Assessment and Regional Accreditation: *Joan Hawthorne*

Center for Community Engagement: *Lara Rakow*

Center for Instructional and Learning Technologies/ Information Technology Systems and Services (ITSS): *Lori Swinney*

Chester Fritz Library: *Wilbur Stolt*

Conflict Resolution Center: *Kristine Paranica*

Essential Studies: *Thomas Steen*

Honors Program: *Sally Pyle*

Institutional Research: *Carmen Williams*

Instructional Development: *Anne Kelsch*

International Programs: *Raymond Lagasse*

Office of Extended Learning: *Lynette Krenelka*

Registrar: *Suzanne Anderson*

Summer Sessions: *Diane Madden*

## Finance & Operations

Vice President for Finance and Operations: *Alice Brekke*

Associate Vice Presidents for Finance and Operations: *Peggy Lucke, Margaret Myers*

**Reporting to Vice President Brekke**

Budget: *Cindy Felsch*

Campus Capital Projects and Planning: *Rick Tonder*

Chief Information Officer: *Joshua Riedy*

Emergency Management and Public Safety: *Terry Sando*

- Environmental Training Institute: *Linda Rohde*
- Risk Management/Radiation Safety: *Jason Uhlir*
- University Police: *vacant*

Facilities Management: *Larry Zilzow*

- Maintenance and Building Services: *Paul Clark*
- Trades and In-House Construction: *Mark Johnson*

Human Resources and Payroll Services: *Pat Hanson*

Rates and Costing: *Dawn Pladson*

**Reporting to Associate Vice President Lucke**

Controller: *Sharon Loiland*

- Assistant Controller/Student Account Services: *Lisa Heher*
  - Student Account Operations: *Chelsea Larson*
  - Student Account Relations: *Matt Lukach*
- Accounting Services: *Allison Peyton*
- Asset Management: *Hazel Lehman*
- Purchasing: *Scott Schreiner*

Parking Services: *Robyn Bancroft*

Transportation: *Mary Metcalf*

**Reporting to Associate Vice President Myers**

Bookstore: *Marie Mack*

Chester Fritz Auditorium: *Betty Allen*

Duplicating Services: *Sherry Metzger*

Mailing Services: *Darin Lee*

Printing Center: *Lowell Brandner*

Ray Richards Golf Course: *Dustin Hellelved*

U Card and Access Systems: *Teresa Billie*

## Health Affairs & Medicine

Vice President for Health Affairs and Dean of the School of Medicine and Health Sciences: *Joshua Wynne*

Senior Associate Dean for Academic and Faculty Affairs: *Gwen Halaas*

**Reporting to Vice President and Dean Wynne**

Academic and Faculty Affairs: *Gwen Halaas*

Administration and Finance: *Randy Eken*

Alumni and Community Relations: *Jessica Soboilk*

Center for Rural Health: *L. Gary Hart*

Research: *vacant*

Student Affairs and Admissions: *Jocelyn Dorscher*

**Reporting to Senior Associate Dean Halaas**

Chief Information Officer: *Nasser Hammami*

Clinical Education: *Charles Christianson*

Continuing Medical Education: *Gwen Halaas*

Faculty Development: *Patrick Carr*

Graduate Medical Education and Designated Institutional Officer: *David Thielge*

Harley French Library of the Health Sciences: *Lila Pedersen*

Indians Into Medicine Program: *Eugene DeLorme*

Preclinical Education: *Thomas Hill*

Undergraduate and Graduate Education: *Kenneth Ruit*

Veterans Affairs: *William Newman*

Northeast Campus (Grand Forks): *Jon Allen*

Northwest Campus (Minot): *Martin Rothberg*

Southeast Campus (Fargo): *Julie Blehm*

- Assistant Dean for Students (Southeast Campus - Fargo): *Steffen Christensen*

Southwest Campus (Bismarck): *Nicholas Neumann*

## Research & Economic Development

Vice President for Research and Economic Development: *Phyllis E. Johnson*

Associate Vice President for Research and Economic Development—Research Development and Compliance: *Barry Milavetz*

Associate Vice President for Intellectual Property Commercialization and Economic Development: *Michael Moore*

Associate Vice President for Research Capacity Building/North Dakota Experimental Program to Stimulate Competitive Research (ND EPSCoR) Co-Project Director: *Mark Hoffmann*

Assistant Vice President for Research and Economic Development—Grants and Contracts Administration: *David Schmidt*

Center for Biomedical Research: *Kap Lee*

Computational Research Center: *Mark Hoffmann*

Grand Forks Human Nutrition Research Center—State Operations: *Linda Hurst Torgerson*

**Liaison Relationship**

Grand Forks Human Nutrition Research Center (Agricultural Research Service, U.S. Department of Agriculture): *Gerald Combs, director*

## Student Affairs

Vice President for Student Affairs: *Lori Reesor*

Associate Vice President for Student Services and Dean of Students: *Cara Halgren*

Associate Vice President for Health and Wellness: *Laurie Betting*

Assistant Vice President for Student Affairs: *Lisa Burger*

Director of Residence Services: *Judy Sargent*

**Reporting to Assistant Vice President Burger**

Admissions: *Deb Melby*

Career Services: *Ilene Odegard (interim)*

Student Financial Aid: *Janelle Kilgore (interim)*

Student Success Center: *Angie Carpenter (interim)*

**Reporting to Associate Vice President Halgren**

American Indian Student Services: *Leigh Jeanette*

Disability Support Services: *Deborah Gleason*

Judicial Affairs: *vacant*

Memorial Union: *Tony Trimarco*

Multicultural Student Services: *Malika Carter*

Student Involvement and Leadership: *Cassie Gerhardt*

Women's Center: *Kay Mendick*

**Reporting to Associate Vice President Betting**

Counseling Center: *Myron Veenstra*

Health and Wellness Education and Outreach: *Jane Croaker*

Student Health Services: *Michelle Eslinger*

Student Wellness Center: *Yvette Halverson*

TRIO Programs: *Elaine Metcalfe*

**Reporting to Residence Services Director Sargent**

Dining Services/Vending: *Orlynn Rosaasen*

Housing: *Judy Sargent*

University Children's Center: *Jo-Anne Yearwood*

## University & Public Affairs

Vice President for University and Public Affairs: *Susan Balcom Walton*

Executive Associate Vice President for University Relations: *Peter Johnson*

**Reporting to Vice President Walton**

Budget Manager: *Pam Walters*

Director of Ceremonies and Special Events: *Fred Wittmann*

**Reporting to Executive Associate Vice President Johnson**

e-Marketing and Communications: *Tim DeBolt*

Television and Radio: *Barry Brode*

University Relations: *Peter Johnson*

Workforce Development: *Galen Carivoau*

# THE SCOPE OF

# FACILITIES MANAGEMENT

Within the University, the Facilities Management Department is responsible for caring, repairing, and updating of all the buildings, as well as monitoring and controlling their interior environments and managing utilities.

Academic and scholastic achievement and campus environments are dependent upon three major components:

1. Clean and sanitary buildings
2. Dependable utility systems
3. Responsive support services.

Knowing this, the Facilities Management Department is dedicated to maintaining the excellent standards of the past but we are also cognizant of the need to respond to the ever-changing needs of a progressive institution.

The Facilities Management Department has a total staff of 276 full-time employees, and 59 temporary/student staff.

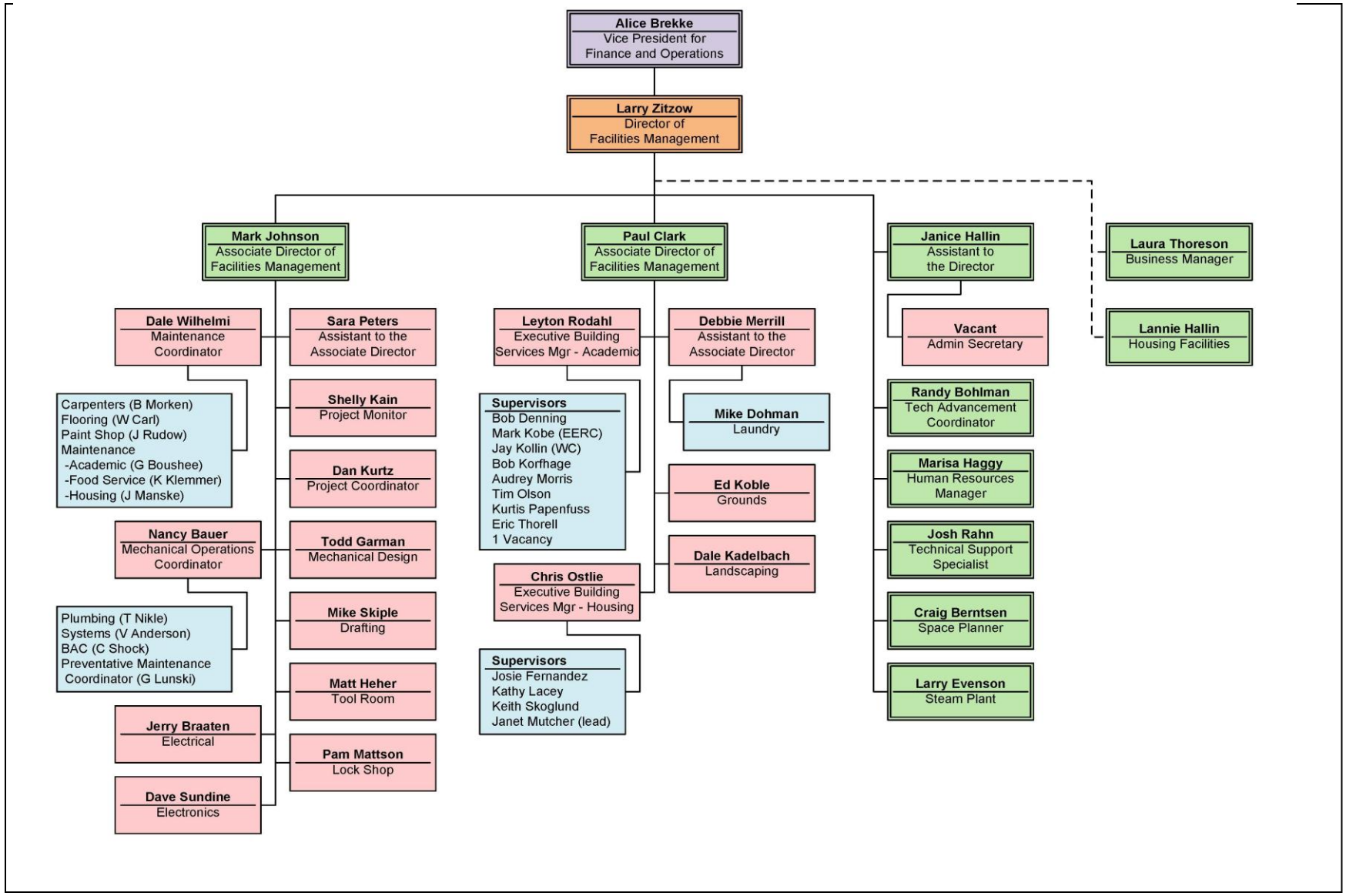
## FACILITIES MISSION STATEMENT

The mission of the Facilities Department is to establish and maintain an environment conducive to working and learning within the University of North Dakota community for its students, staff, employees, and visitors.

## FACILITIES VISION STATEMENT

The vision of the Facilities Department is to achieve its mission with efficiency and amiability.

# Facilities Management Organizational Chart



# POWER CONTRACTS, GENERATION & TRANSMISSION FACILITIES

**Western Area Power Administration**

The University of North Dakota has a fixed rate of delivery contract with Western Area Power Administration (WAPA). Western Area Power Administration is the primary power supplier to the University with wheeling by Xcel Energy.

**Western Area Power Administration Allocations**

| Month | 2011 WAPA Allocation KW | 2011 WAPA Allocation KWH |
|---|---|---|
| July | 7,631 | 3,729,000 |
| August | 7,573 | 3,924,000 |
| September | 7,735 | 4,349,000 |
| October | 7,407 | 4,061,000 |
| November | 6,369 | 3,495,000 |
| December | 6,409 | 3,620,000 |
| January | 6,228 | ,3,260,000 |
| February | 6,369 | 3,760,000 |
| March | 6,334 | 3,110,000 |
| April | 6,326 | 3,380,000 |
| May | 7,608 | 3,733,000 |
| June | 6,987 | 3,641,000 |
| Total | | **44,062,000** |

## Xcel Energy

Xcel Energy provides all additional supplemental power needs that exceed the Western Area Power Administration's allocation to UND. Xcel Energy provides three 12.47/7.2KV points of delivery to the campus as follows:

1. The main body of campus is fed from Xcel's circuits Nor25 and Nor35 from the Nordic substation located on Columbia Road at Knight Drive. An alternate service can also be obtained at this location from Xcel's circuit Nor31 and GAT 33.
2. The School of Medicine service is fed from Xcel's Gateway 33 circuit, from the Gateway substation located on 5th Avenue North. An alternate service can also be obtained at this location from Xcel's GAT 23.
3. The Bronson Property service is fed from Xcel's Gateway 33 circuit, from the Gateway substation located on 5th Avenue North. An alternate service can also be obtained at this location from Xcel's GAT 23 and GAT31.

There are also major campus buildings which are presently serviced directly by Xcel Energy. These include the Ryan Hall, Skalicky Technology Incubator (west of 42nd Street), and Clifford Hall.

As of December 2004 all of the WAPA energy and supplemental energy is totalized and distributed to all three medium voltage feed points; Nordic, School of Medicine, and Bronson Property. This reconfiguration of our transmission agreement allows us to inject power from a single generation point and utilize the WAPA energy throughout the campus.

## University of North Dakota Diesel Generation

UND currently has seven diesel generation units in operation with a total capacity of 11,425 KW. The UND Steam Plant contains a 1,375 KW unit, the School of Medicine facilities contains a 1,650 KW unit, the Biomedical Research Center has a 500 KW unit, the Facilities generator farm and the Nordic feed point has three 1,850 units, and newest generator added to the fleet, the Wellness Generator serving the Bronson Property Service.

These diesel generation units are normally used as peaking generation units in conjunction with Xcel Energy's "Energy Control Periods". The generator sets operate in continuous parallel with the utility and are modulated by our central control center.

These generators can also provide backup power in emergency situations.

## Transmission Facilities

The University of North Dakota campus is presently served from Xcel Energy's three separate distribution sources at 12.47 kV. The delivery points are strategically located throughout the campus. At each distribution point metal-clad switchgear protects the 12.47 kV circuits. The switchgear is fed from Xcel and serves the University-owned primary distribution system which consists of 12.47 kV and 4.16 kVcable feeders in underground ducting. The electrical transmission infrastructure totals 74,582 linear feet of distribution lines valued at $ $10,979,033.

These transmission facilities were evaluated by Stanley Consultants in 2012. The results of this report have provided updated inventory, costs and conditions of the transmission facilities.

# Geographic and Weather Data

The University of North Dakota's geographic location is in the northern central part of the United States. Because of our extreme northern geographic location our weather would be classified as extremely diverse.

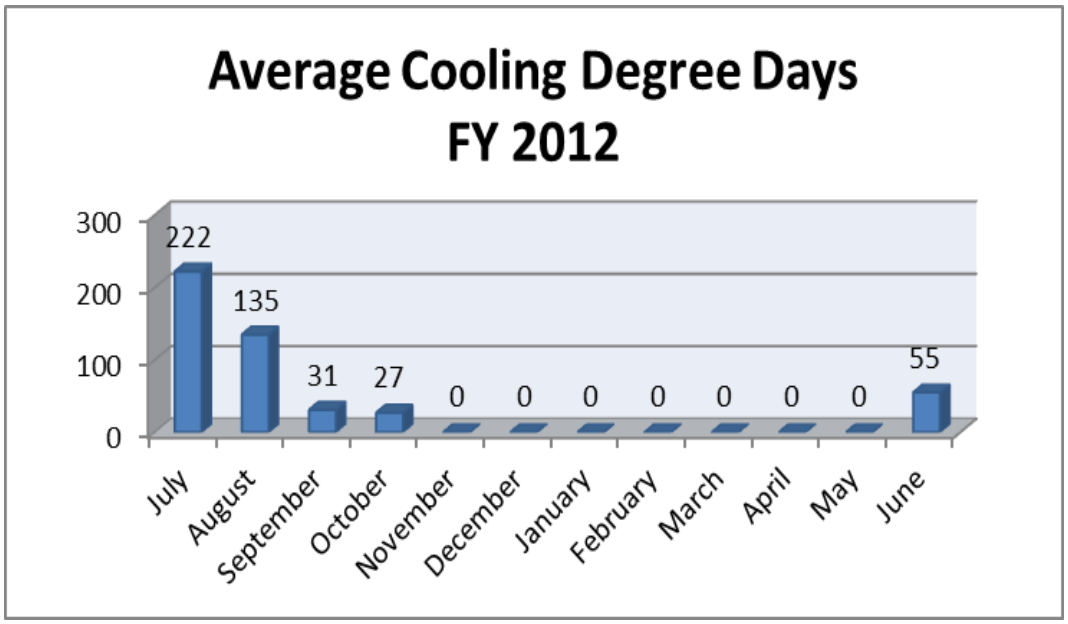
The average winter temperature for the University of North Dakota is 24.6 $^{o}$F. The average summer temperature for the University of North Dakota is 76.1 $^{o}$F. The median of annual temperature extremes are a maximum of 97.6 $^{o}$F. for summer and the minimum is -29.0 $^{o}$F for winter.

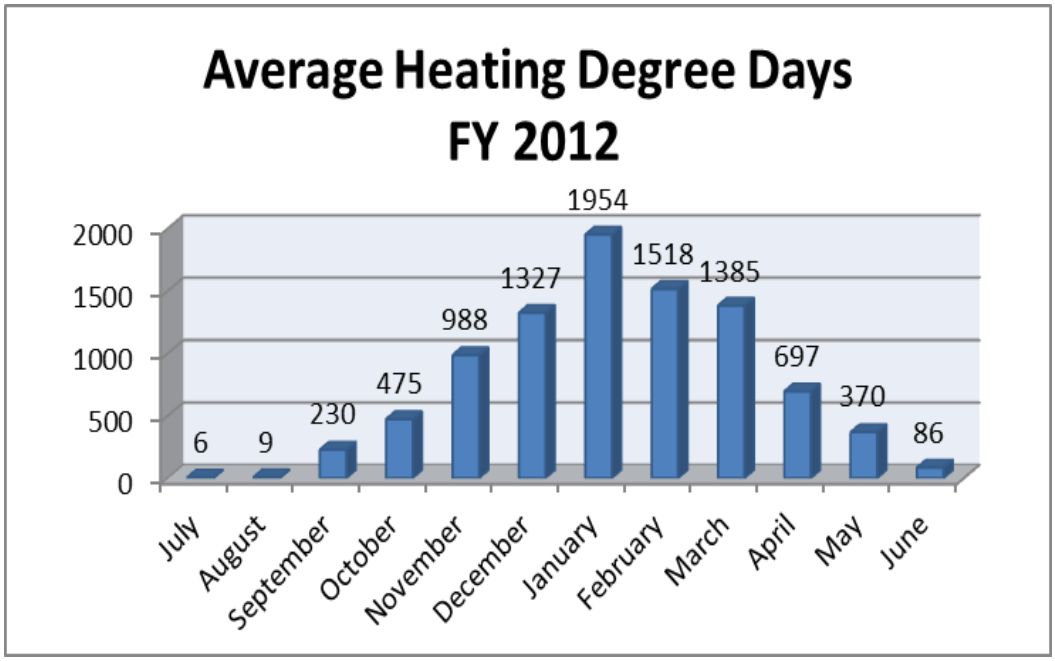
Heating and cooling degree days are recorded and maintained at the University of North Dakota. A cooling degree day (CDD) is the difference of the average daily temperature above 65 $^{o}$F. A heating degree day (HDD) is the difference of the average daily temperature below 65 $^{o}$F. The average daily temperature is the average of the difference between the recorded low and high temperatures for each day. Based on records maintained from 1990 to June of 2012, the annual average of heating degree days is 9,369 HDD's and the annual average of cooling degree days is 524 CDD's.

Weather data for the University of North Dakota is collected by the Geography Department of UND.

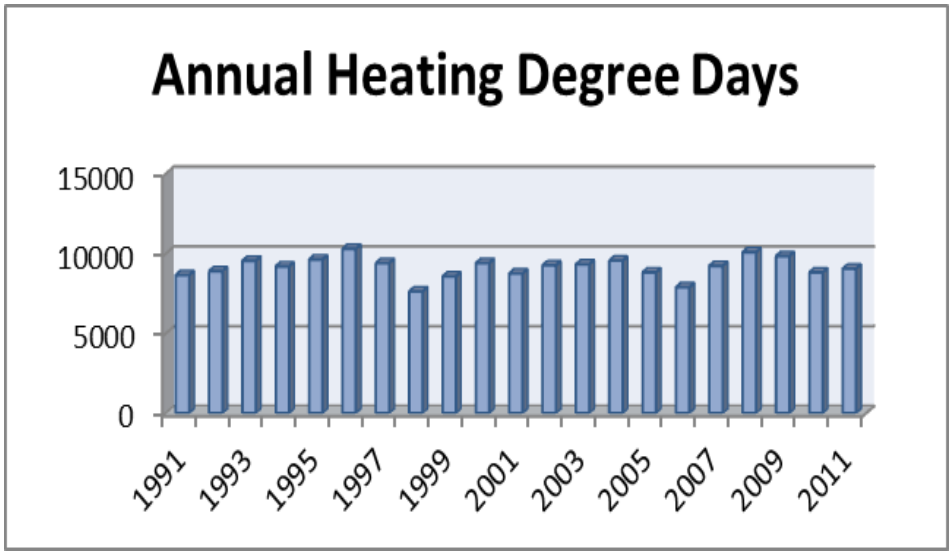
**Average Degree Days for FY 2012**

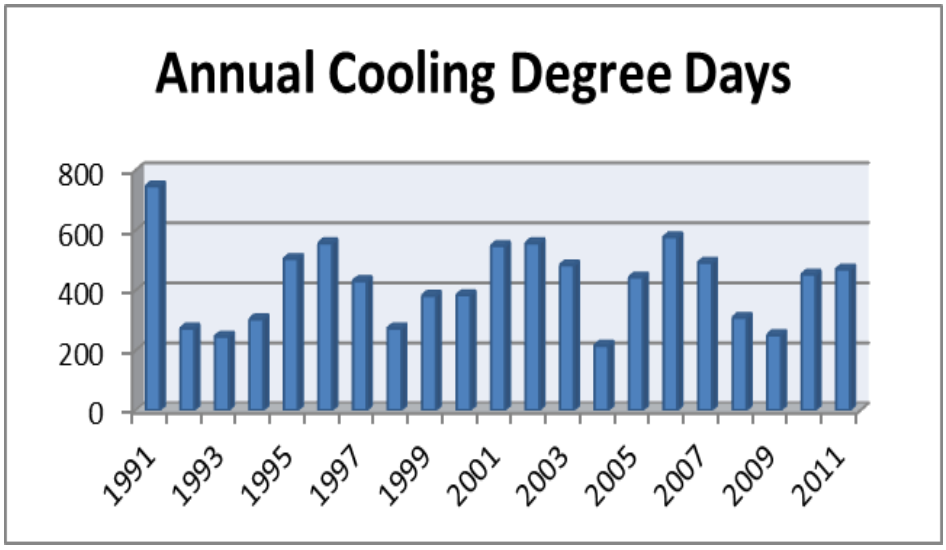
| Month | Average CDD FY 12 | Average HDD FY 12 |
|---|---|---|
| July | 222 | 6 |
| August | 135 | 9 |
| September | 31 | 230 |
| October | 27 | 475 |
| November | 0 | 988 |
| December | 0 | 1327 |
| January | 0 | 1954 |
| February | 0 | 1518 |
| March | 0 | 1385 |
| April | 0 | 697 |
| May | 0 | 370 |
| June | 55 | 86 |
| **Total** | **470** | **9045** |


Average Cooling Degree Days
FY 2012
300
200
100
0
222
135
31
27
0
0
0
0
0
0
0
55
July
August
September
October
November
December
January
February
March
April
May
June


Average Heating Degree Days
FY 2012
2000
1500
1000
500
0
6
9
230
475
988
1327
1954
1518
1385
697
370
86
July
August
September
October
November
December
January
February
March
April
May
June

| Year | HDD | CDD |
|---|---|---|
| 1991 | 8649 | 747 |
| 1992 | 8899 | 273 |
| 1993 | 9547 | 246 |
| 1994 | 9202 | 304 |
| 1995 | 9632 | 505 |
| 1996 | 10296 | 557 |
| 1997 | 9404 | 431 |
| 1998 | 7619 | 273 |
| 1999 | 8560 | 382 |
| 2000 | 9402 | 384 |
| 2001 | 8753 | 548 |
| 2002 | 9266 | 557 |
| 2003 | 9324 | 484 |
| 2004 | 9563 | 216 |
| 2005 | 8825 | 443 |
| 2006 | 7888 | 577 |
| 2007 | 9227 | 492 |
| 2008 | 10088 | 309 |
| 2009 | 9843 | 251 |
| 2010 | 8818 | 453 |
| 2011 | 9045 | 470 |
| **TOTAL** | 191850 | 8902 |



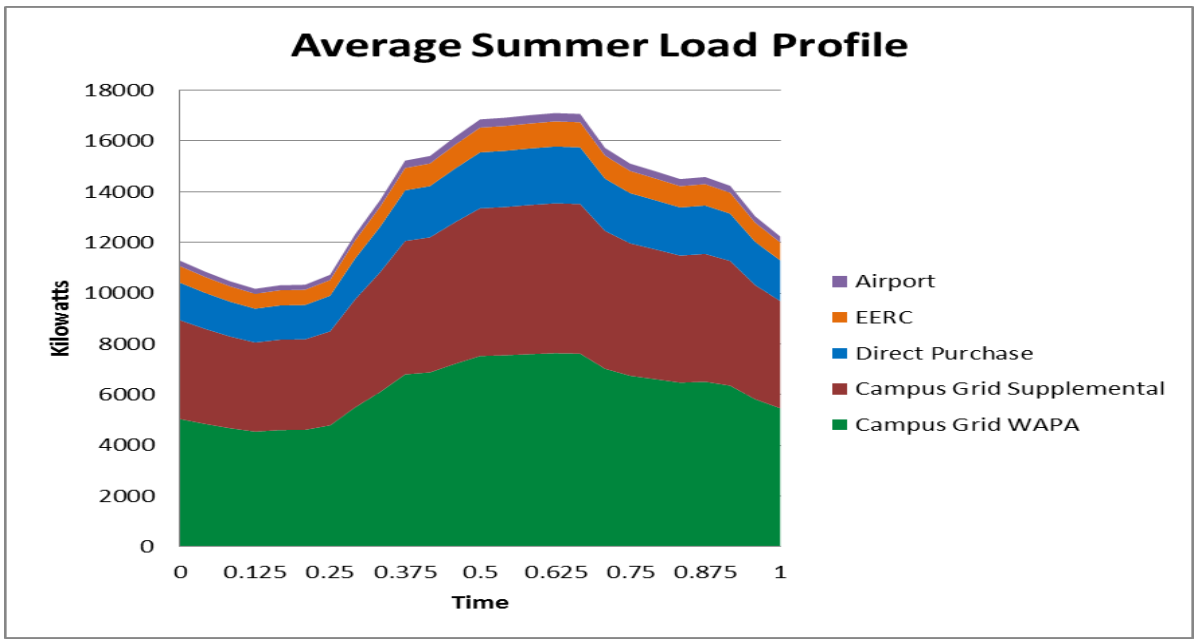



# LOAD PROFILES

The University of North Dakota is a summer peaking facility. Below is an average load profile for a typical summer weekday. This summer load profile is with peak demand load management practices applied. Combined demand of all service points is illustrated in the chart below

## Daily Summer Load Profile

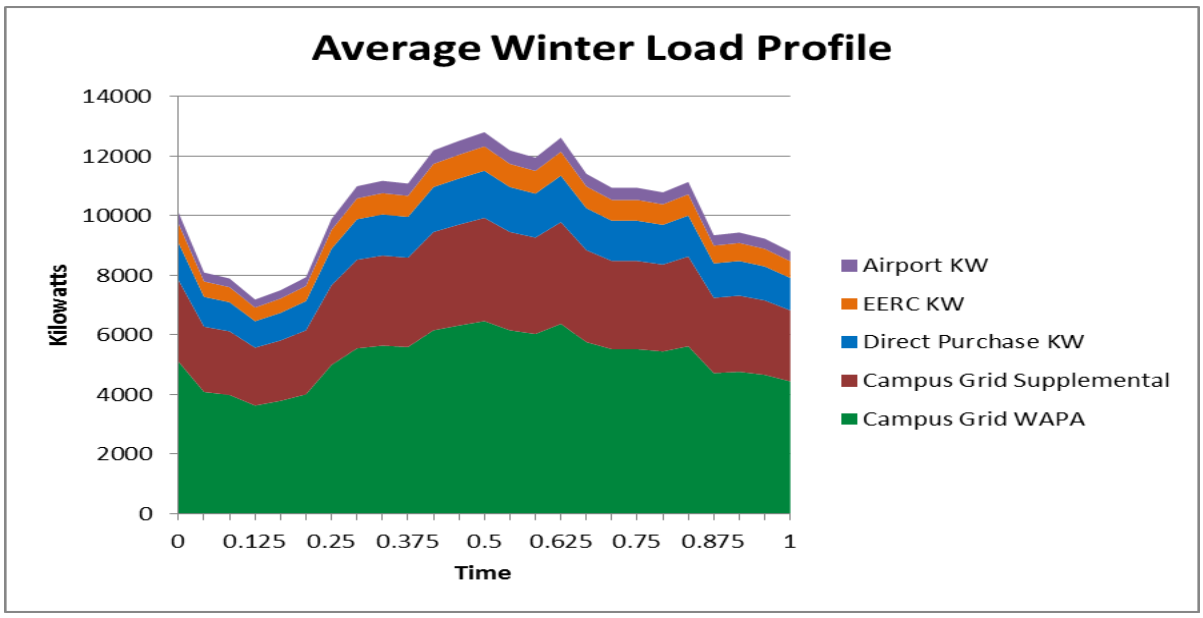
| Time | Campus Grid WAPA KWH | Campus Grid Supplemental KWH | Direct Purchase KWH | EERC KWH | Airport KWH |
|---|---|---|---|---|---|
| 0:00 | 5,033 | 3,900 | 1,479 | 653 | 217 |
| 1:00 | 4,841 | 3,751 | 1,422 | 628 | 209 |
| 2:00 | 4,671 | 3,619 | 1,372 | 606 | 202 |
| 3:00 | 4,538 | 3,516 | 1,333 | 589 | 196 |
| 4:00 | 4,600 | 3,564 | 1,352 | 597 | 198 |
| 5:00 | 4,610 | 3,572 | 1,354 | 598 | 199 |
| 6:00 | 4,784 | 3,707 | 1,406 | 621 | 206 |
| 7:00 | 5,495 | 4,258 | 1,614 | 713 | 237 |
| 8:00 | 6,099 | 4,726 | 1,792 | 791 | 263 |
| 9:00 | 6,795 | 5,265 | 1,996 | 882 | 293 |
| 10:00 | 6,876 | 5,328 | 2,020 | 892 | 297 |
| 11:00 | 7,212 | 5,588 | 2,119 | 936 | 311 |
| 12:00 | 7,520 | 5,827 | 2,209 | 976 | 324 |
| 13:00 | 7,550 | 5,850 | 2,218 | 980 | 326 |
| 14:00 | 7,594 | 5,884 | 2,231 | 985 | 328 |
| 15:00 | 7,631 | 5,913 | 2,242 | 990 | 329 |
| 16:00 | 7,616 | 5,902 | 2,238 | 988 | 329 |
| 17:00 | 7,017 | 5,437 | 2,062 | 910 | 303 |
| 18:00 | 6,741 | 5,224 | 1,981 | 875 | 291 |
| 19:00 | 6,608 | 5,120 | 1,941 | 857 | 285 |
| 20:00 | 6,469 | 5,013 | 1,901 | 839 | 279 |
| 21:00 | 6,506 | 5,041 | 1,911 | 844 | 281 |
| 22:00 | 6,351 | 4,921 | 1,866 | 824 | 274 |
| 23:00 | 5,815 | 4,506 | 1,708 | 755 | 251 |
| 0:00 | 5,459 | 4,230 | 1,604 | 708 | 236 |



Our winter peak normally occurs in January or February when the weather is the most severe and in conjunction with a high level of activities on campus. Note the difference in load factors between summer and winter. This is partially attributed to the large amount of evening activities within the campus facilities. This winter load profile is with peak demand load management practices applied.

## Daily Winter Load Profile

| Time | Campus Grid WAPA KW | Campus Grid Supplemental KW | Direct Purchase KW | EERC KW | Airport KW |
|---|---|---|---|---|---|
| 0:00 | 5,100 | 2,734 | 1,248 | 645 | 376 |
| 1:00 | 4,085 | 2,190 | 1,000 | 516 | 301 |
| 2:00 | 3,984 | 2,136 | 975 | 504 | 294 |
| 3:00 | 3,627 | 1,944 | 888 | 458 | 267 |
| 4:00 | 3,784 | 2,029 | 926 | 478 | 279 |
| 5:00 | 4,006 | 2,147 | 981 | 506 | 295 |
| 6:00 | 4,991 | 2,675 | 1,222 | 631 | 368 |
| 7:00 | 5,547 | 2,973 | 1,358 | 701 | 409 |
| 8:00 | 5,638 | 3,022 | 1,380 | 713 | 416 |
| 9:00 | 5,592 | 2,998 | 1,369 | 707 | 412 |
| 10:00 | 6,154 | 3,299 | 1,506 | 778 | 454 |
| 11:00 | 6,315 | 3,385 | 1,546 | 798 | 465 |
| 12:00 | 6,461 | 3,463 | 1,582 | 817 | 476 |
| 13:00 | 6,154 | 3,299 | 1,506 | 778 | 454 |
| 14:00 | 6,031 | 3,233 | 1,476 | 762 | 444 |
| 15:00 | 6,369 | 3,414 | 1,559 | 805 | 469 |
| 16:00 | 5,757 | 3,086 | 1,409 | 728 | 424 |
| 17:00 | 5,520 | 2,959 | 1,351 | 698 | 407 |
| 18:00 | 5,520 | 2,959 | 1,351 | 698 | 407 |
| 19:00 | 5,443 | 2,918 | 1,332 | 688 | 401 |
| 20:00 | 5,618 | 3,012 | 1,375 | 710 | 414 |
| 21:00 | 4,716 | 2,528 | 1,154 | 596 | 348 |
| 22:00 | 4,762 | 2,553 | 1,166 | 602 | 351 |
| 23:00 | 4,658 | 2,497 | 1,140 | 589 | 343 |
| 0:00 | 4,442 | 2,381 | 1,087 | 561 | 327 |

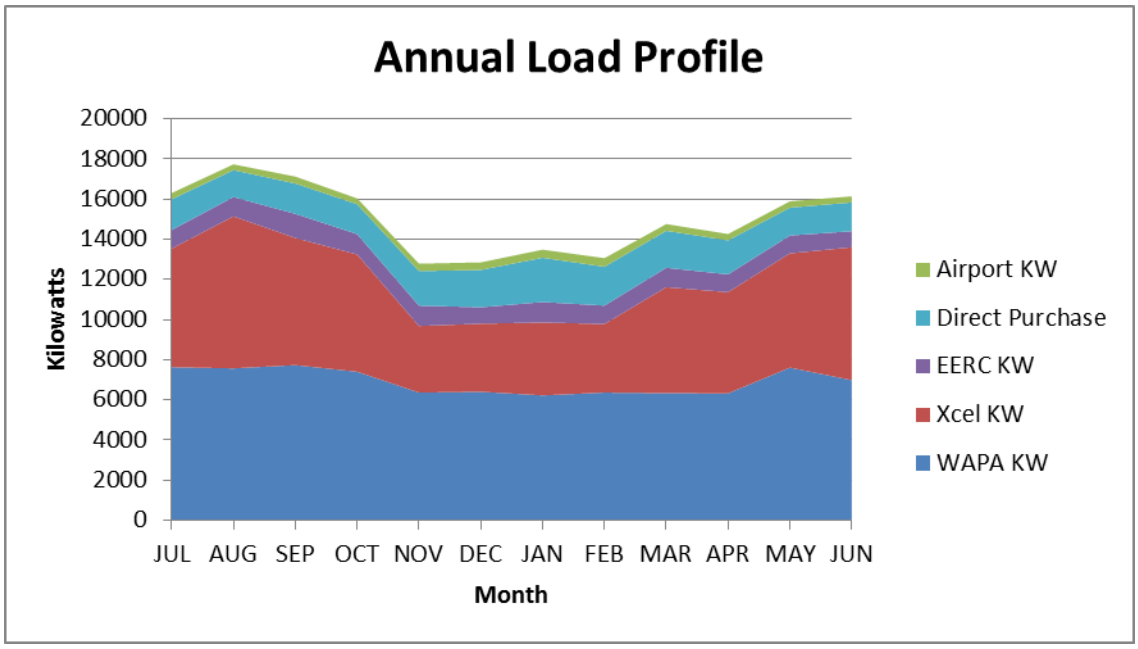


A monthly load profile for the campus grid is identified in the charts below. The charts identify the total KW for the campus electrical grid and the respective resources.

**ANNUAL LOAD PROFILE**

| Month | Xcel KW | Airport KW | EERC KW | Direct Purchase | Total KW |
|---|---|---|---|---|---|
| JUL | 5,913 | 307 | 924 | 1,534 | 16,310 |
| AUG | 7,574 | 290 | 964 | 1,339 | 17,740 |
| SEP | 6,337 | 344 | 1,201 | 1,510 | 17,127 |
| OCT | 5,839 | 285 | 1,017 | 1,492 | 16,040 |
| NOV | 3,314 | 368 | 1,016 | 1,722 | 12,790 |
| DEC | 3,392 | 376 | 817 | 1,859 | 12,852 |
| JAN | 3,630 | 404 | 1,020 | 2,206 | 13,488 |
| FEB | 3,414 | 428 | 919 | 1,936 | 13,065 |
| MAR | 5,284 | 338 | 968 | 1,839 | 14,764 |
| APR | 5,045 | 316 | 885 | 1,695 | 14,267 |
| MAY | 5,695 | 318 | 893 | 1,385 | 15,899 |
| JUN | 6,620 | 305 | 800 | 1,432 | 16,144 |

A monthly load profile for the campus electrical grid is graphically identified in the following chart:

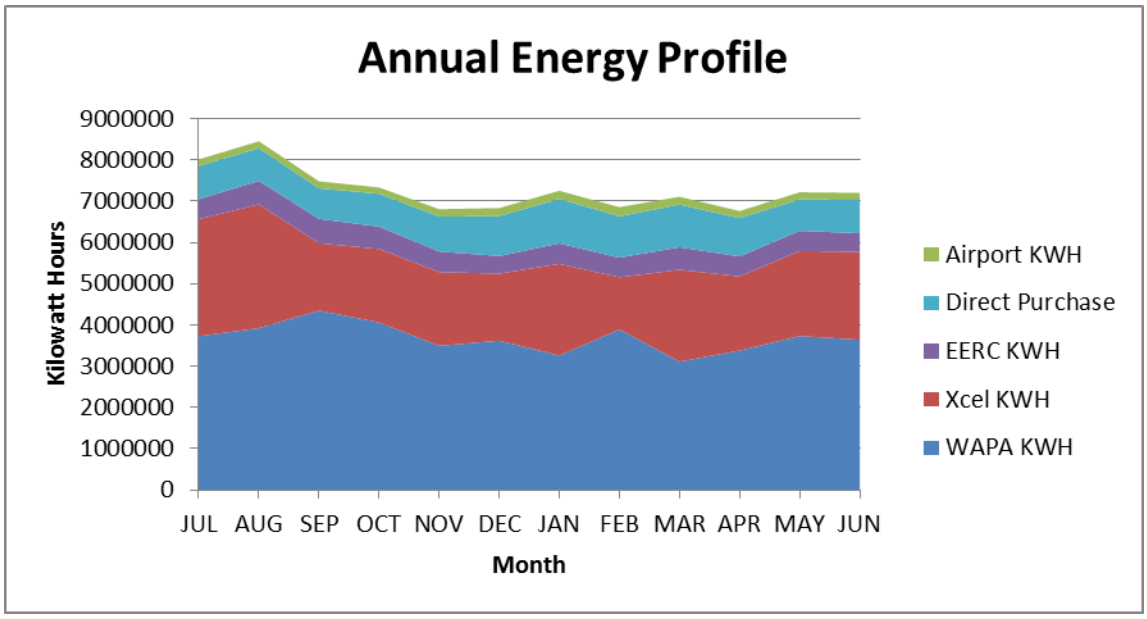


A monthly energy profile for the campus grid is identified in the chart below. The chart identifies the total KWH for the campus electrical grid and the respective resources.

**ENERGY PROFILE**

| Month | WAPA KWH | Xcel KWH | Airport KWH | EERC KWH | Direct Purchase | Total KWH |
|---|---|---|---|---|---|---|
| JUL | 3,729,000 | 2,840,528 | 160,880 | 483,881 | 802,960 | 8,017,249 |
| AUG | 3,924,000 | 3,001,674 | 171,080 | 568,983 | 790,709 | 8,456,446 |
| SEP | 4,349,000 | 1,634,953 | 169,000 | 589,800 | 741,443 | 7,484,196 |
| OCT | 4,061,000 | 1,781,723 | 152,480 | 543,368 | 796,922 | 7,335,493 |
| NOV | 3,495,000 | 1,789,272 | 180,600 | 498,753 | 845,138 | 6,808,763 |
| DEC | 3,620,000 | 1,627,648 | 195,760 | 425,504 | 968,872 | 6,837,784 |
| JAN | 3,260,000 | 2,221,285 | 197,320 | 498,379 | 1,078,080 | 7,255,064 |
| FEB | 3,894,000 | 1,263,075 | 221,800 | 476,097 | 1,002,912 | 6,857,884 |
| MAR | 3,110,000 | 2,232,534 | 190,240 | 544,411 | 1,034,065 | 7,111,250 |
| APR | 3,380,000 | 1,797,206 | 173,440 | 484,997 | 929,232 | 6,764,875 |
| MAY | 3,733,000 | 2,062,706 | 174,760 | 489,837 | 759,819 | 7,220,122 |
| JUN | 3,641,000 | 2,131,099 | 172,160 | 452,144 | 808,648 | 7,205,051 |

A monthly energy profile for the campus electrical grid is graphically identified in the following chart:



**Purchase Cost per KWH for the University of North Dakota Electrical Grid**

| Fiscal Year | Aggregated cost per KWH for the campus WAPA electrical energy | Aggregated cost per KWH for the campus supplemental electrical energy (Xcel) | Aggregated cost per KWH for the campus combined electrical energy (WAPA & Xcel) |
|---|---|---|---|
| **08/09** | $ 0.02807 | $ 0.05220 | $ 0.03569 |
| **09/10** | $ 0.03330 | $ 0.04767 | $ 0.03739 |
| **10/11** | $ 0.03518 | $ 0.05088 | $ 0.03992 |
| **11/12** | $ 0.03530 | $ 0.05704 | $ 0.04213 |

# LOAD PROJECTION

Load forecast projections for energy load were based on trend growth loads from the year 1970. A growth load of 1.5 % was calculated for the campus Nordic feed point. A growth load of 0.5% was calculated for Skalicky and Ryan Hall. Additional loads were added for known large construction projects in each of the feed-points. The numbers for the load forecast are represented in the following chart, with the updated projections highlighted by italics and in yellow:

**KW LOAD PROJECTION**

| Fiscal Year | CAMPUS Grid | Direct Purchases | EERC | Airport | TOTAL |
|---|---|---|---|---|---|
| 1996 | 10882 | 2199 | 1093 | 454 | 14628 |
| 1997 | 10511 | 2366 | 993 | 459 | 14330 |
| 1998 | 11413 | 2299 | 968 | 452 | 15132 |
| 1999 | 11309 | 2297 | 989 | 451 | 15046 |
| 2000 | 11184 | 2146 | 848 | 419 | 14597 |
| 2001 | 13781 | 2228 | 978 | 444 | 17431 |
| 2002 | 14285 | 2392 | 979 | 471 | 18127 |
| 2003 | 14442 | 2376 | 1013 | 475 | 18306 |
| 2004 | 15080 | 2200 | 1019 | 438 | 18736 |
| 2005 | 14516 | 2424 | 1095 | 484 | 18519 |
| 2006 | 14730 | 2694 | 1098 | 467 | 18989 |
| 2007 | 13971 | 2430 | 1094 | 458 | 17953 |
| 2008 | 13695 | 2170 | 974 | 434 | 17272 |
| 2009 | 13780 | 2139 | 1043 | 451 | 17413 |
| 2010 | 13612 | 2103 | 1035 | 435 | 17185 |
| 2011 | 15199 | 2334 | 1263 | 526 | 19323 |
| 2012 | 15147 | 2285 | 1311 | 467 | 19210 |
| 2013 | 15374 | 2296 | 1317 | 470 | 19457 |
| 2014 | 15605 | 2308 | 1324 | 472 | 19708 |
| 2015 | 15839 | 2319 | 1330 | 474 | 19963 |
| 2016 | 16076 | 2331 | 1337 | 477 | 20221 |
| 2017 | 16318 | 2343 | 1344 | 479 | 20483 |
| 2018 | 16562 | 2354 | 1350 | 482 | 20749 |
| 2019 | 16811 | 2366 | 1357 | 484 | 21018 |
| 2020 | 17063 | 2378 | 1364 | 486 | 21291 |
| 2021 | 17319 | 2390 | 1371 | 489 | 21568 |
| 2022 | 17579 | 2402 | 1378 | 491 | 21849 |
| 2023 | 17842 | 2414 | 1384 | 494 | 22134 |
| 2024 | 18110 | 2426 | 1391 | 496 | 22423 |
| 2025 | 18382 | 2438 | 1398 | 499 | 22717 |
| 2026 | 18657 | 2450 | 1405 | 501 | 23014 |
| 2027 | 18937 | 2462 | 1412 | 504 | 23316 |
| 2028 | 19221 | 2475 | 1419 | 506 | 23622 |

Projections for KWH were calculated by the same methods used for the KW load forecasting. The chart below represents the energy forecasts and the associated resources with the updated projections highlighted by italics and in yellow:

**Kwh Energy Projection**

| YEAR | CAMPUS Grid | Direct Purchases | EERC | Airport | TOTAL |
|---|---|---|---|---|---|
| 1996 | 54,381,651 | 10,990,411 | 5,460,855 | 2,271,259 | 73,104,176 |
| 1997 | 52,005,614 | 11,708,421 | 4,914,845 | 2,271,259 | 70,900,139 |
| 1998 | 57,404,048 | 11,562,951 | 4,869,233 | 2,271,259 | 76,107,491 |
| 1999 | 57,010,322 | 11,580,894 | 4,984,095 | 2,271,259 | 75,846,570 |
| 2000 | 60,655,893 | 11,637,211 | 4,599,146 | 2,271,259 | 79,163,509 |
| 2001 | 69,554,068 | 11,244,018 | 4,937,489 | 2,242,220 | 87,977,795 |
| 2002 | 70,022,046 | 11,726,647 | 4,797,179 | 2,309,330 | 88,855,202 |
| 2003 | 71,374,233 | 11,744,316 | 5,004,534 | 2,349,060 | 90,472,143 |
| 2004 | 80,442,858 | 11,733,096 | 5,433,653 | 2,336,190 | 99,945,797 |
| 2005 | 69,938,791 | 11,679,122 | 5,275,011 | 2,331,970 | 89,224,894 |
| 2006 | 68,880,894 | 12,599,674 | 5,134,493 | 2,183,630 | 88,798,691 |
| 2007 | 67,678,263 | 11,772,378 | 5,297,508 | 2,220,335 | 86,968,484 |
| 2008 | *69,416,256* | 10,998,661 | 4,935,394 | 2,197,336 | 87,547,647 |
| 2009 | 69,224,147 | 10,747,708 | 5,238,596 | 2,266,248 | 87,476,699 |
| 2010 | 68,735,447 | 10,618,010 | 5,228,547 | 2,196,143 | 86,778,147 |
| 2011 | 69,871,248 | 10,731,485 | 5,806,384 | 2,419,920 | 88,829,037 |
| 2012 | 69,993,975 | 10,558,799 | 6,056,164 | 2,159,520 | 88,768,458 |
| 2013 | *71,043,885* | *10,611,593* | *6,086,445* | *2,170,318* | 89,912,240 |
| 2014 | *72,109,543* | *10,664,651* | *6,116,877* | *2,181,169* | 91,072,240 |
| 2015 | *73,191,186* | *10,717,974* | *6,147,461* | *2,192,075* | 92,248,697 |
| 2016 | *74,289,054* | *10,771,564* | *6,178,199* | *2,203,035* | 93,441,852 |
| 2017 | *75,403,390* | *10,825,422* | *6,209,090* | *2,214,051* | 94,651,952 |
| 2018 | *76,534,440* | *10,879,549* | *6,240,135* | *2,225,121* | 95,879,246 |
| 2019 | *77,682,457* | *10,933,947* | *6,271,336* | *2,236,246* | 97,123,986 |
| 2020 | *78,847,694* | *10,988,616* | *6,302,693* | *2,247,428* | 98,386,431 |
| 2021 | *80,030,409* | *11,043,560* | *6,334,206* | *2,258,665* | 99,666,840 |
| 2022 | *81,230,865* | *11,098,777* | *6,365,877* | *2,269,958* | 100,965,478 |
| 2023 | *82,449,328* | *11,154,271* | *6,397,706* | *2,281,308* | 102,282,614 |
| 2024 | *83,686,068* | *11,210,043* | *6,429,695* | *2,292,714* | 103,618,520 |
| 2025 | *84,941,359* | *11,266,093* | *6,461,843* | *2,304,178* | 104,973,474 |
| 2026 | *86,215,480* | *11,322,423* | *6,494,153* | *2,315,699* | 106,347,755 |
| 2027 | *87,508,712* | *11,379,035* | *6,526,623* | *2,327,277* | 107,741,648 |
| 2028 | *88,821,343* | *11,435,931* | *6,559,257* | *2,338,914* | 109,155,444 |

# SUPPLY OPTIONS

The main goal of the primary distribution system and electrical suppliers is to be reliable, safe, and free of hazards for campus staff, faculty, students and the general public at the most economical cost. Reliability is an important factor that incorporates many characteristics such as type of source, condition of equipment, quality of maintenance, fault clearing capability, etc. In many cases the question of reliability cannot be answered with exact data, but is a subjective evaluation. Two or three outages per year are not a concern to most students, but are excessive to research facilities and computer centers.

The University of North Dakota's Facilities Management accomplished its goal of multiple medium voltage services for the campus, from multiple electrical sources. This provides our distribution system with additional diversity and reliability.

A study was completed for development and installation of a 1 megawatt wind generator to be located adjacent to the campus. The power generated from this unit would be connected to the university distribution system. This would provide additional renewable resources to the university. The University's Facilities Management pursued the installation of a wind generator in 2011, but was unable to begin development due to geographic location, climate, and raised public concerns.

Due to the issues that arose during the wind generator installation planning process, the University of North Dakota's Facilities Management is currently conducting research on photovoltaics as an alternative renewable energy source for the University.

Incorporation of these plans would provide the University the highest level of redundancy and reliability while maintaining the lowest available electrical rates.

# SUPPLY RESOURCES

The primary power supplier to the University of North Dakota is Western Area Power Administration (Western), with wheeling by Xcel Energy. Additional supplemental power needs are supplied by Xcel Energy.

The University of North Dakota has a fixed delivery rate contract with Western Area Power Administration through the year 2020. The allocations from Western Area Power Administration are represented in the charts below.

**Western Area Power Administration Allocation**

| Month | 2011 WAPA Allocation KW | 2011 WAPA Allocation KWH |
|---|---|---|
| **July** | 7,631 | 3,729,000 |
| **August** | 7,573 | 3,924,000 |
| **September** | 7,735 | 4,349,000 |
| **October** | 7,407 | 4,061,000 |
| **November** | 6,369 | 3,495,000 |
| **December** | 6,409 | 3,620,000 |
| **January** | 6,228 | 3,260,000 |
| **February** | 6,369 | 3,760,000 |
| **March** | 6,334 | 3,110,000 |
| **April** | 6,326 | 3,380,000 |
| **May** | 7,608 | 3,733,000 |
| **June** | 6,987 | 3,641,000 |
| **Total** | | **44,062,000** |

The University of North Dakota campus (UND) is presently served from the Xcel Energy distribution system at 12.47 kV. The main delivery point is at the southwest corner of the campus near the Building Mechanical Shop and is comprised of eight pad-mounted metal-clad switchgear compartments with four primary 12.47 kV circuits. The switchgear is fed from Xcel circuits Nor25 and Nor35 from the Nordic Substation located on Columbia Road at Knight Drive. Alternate service can be obtained from circuit Nor31 and Gat 33. Ryan Hall, Clifford Hall, and Skalicky Technology Incubator are served directly by Xcel Nor35.

Each Nordic feeder has approximately 10MW of capacity. The following are peak values over the last year.

1. Nordic 25 is 68% loaded. This feeder is used exclusively by UND Main Campus.
2. Nordic 35 is 87% loaded. Circuit #1 of the Main Campus is fed from here. Clifford, Ryan, and Skalicky also take service from this feeder. Since it is lightly loaded, there work is in progress for backup service and ability to shift load from Gateway 33 to Nordic 35.

The School of Medicine (SOM) is a medium voltage service presently fed from Xcel Energy Gateway 33.

The Bronson Property is a medium voltage service presently fed from Xcel Energy Gateway 33.

Gateway 33 is 80% loaded. Both the Medical Sciences Complex and the Bronson Property are served from this feeder.

Presently UND has 11,425 KW of diesel generation for demand side management control and emergency power. The generation assists with the additional capacity required from load growth and totalization of the Bronson and School of Medicine medium voltage service point. The generation is used in conjunction with the energy control program with Xcel energy and emergency electrical generation.

# ENERGY MANAGEMENT & CONTROL

The University of North Dakota, Facilities Management has been very active in energy management and control since the early 1970's. A wide variety of programs and practices toward energy conservation have been incorporated into renovation projects, new construction projects, maintenance practices, and management procedures. There are two major factors that are observed with each energy management and control project; enhancement and reliability to the University facilities and the economic feasibility of the project.

The largest and most unique energy program currently in process at UND is the North Dakota – State Facility Energy Improvement Program. This program was passed by the 56th Legislative Assembly of the State of North Dakota. The objective of the program is to provide a funding mechanism for the purchase and installation of energy improvements that result in energy and energy dollar savings. Energy cost savings from utility budgets will be used to pay back the project costs. The University bonded its first projects at $3.9 million dollars.

These projects consist of energy efficient lighting, heat recovery, electrical diesel generation, and mechanical system upgrades. These energy improvement projects have been completed and are meeting and/or exceeding the savings projected. Measurement and Verification of energy savings are in place to insure the energy savings are present. The projected project costs and summary of paybacks are summarized in the following chart: The measured savings are shown in exhibit A.

| 2002 Energy Projects | Capital Cost | Annual Savings | Years for Payback |
|---|---|---|---|
| Building Lighting Retrofit Project | $679,522.36 | $111,867.00 | 6.074 |
| Chester Fritz Library | $425,827.00 | $76,166.21 | 5.591 |
| College of Nursing | $240,040.00 | $34,971.00 | 6.864 |
| Electrical Generator Demand Side Management Project | $966,075.00 | $161,900.00 | 5.967 |
| Facilities | $34,400.00 | $4,851.40 | 7.091 |
| Gamble Hall | $517,638.00 | $74,010.00 | 6.994 |
| Hughes Fine Arts Center | $324,863.76 | $45,794.39 | 7.094 |
| Law School | $320,464.00 | $51,590.00 | 6.212 |
| Memorial Union | $235,491.93 | $32,632.62 | 7.216 |
| Steam Plant | $36,800.00 | $13,645.43 | 2.697 |
| Upson II | $209,663.00 | $33,095.00 | 6.335 |
| **TOTALS** | **$3,990,785.05** | **$640,523.05** | **6.231** |

The second round energy projects funded and in construction by the University in the second round consist of energy efficient lighting, heat recovery, and mechanical system upgrades. Construction is in process and completion of these projects is expected in the 2nd quarter of 2013.

| 2005 Energy Projects | Capital Costs | Annual Savings | Simple Payback | |
|---|---|---|---|---|
| Campus Lighting | $ 806,449 | $ 116,828 | 6.90 | |
| Daycare Multizone VAV Conversion | $ 49,500 | $ 6,159 | 8.04 | |
| Fargo Medical Education Research Center Controls | $ 45,655 | $ 4,917 | 9.28 | |
| Hyslop Sports Center Control Retrofit & CO2 Conversion & Pool Recovery | $ 174,264 | $ 24,765 | 7.04 | * |
| Lab and Research Energy Conservation Projects | $ 341,045 | $ 61,826 | 5.52 | * |
| Merrifield Hall VAV Conversion & CO2 Control | $ 116,070 | $ 13,372 | 8.68 | |
| Ryan/RTC Controls & Windows | $ 364,550 | $ 50,991 | 7.15 | * |
| West, McVey, Brannon Halls; Heat Recovery | $ 317,926 | $ 37,852 | 8.40 | |
| Witmer Hall VAV Conversion & CO2 Control | $ 116,095 | $ 16,148 | 7.19 | |
| **Total** | **$ 2,331,554** | **$ 332,858** | **7.00** | |

∗ Indicates projects still under construction

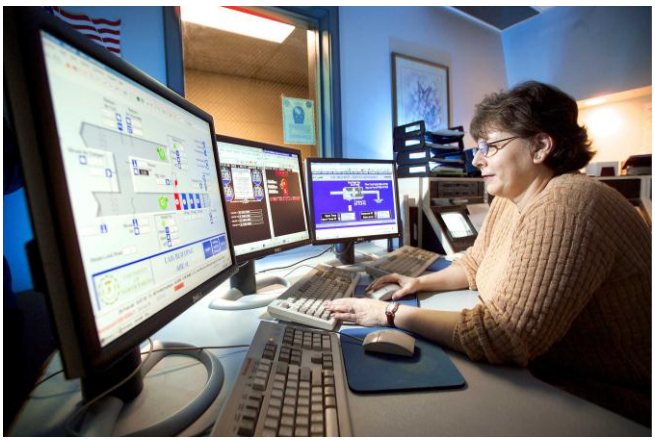
During the fiscal year of 2011 and 2012 UND received funding for round 3 energy projects. Round 3 was funded by the American Recovery and Reinvestment Act (ARRA) of 2009.

| **Round 3 ARRA Energy Projects** | **Capital Cost** | **Annual Savings** | **Years for Payback** |
|---|---|---|---|
| HVAC CO2 Control | $195,353 | $65,060 | 3 |
| Steam plant Variable Frequency Drive Motor Control | $163,544 | $36,518 | 4.48 |
| Clifford Hall Lighting Efficiency | $91,606 | $12,949 | 7.07 |
| School of Medicine Lighting Efficiency | $72,490 | $9,088 | 7.98 |
| Range Hood Control | $405,198 | $66,126 | 6.13 |
| Streibel Hall, HVAC Controls and CO2 DVC Control | $71,809 | $10,105 | 7.11 |
| **TOTALS** | **$1,000,000.00** | **$199,845** | **5** |

During the fiscal year of 2011 and 2012 UND received funding for round 4 energy projects. Round 4 was funded by the American Recovery and Reinvestment Act (ARRA) of 2009.

| Project | Capital Cost | Annual Savings | Years for Payback |
|---|---|---|---|
| Restroom lighting control | $177,360 | $12,835 | 13.82 |
| Outdoor lighting retrofit | $263,633 | $7,885 | 33.44 |
| 3904 Heat Recovery; | $132,450 | $9,311 | 14.23 |
| Twamley Hall Heat Recovery | $76,850 | $5,288 | 14.53 |
| Chester Fritz Library CO2 Demand Ventilation Control | $99,800 | $10,923 | 9.14 |
| CO2 Control | $236,360 | $43,368 | 2.37 |
| Hallway Sensored Lighting | $79,911 | $12,814 | 6.24 |
| Office Sensored Lighting | $40,908 | $5,664 | 7.24 |
| Outdoor LED Wall Packs | $46,649 | $4,910 | 9.5 |
| **TOTALS** | **$1,000,000** | **$116,998** | **8.59** |

One of UND's long term and most beneficial energy management and control projects at UND is the Building Management and Control System (BMCS). The BMCS provides central monitoring and energy management functions throughout the University's major buildings and facilities. Key mechanical and energy systems are monitored and controlled through modern, state of the art technology; thus providing optimized, efficient facility operation and control. The BMCS executes a number of energy management programs reducing energy consumption by $1,000,000 annually. Some of the energy management functions are as follows: timed start-up and shut-down of mechanical and electrical systems, electrical demand management, enthalpy control of ventilation outside air intakes, optimized start-up and shut-down of heating and ventilation systems, occupied control, and optimized management of facility operations. The chart below represents the impact that the Building Management and Control System has on UND's electrical load profile. The chart demonstrates a comparison of different load profiles based without Building Management and Control System (BMCS), night/unoccupied cutback only, and the preferred method of night/unoccupied cutback with demand control.



The University installs high efficiency electric motors in all new construction and renovations. In the event of an electric motor failure an evaluation process occurs to determine if the motor is the proper horsepower for its application and the economics of motor rewind versus high efficient motor replacement.

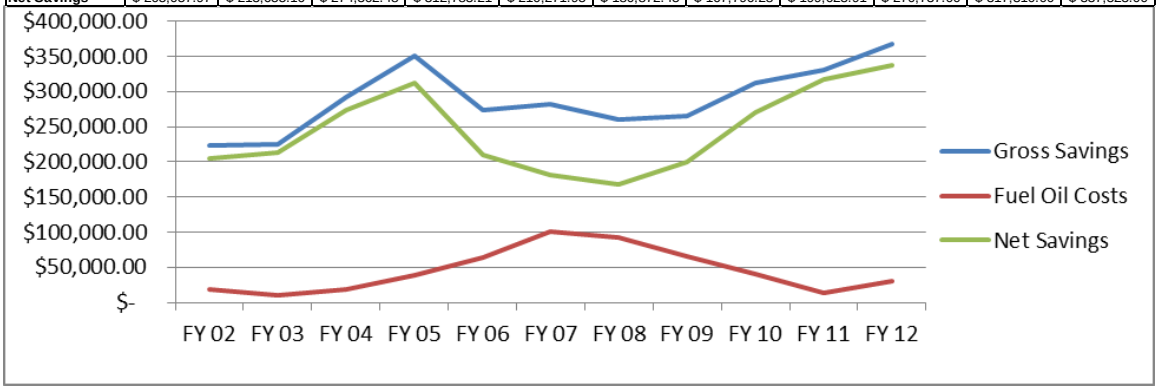
UND Facilities has become very sophisticated in evaluation and measurement & verification of buildings and energy projects. Facilities uses Department of Energy DOE 2.4 for building models of new construction, large remodeling projects, and energy improvement projects. By the use of this modeling process and engineered calculations, Facilities can determine the energy use, best economic energy solutions, load growth, and measurement and verification.

UND incorporates the use of variable frequency drives (VFD) into new construction and renovations where applicable. An evaluation process of hydronic and ventilation systems is completed to help determine applications of VFD's for energy conservation and demand side management.

Seven (7) major diesel generators with a total capacity of 11,350 KW have been installed as distributive generation peaking units and emergency backup. As result the demand cost for supplemental power has been reduced from $11.10 to $2.66.

**Total Generator Savings**

| | FY 02 | FY 03 | FY 04 | FY 05 | FY 06 | FY 07 | FY 08 | FY 09 | FY 10 | FY 11 | FY 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gross Savings** | $ 223,966.61 | $ 224,456.60 | $ 292,504.23 | $ 350,956.85 | $ 273,406.83 | $ 281,429.35 | $ 259,959.74 | $ 265,984.75 | $ 311,513.00 | $ 331,548.00 | $ 367,372.00 |
| **Fuel Oil Costs** | $ 18,908.64 | $ 10,801.44 | $ 18,141.75 | $ 38,173.64 | $ 63,134.88 | $ 100,556.90 | $ 92,163.46 | $ 66,360.84 | $ 40,776.00 | $ 14,238.00 | $ 29,849.00 |
| **Net Savings** | $ 205,057.97 | $ 213,655.16 | $ 274,362.48 | $ 312,783.21 | $ 210,271.95 | $ 180,872.45 | $ 167,796.28 | $ 199,623.91 | $ 270,737.00 | $ 317,310.00 | $ 337,523.00 |

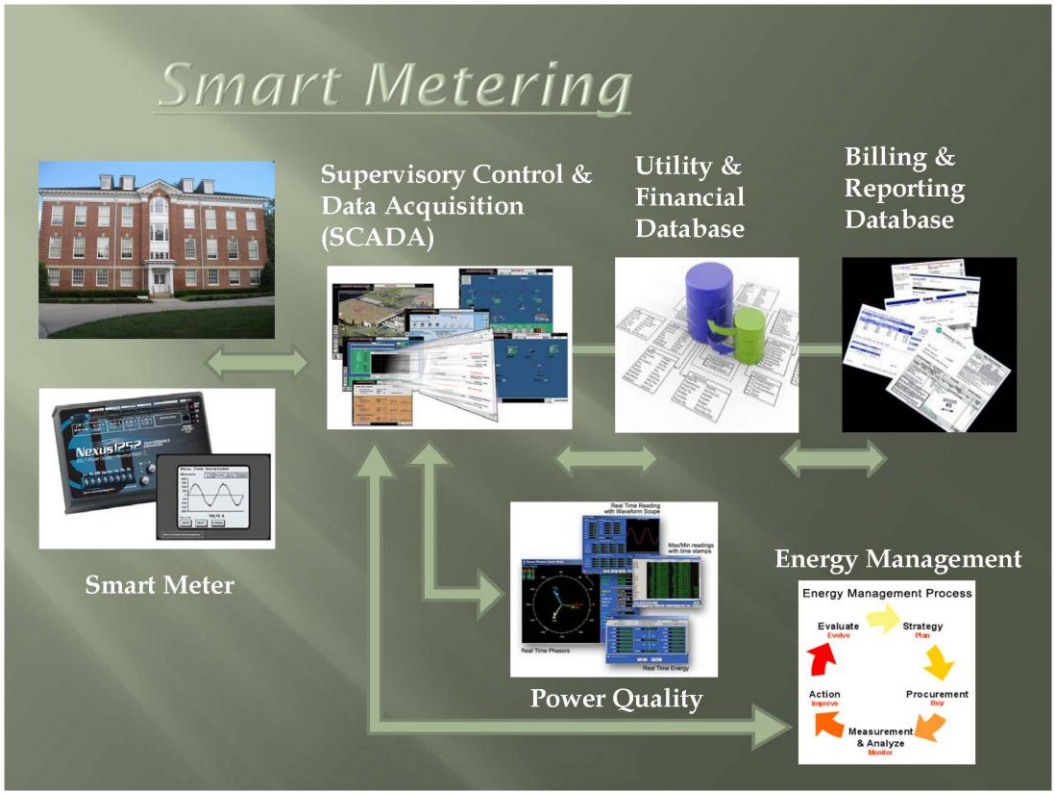



In 2010 UND Facilities Management began implementation of a utility management module into "famis". "famis" is a facility administration maintenance and information

software system. A complete inventory of Facilities Management's meters was completed and is maintained in famis. All meter readings, energy consumption, utility invoices, and utility billings are generated and maintained in this system. This system no provides Facilities Management with a central data base of energy use and costs for each building and production for each utility of energy used.

## Smart Metering

In 2009 UND Facilities Management began a smart metering program. Phase one of the program targeted replacement of conventional meters or installation of new smart meter the larger and key operational facilities across campus. The smart meters provide real time data over internet and web based networks. The smart meters will compile information on all utilities within a building. The smart meters providing information for data acquisition, power quality, energy management, utility & financial databases, and billing & reporting databases.

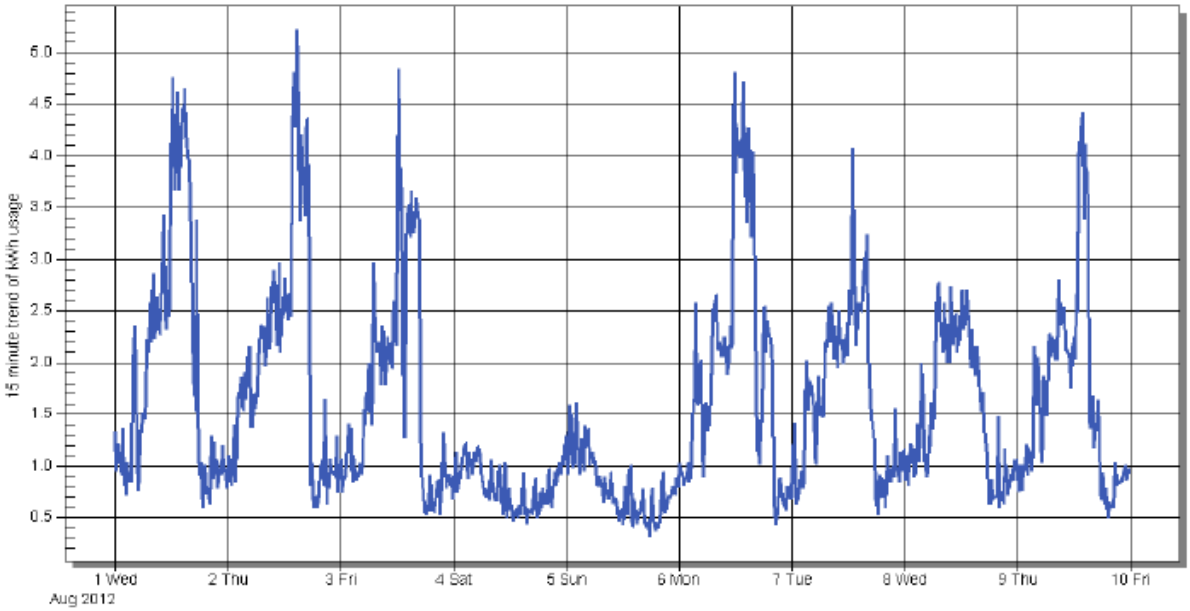



**Smart Metering Flow Chart 1**

**HMI Utility SCADA System:**

Beginning in 2010, Facilities Management began implementation of a SCADA system used to gather and compile data from the smart metering system. Electro Industries/Gauge Tech (EIG), HMI (human machine interface) EXT is a supervisory control and data acquisition (SCADA) software program that allows UND to remotely read smart meters throughout the campus. The company, Electo Industries/Gauge Tech (EIG), designs custom interfaces based on a client's needs. Using this software, we are able to view real time energy use in fifteen minute averages. On the 28th day of each month, HMI EXT generates a .csv file which UND can use to import into FAMIS. Another benefit of HMI EXT is that we are able to see what time(s) throughout the day each building has peak energy consumption. This tool will help UND to find electrical issues with buildings for better building and energy management.

E-Billing and reporting module EXT is a program associated with HMI EXT that can generate bills and energy usage reports. An energy usage report breaks down energy use by the month, by the week with the highest peak demand, and by the day with the highest peak demand. These reports are crucial to performing energy audits. There is also a function in E-Billing EXT to generate graphs to compare energy use between buildings or different months. This will help illustrate how well energy efficiency projects on campus perform. The following chart illustrates the electrical usage of the Mechanical Shop from August 1, 2012 to August 10, 2012.



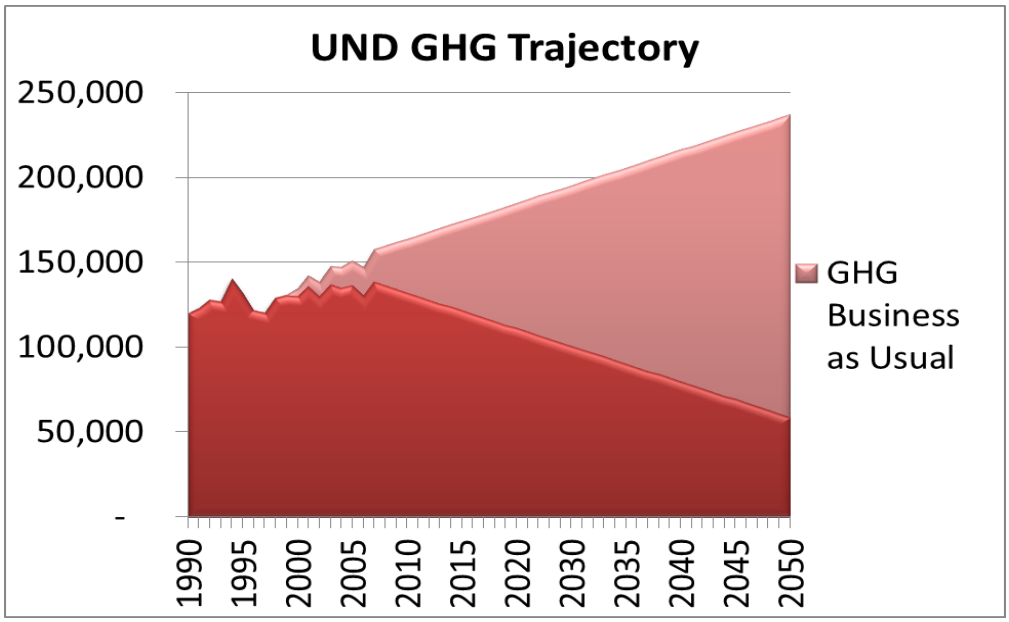

**Building 89, Energy Use Chart 1**

**Sustainability:**

January 2008, UND President Charles Kupchella signed a pledge to the American Colleges and University Presidents Climate Commitment (ACUPCC). Signatories to the commitment pledge to eliminate their campuses' greenhouse gas (GHG) emissions in a reasonable period of time as determined by each institution. The University of North Dakota "Council on Environmental Stewardship and Sustainability" leads the charge for UND sustainability and GHG reductions. Since the development of the council, GHG inventories have been completed from 1990 through 2007 and the second report provides inventories through 2010. UND's GHG footprint was 137,780 MTCDE.

Another major accomplishment by the council was development of the UND Climate Action Plan. The Climate Action Plan outlines UND's plans, objectives, and trajectories on how to reach climate neutrality. The plan outlines several sustainability improvement measures of which 8 have been chosen for FY 2013. The improvement measures are:

- Bike parking infrastructure
- Carpet purchase program
- Energy awareness program
- Energy dashboard for campus
- Establish an energy policy
- Recycling communication plan
- Revolving fund for facility energy improvement projects
- Sustainability office and coordinator



**High Mast Lighting:**

Five high mast lighting parking lot projects have been completed. The energy efficient high mast lights have replaced conventional street/parking lot lighting systems. This project has increased lighting levels in the parking lots, while reducing energy and maintenance costs.

**High Efficiency Lighting:**

High efficient lighting is installed in all new construction projects. In renovation construction projects, older non-efficient lighting is replaced with high efficient lighting. Our connected electrical load has been reduced by 1,800 KW to date through lighting retrofit projects.

**Window Replacement:**

The University of North Dakota has a policy on new construction of installing one inch thick thermal insulated glass with low-E coating. Each window is tested and the test results need to be provided for each project to determine infiltration and R value for each. For existing buildings window replacements, are planned in buildings with the poorest R values. Some of UND's existing buildings have no insulated glass at all and many other buildings only have half inch glass and need replacement due to energy and condition. One inch thermal units are then installed as replacement windows in existing buildings. The University spends an average of $100,000 annually on window renovation projects for existing buildings.

**Roofing:**

UND has a standard policy for roofing on new buildings and replacement of existing roofs. Roofing installation is installed with an R value of 30 and a single membrane system. The University spends an average of $150,000 annually on roofing projects for existing buildings.

**Infrared Program:**

The University maintains a high quality infrared program. The primary purpose of the infrared program is heat detection in the electrical distribution system. Infrared heat detection has occasionally been used on building infrastructures to identify heat loss.

**UND Steam Plant:**

A state of the art boiler control system has been installed at the UND Steam Plant. This control system automatically optimizes boiler efficiency while increasing management of the facility. The project name was "A New Dimension in Boiler Management & Building Technology". The project had a simple payback of 4.5 years. This project received the 1994 national award for "Energy Efficiency and Renewable Energy" from the Department

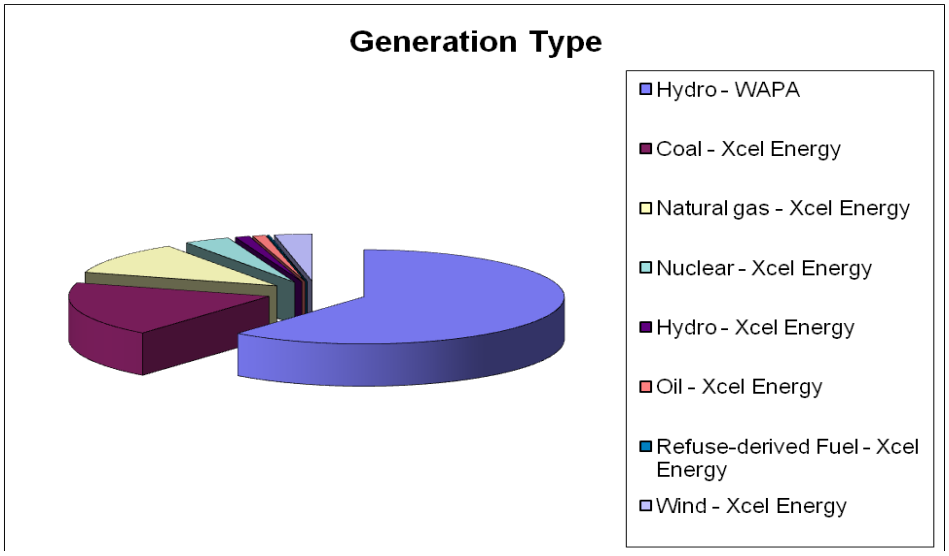
of Energy (DOE). A second phase of this project is planned that will integrate the boiler control system with the campus Building Management and Control System. This will provide exchange of information between the two systems for optimized control of steam management.

This identifies some of the major activities with energy management and control at the University of North Dakota.

# Power Generation and Renewable Resources

The University of North Dakota receives the majority of their electrical resources from Western Area Power Association (WAPA). The electricity produced and delivered by WAPA is hydro power, generated at the Garrison Dam with water from the Missouri River. Supplemental power for the campus is purchased from Xcel Energy. Xcel Energy uses a multitude of generation sources. The charts below indicate the generation types, quantities of energy, and generation percentages of electrical energy used at the University of North Dakota.

| Generation Type | KWH's | Percentage |
|---|---|---|
| Hydro - WAPA | 44,062000 | 50% |
| Coal - Xcel Energy | 21,233,810 | 23% |
| Natural gas - Xcel Energy | 17,584,924 | 20% |
| Nuclear - Xcel Energy | 3,950,165 | 4% |
| Hydro - Xcel Energy | 936,739 | 1% |
| Oil - Xcel Energy | 24,781 | 0% |
| Refuse-derived Fuel - Xcel Energy | 131.342 | 0.15% |
| Wind - Xcel Energy | 807,876 | 1% |
| UND Total Electrical | 88,731,637 | |



The University of North Dakota has participated in multiple research projects testing the utilization of renewable solid fuels. The projects included mixing sunflower hulls, wood, etc. with sub-bituminous coal as a fuel for UND's central heating plant. The University does not burn renewable fuels on a constant basis, but will continue research on the subject.

The University has completed an engineering study for the installation of a 1 megawatt wind generator to be located on the western edge of the campus. The success of this project is dependent upon funding.

The University of North Dakota currently uses 2 % renewable for electricity.

The University of North Dakota currently uses 50 % Hydo generation for electricity.

# STRENGTHS, WEAKNESSES, OPPORTUNITIES, & THREATS

**STRENGTH**

Below, the University has identified its strengths, weaknesses, opportunities, and threats as it relates to this Integrated Resource Plan.

1. A state of the art Building Management and Control System.
2. A stable demand side management program.
3. A strong energy management program.
4. State of the art distributive, continuous paralleling, generation system
5. Ample amount of electrical resources available at UND's campus 3 points of delivery.

**WEAKNESSES**

1. Even though Xcel Energy has constructed an emergency link between the Nordic feed points and Gateway feed point; in the event of a catastrophic failure to the Nordic feed point there would not be enough power to operate the University at full capacity.

**OPPORTUNITIES**

1. The University has the opportunity to connect existing Xcel Energy directly served buildings to the campus grid. This will enable greater diversity, additional redundancy, and lower utility costs.
2. Installation of an additional diesel generation would provide the needed emergency power for the Center of Aerospace Science's research facilities. These generators would also provide additional peak generating capacity while maintaining lower electrical rates.
3. The costs of wind generation and photovoltaic systems (PV system) are decreasing, that may provide a cost effective opportunity for additional renewable resources to the campus electrical grid.

**THREATS**

1. The Nordic feed point is presently served from the Xcel-Nordic substation. At a point at the southwest corner of the campus. This delivery is vulnerable in several aspects. Although delivery is from three different NSP feeders, all connections to the sources share several common manholes and underground raceways. A catastrophic fault within one of these manholes or raceway could conceivably interrupt service to the majority of the campus. One of the main priorities is to provide an alternate feed point that could operate the campus in the event of a catastrophic failure.

# 2 YEAR ACTION PLAN

1. Installation of the automated “Energy Cockpit”. The Energy Cockpit shall provide an automated interface to utility metering, analysis, reporting, and automated billing.
2. Load balancing of circuit No. 4. Currently circuit no. 4 has a much lower load than other university circuits. Because of the low load we are not able to operate the associated generator at full capacity. Adding additional load to circuit no. 4 would correct this problem.
3. Expand the Facilities Management’s smart metering system.
4. Expand the Facilities Management’s SCADA energy management & reporting system
5. Perform a power factor (PF) measurement and evaluation for each campus building.
6. Expand the Building Management and Control System to enable more diverse and efficient energy and facilities management.
7. Search for source of funding for Photovoltaic pilot project.
8. Continue the use of high efficient lighting, energy efficient mechanical systems, and energy efficient design & construction in renovation and new construction projects.
9. Expand outdoor lighting project. Replacement of conventional lighting systems with induction and LED lighting systems
10. Continue with infrared program for the electrical distribution system.
11. Continue with the roof replacement program.
12. Continue with the high efficient motor replacement program and expanded use of variable frequency drives.
13. The University staff will continue to search out and analyze new technologies for energy conservation and the cost-effectiveness of utilize these technologies as it applies to the University of North Dakota.
14. UND staff will evaluate the progress of the 2008 Integrated Resource Plan submitted to Western Area Power Association.
15. Continue with development of a campus wide ”energy, utility, sustainability, and construction policies”.
16. Continue to pursue additional sustainability initiatives.

# 5 YEAR ACTION PLAN

1. Installation of high mast lighting or induction lighting for parking lots. The parking lot lighting replacement project would include east campus parking lots and the West complex of the resident life buildings. The energy efficient lights would replace conventional street/parking lot lighting systems. This project will increase lighting levels in the parking lots while reducing energy and maintenance costs.

2. Continue to expand the Building Management and Control System to enable more diverse and efficient energy and facility management.

3. Continue the use of high efficient lighting, energy efficient mechanical systems, and energy efficient design & construction in renovation and new construction projects.

4. Continue with infrared program for the electrical distribution system.

5. Continue with the roof replacement program.

6. Continue with the high efficient motor replacement program and expanded use of variable frequency drives.

7. The University staff will continue to search out and analyze new technologies for energy conservation and the cost-effectiveness of utilizing these technologies as it applies to the University of North Dakota.

8. UND staff will complete future Integrated Resource Plans as required.

9. Implement a campus wide energy and sustainability policy and program.

# SUMMARY

This Integrated Resource Plan (IRP) has been prepared to help identify the resource and load management options best fit for the University of North Dakota. The IRP does consider how to maintain and improve electrical service to the University community, sustain the most economic electrical rates, support energy conservation, and minimize environmental impacts.

The University of North Dakota is a state agency and accordingly receives state appropriated funds for utilities and renovation projects associated with UND's 2 year and 5 year plan identified in this Integrated Resource Plan. The execution of these plans are subject to change upon the availability of funds appropriated by the state of North Dakota and the North Dakota State Board of Higher Education.

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