

2011 SENATE APPROPRIATIONS

SB 2299

# 2011 SENATE STANDING COMMITTEE MINUTES

Senate Appropriations Committee  
Harvest Room, State Capitol

SB 2299  
01-28-2011  
Job # 13606

Conference Committee

Committee Clerk Signature 

## Explanation or reason for introduction of bill/resolution:

A Bill relating to an energy improvement revolving loan fund

## Minutes:

Attachments #1, #2, #3, #4

**Chairman Holmberg** called the committee to order on Friday, January 28, 2011 at 9:30 am in reference to SB 2299. All committee members were present. Becky J. Keller, Legislative Council and Tad H. Torgerson, OMB was present.

**Senator Laffen:** District 43, Grand Forks testified in favor of SB 2299 and Testimony attached # 1. He introduced the bill as a sponsor of this bill.

**V. Chair Grindberg:** When you put your bill together, have you worked with the Bank of North Dakota for their reserves, connecting with their revolving funds?

**Senator Laffen:** No I did not. This idea came out of Bismarck Tribune about 30 days ago. I certainly would defer to your group expertise if you have a better source of funds.

**Senator Warner:** The 22 million sq feet...is that owned by the state or is it owned and leased?

**Senator Laffen:** That is owned by the state of North Dakota in four categories; higher education, the states buildings, research buildings and includes the National Guard facilities. They are all owned by the state of ND.

**Senator Warner:** Bottom of the first page, second step...referring to SB2299, the term "smart grid technology"...is that the same as this bill would address? Or is it a different level of using micro switches to divert electricity and optimize P codes? Is there a distinction to be made between the two concepts?

**Senator Laffen:** Yes, that has more to do with the public utilities and the way they provide electricity to our buildings. This would be more specifically right to our individual buildings that we own. Changes are simple,.. replacing higher efficiency lighting is one of the biggest. The second is having systems shut down when people aren't

around. They are many energy saving measures beyond this one. This is the simplest, short of operational things we can do within our buildings.

**Senator Holmberg:** Senator Laffen, contact your people and have them look at next week's calendar...open Thursday, Friday most afternoons.

**Senator Laffen:** People who would like to be here are the sheet metal, heating and air conditioning contractors. They are at the national convention this week.

**Representative Kreun** District 43, Grand Forks. I have been a consultant and worked on some of these particular projects and sold and helped the people who own these large buildings with their problems. I sit on the Safety and Services Committee in Grand Forks City Council. We are utilizing some of the services in our buildings and starting to go through more analysis in order to save energy. One of the companies I did work for was a consultant for DID the retro commissioning and that term is "retro commissioning". On the newer buildings, when constructed, they design it for a purpose and frequently it changes as the building is built or actually finds out that the purpose isn't exactly what they designed it for. The heating and air condition systems don't reflect those changes, so you come in to make the "retro commissioning" to adjust to the use of the building. As its indicated the lights going off at different times, use variable speed pulleys because of many people in a particular room, you can increase the air ventilation...fewer people you decrease the ventilation. That is done automatically with controls so it is not necessarily has to be manually input; the same with lighting and heating when it is not being utilized. The county office building in Grand Forks put \$140,000 into the retro commissioning of that building and in 7 to 8 years, they tracked and saved over \$1M dollars in energy savings. It was a relatively new building. Utilizing this type of energy savings is the Alerus Center Commission, looking at the fire stations, city hall, and other buildings. I am in support of SB2299. I have friends here who are looking at the ten million dollars and also sit on the Safety and Service Commission. We are in the process of building the water treatment plant. If there is a financial scenario that could be done, it can be done through public and private partnership. There are private companies under state law that will help us. Many times it takes "seed money" to get to that point. We could use "seed money" to get into that particular process and partner with private sector.

**Chairman Holmberg:** How is that going with 1/3 of city council in Bismarck every Monday night?

**Representative Kreun:** We have separate room and skype.

**V. Chair Grindberg:** Explain about the new water treatment plant.

**Representative Kreun:** It has nothing to do with other than his friends are looking at the financing of this.

**Senator Bowman:** The newer buildings that we are building today, don't the architects take this into consideration when they are building them as far as energy saving, or is this a different means of different heating systems? When we redid our court

house...this is something we looked at. Is this common practice or is it up to the individual contractor to bring this forward or the architect when you are building a new building?

**Representative Kreun:** The architect usually designs the energy savings into the building. The building usage does change after and even during construction. The usage designed or intended is sometimes not what it is used for. What we found, if we re-adjust, the HVA systems to match the use of the building, we find a lot of savings (Lights example). If room gets used a lot, you can change the air exchange to greater degree.. same as less used. You have the controls to set. The energy savings are usually designed into the construction of the new buildings, but it is the HVA system that is usually that has to be adjusted to match the use and develop a lot of savings. The contractor or architect or owner can request, as part of the bid. When they come in to adjust that, they adjust it for the design use of the building and re-adjust for the actual use of the building.

**Senator Warner:** Sometimes we have agencies that are allowed to charge back some of the operating costs of their buildings toward the federal government or towards special funds. It would be nice if we would be able to capture the interest from those entities to contribute to this fund. I don't think we would be able to or would be allowed to discriminate between the federal projects as the National Guard or the Human Services. We couldn't build and discriminate between those and the things that are 100% general fund. Do you think it adversely impacts the payback period on some of these projects if we were to charge interest on all of them? Even if it were subsidized, the interest or below market interest, would that adversely affect the project?

**Representative Kreun:** Not to a great degree. That could be worked into the repayment plan. There are private sector companies (ESG) by the North Dakota law, made the recommendation years ago, make the requirement that they can come in and go through the process, fund the retro fitting, fund the updating, with the saving and guarantee it to that particular entity. Interest in that case may or may not be a large factor if we have to do that and discriminate, but that is guaranteed by the company with the bond. We are working with that at the Alerus Center now. It is a two year process to analyze what we need done because it is such a large building. Before going in to make the corrections, we start the process of the payback, and cost of doing...there are several options. There are so many square feet in the state, we need to get started on the comprehensive energy saving plan. The funding is debatable.

**Kim Christianson:** Vice Chair ND Alliance for Renewable Energy (NDARE) testified in favor of SB 2299 Testimony attached # 2. Support of 2299.

**Senator Christmann:** I am insulted by the implication that we have ignored the wishes of the voters. I want you to haul thousands of gallons of water to cattle or billions of water to the oil wells all over North Dakota. You will find you can't do it. You need trucks, fuel, and water pipelines to save an enormous amount of energy.

**Kim Christianson:** I am not here to insult the legislature. What I am indicating is that it was voted on in 1990, voted on for two purposes. It could argued, that a number of

people voted for that bill because it contained both purposes. Today, it hasn't been used for energy.

**Senator Christmann:** It has been used for energy because water pipe lines save a lot of energy compared to hauling.

**V. Chair Grindberg:** Would you be ok with interoperability? (Standard on Hback systems)?

**Kim Christianson:** Certainly. There is any number of projects that can be funded through this program. That would be one of them. It could be used at the Capitol and would be a good place for the funds, in a variety of activities.

**V. Chairman Bowman:** How long do you think it would take to use the \$10 million dollars, to spend on "A, B, C and D" to save all this energy? I think that would go about as fast as a card game in the café. How do we justify? We talk about the savings. By the time the building is used up, we re-do it. Have we benefited by spending the money on that old building?

**Kim Christianson:** This is a revolving loan program so the money should be coming back after its funds these energy efficiency programs. I can't respond to the number of buildings that are being torn down, but most public buildings are in existence for a long time and every effort is put into place to keep their useful life extended. This program would help with this.

**V. Chair Bowman:** We have a maintenance agreement with the group that takes care of our public buildings. In the maintenance agreements they suggest that we have a lot of inefficiencies and are bringing this forward or is it a group of people that are interested in doing these projects or more interested in getting this bill through?

**Kim Christianson:** It is a little difficult for me to respond to your particular maintenance agreements. I would hope that in these maintenance agreements the energy operational changes would be included to use the least energy as possible.

**Chairman Holmberg:** I am sure you're very well aware of it, but I think this committee should be very proud of what we did years ago at Mayville State for removing 60% of their deferred maintenance by tearing down East and West Hall which were aptly named and connecting those other buildings. It made a huge difference and that was something that this committee was very involved. It was a real good project which is bigger than what you're talking about. But we've done some of these projects that really have made a difference on the energy, on one of our campuses at least.

**Kim Christianson:** I work in the National Energy Center of Excellence at Bismarck State College (BSC) building. There were all sorts of energy efficiency design aspects of that building. It has a ground source heat pump system for heating and cooling. It has very efficient lighting system. I do think the newer buildings are being built to efficiency standards.

**Al Christianson**, Representing Great River Energy at the Coal Creek Station which is the largest power plant. It is not a public building but when it was designed it was designed as state of the art. 13% of the output of that power station was used to run the power station. In doing energy efficiency projects there were life cycle cost analysis over the years; we're now 8%. So it was in the original design we used 156 megawatts out of 1200 megawatts to run the plant. Today we're using 96 megawatts. That 60 megawatts difference is the power that is used in Bismarck/Mandan. So why would somebody that's made their living selling energy want you to be more efficient? Because the cheapest megawatt that we have at Great River Energy is the one we don't have to build. Why have we built two leads buildings? Our headquarters in Maple Grove, Minnesota was the first leads platinum building and yes we spent about an extra 7% up front, but the life cycle analysis paid it back in less than six years. Our building in Bismarck, North Dakota is gold with about 30% savings on our energy usage. Being a taxpayer in North Dakota, I like these buildings that are controlled energy systems. I support this bill. Its real projects that can happen and you have done a wonderful job.

**Harlan Fugleston**: North Dakota Association of Rural Electric Cooperatives. We're a member of the North Dakota Alliance for Renewable Energy (NDARE). Our distribution cooperatives have all been involved in energy efficiency. We sell about 50% of all the retail generation in the state. We support any effort we can to make it as energy efficient as possible. We have a lot of our private consumers as members who are doing things every day to try to save energy as our energy costs are going up. We think this is a good way to help stem those costs for our state as well.

**Senator Laffen**: Senator Bowman asked if this was motivated in any way to find work for those of us who do those kinds of projects. I just wanted to point out that I set the limit at \$100,000 dollar projects because that is the limit at which point any of our state agencies actually don't have to hire an architect. I just wanted to point out that there was not self motivation in this project.

**Chairman Holmberg**: On Monday we will make a decision.

**Senator Christmann**: It is interesting how energy discussions might have changed 60 years ago when electricity got to our ranch. Short family story cited.

**Chairman Holmberg**: I did a tour in Buenos Aires and they had these palaces that had been taken over by the people and were being lived in, and they had bulbs hanging from the ceiling where there used to be chandeliers. They had a bulb hanging down on a wire which was kind of interesting.

**Zachary Weis**: State Energy Engineer, ND Department of Commerce at the Dept of Commerce; neutral on SB 2299. Testimony attached # 3

**Senator Warner**: What is the source of funds you use for low interest loans?

**Zach Weis**: That is performance contracting. That's when the outside entity comes into the facility and finds that private financing on their own; so it's not a source that we come with. It is financing from a private entity.

**Zach Weis:** That is performance contracting. That's when the outside entity comes into the facility and finds that private financing on their own; so it's not a source that we come with. It is financing from a private entity.

**Senator Warner:** Should we decide to fund something similar to this, which is in the bill, is assigned to the State Treasury, would you think Commerce would be better equipped perhaps to be the housing agency for that initiative?

**Zach Weis:** I guess I was under the understanding that the Commerce Department would be the one administering the program but the money would be in the Treasury.

**Chairman Holmberg:** We did one of those big performance projects a few years ago in Wahpeton on the campus.

**Zach Weis:** That's correct. Wahpeton was actually one of the first ones to do a performance contract.. When performance contracting first came to our state in 1999, at that time it allowed payback for 10 years to show the projects have to be paid back with 10 years. Wahpeton for sure made that. Now we have performance contracts that happen all over the state.

**Chairman Holmberg:** In some instances, this committee has turned down requests for appropriations for doing energy projects because they were of such a size that the performance private sector was the way to go and it made more sense. I think it might have been at the University of North Dakota that I know we turned down some money.

**Zach Weis:** That was probably in the State Facility and Energy Improvement Program. UND is well equipped to do these projects on their own without a private entity coming in and finding the energy conservation measures themselves. They have good staff up there.

**Chairman Holmberg:** They also have a power plant that we will be talking about in the next years, that is not going to make it..

**Mike Dwyer,:** Representative: of the North Dakota Water Users Association. We are neutral on SB 2299. Testimony attached #4. We want to finish the NAAS and the Southwest Pipeline. We are looking at money this biennium to avoid the catastrophe that is going to happen. We want to remind you of the funding challenge we have in the water community.

**Senator O'Connell:** Harlan, basically this would piggy-back what the rural electrics has on the rural development for energy package to be patterned after that, or basically can accept this for to be used for government buildings? Is that unlike any part close on the scenario?

**Harlan Fuglesten:** We do have a number of programs where we have revolving loans which we give to our customers. Those loans do carry interest but they are paid back over a period of years, so it is the same concept except this is a zero interest loan

program. But yes, we have loaned millions of dollars to our consumers through various programs like this.

**Chairman Holmberg** Suspend the hearing take it up again next week, before the end of the week.



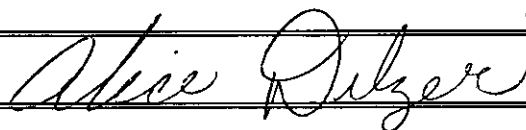
# 2011 SENATE STANDING COMMITTEE MINUTES

## Senate Appropriations Committee Harvest Room, State Capitol

SB 2299  
02-04-2011  
Job #14001

Conference Committee

Committee Clerk Signature



### Explanation or reason for introduction of bill/resolution:

Energy Improvement Revolving Loan Fund (Rehearing)

### Minutes:

See attached testimony.

**Chairman Holmberg** called the committee to order on Friday, February 4, 2011 at 8:00 am In reference to SB 2299. Roll call was taken. All committee members were present except Senator Kilzer and Senator Robinson. Tammy R. Dolan, OMB and Brady Larson, Legislative Council were present.

**Senator Lonnie Laffen, District 43, Grand Forks** introduced the SB 2299. He stated he thought this Bill would only be for the state facilities but it comes out that it is for both state facilities and political subdivisions. The idea I had was for just own state buildings which is 22 million square feet. But I am open to whatever the committee would think is best. The idea is to create a revolving loan fund that makes small energy improvements that pay back with their energy savings back into the loan and the loan would keep refreshing and renewing itself and continue to bring our energy costs back in line with where we know we can today.

**Dave McFarlane** with McFarlane Inc Grand Forks testified in favor of SB 2299. Testimony attached # 1 requesting to establish a revolving loan fund. There are only a handful of states that have this so this is a step in the right direction. He also submitted Testimony attached # 2, Technical RCx for Office by Dave McFarlane, Member of ASHRAE which explains Technical Retrocommissioning RCx, which is where corrective action is taken to make an existing building conform to the owner's current facility requirements. This bill will allow schools, counties, cities and states to a access up to \$100,000. To fund energy projects. I am asking you to support this legislation.

**V. Chair Bowman** had questions regarding if you can see this coming to an end some day, because we should have a code in addressing energy efficiency.

**Dave McFarlane** stated he would agree. He commented many new buildings still need upgrades concerning saving energy. It's that tuning process that we do after the fact that makes them efficient. There is a process called Commissioning for new buildings that does exactly what you are asking about. It takes a lot of time and technical expertise to do that.

**Heather Jones**, Owner of City Air Mechanical, Bismarck, testified in favor of SB 2299 and stated we have been involved with many projects when you speak of old buildings in the last couple of years we have done a lot of energy efficient improvements, including a local hospital. This is an important Bill for our business and our industry and this gives a huge opportunity for small businesses such as mine that employs just 30 people here in the state an opportunity to go on and make a big impact, and this is an opportunity for the state to move forward.

**Chairman Holmberg** asked Senator Laffin in putting this Bill together did you have any discussion with the BND concerning the loan program? He was told no. Chairman Holmberg continued to say that we will have the president of the BND in our committee hearing on Tuesday and we will ask him to look over the Bill and how this will interface with what you are doing. Because if we pass this bill what happens is we encumber 10 million dollars from the Resources Trust Fund. Maybe there is another mechanism to do the same thing without encumbering the Resources Trust Fund

**Senator Laffin:** I don't think anyone cares where the money comes from. One more comment to Senator Bowman's question, will this ever end, I do agree that today's buildings are much more energy conscious as we design them and we are starting to build in this fine tuning right into the original plans and specs. But, yes this might end down the road.

**Chairman Holmberg:** You might do something today and 5 years from now there is a new process or new technology that you could go back in and fine tune a little further.

**Senator Laffin:** That is very possible but I think we would be open to a sunset on this.

**Chairman Holmberg** I don't know what the committee wants to do with the bill but we will explore some other funding sources.

**Senator Wardner** talked about serving during the interim regarding these issues and it always comes down to a cost savings, which he is all for, but struggling with some of the issues concerning energy development. Our issues were more with regulation and not a fund like this.

**Senator Laffin** stated the industry has changed in the last 10 years energy used to be cheap, not so now, and feels it is time to address this energy efficiency problem in old and new buildings. Any building that is 30 years or older is a huge energy hog. He addressed the database concerning this matter.

**Senator Wardner** So you would say this is kind of a little motivational nudge to get those people to take advantage and correct those things because if they do it on their own it will save a ton of money. I agree if you own a building you need to take care of it.

**Senator Laffin** we do all the work for all the Higher education institutions in the state and they just don't have the resources to get this done so this Bill would be beneficial for them.

**Dave McFarlane** shared about his local bank in Grand Forks and how it has improved their heating and cooling costs for them.

**Senator Christmann** had questions regarding the savings and how to define that.

**Dave McFarlane** explained how they take the energy bills beforehand, for the last three years, and average that up then convert to BTU's per square foot. So those are numbers that come right off the energy bill so we got a base so when you are done you will be here. Then when the energy bills start coming back we do our tweaking, make our fixes, the energy bill was 1000 units per square foot, when we are done they are down to 750. You can see that number right on your energy bill.

**Chairman Holmberg** stated we want to do some exploring before we do anything with the Bill. He closed the hearing on SB 2299.

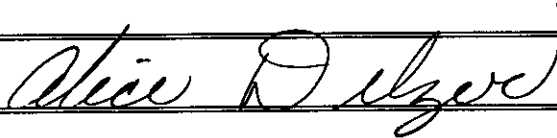
# 2011 SENATE STANDING COMMITTEE MINUTES

Senate Appropriations Committee  
Harvest Room, State Capitol

SB 2299  
02-17-2011  
Job # 14716 (Meter 28.35)

Conference Committee

Committee Clerk Signature



## Explanation or reason for introduction of bill/resolution:

A Roll call vote on the Bill Energy Improvement Revolving Loan Fund

## Minutes:

You may make reference to "attached testimony."

**JOB # 14716 INCLUDES ROLL CALL VOTES ON THE FOLLOWING BILLS: SB 2345,2159,2029,2299,2298,2212,2334,2347 and discussion concerning other bills.**

**Chairman Holmberg** called the committee to order in reference to SB 2299. That bill should not have been in Human Services. I do have an amendment # 11.0739.01001 from Senator Laffen. The original Bill says Political Subdivisions of the state to do some energy saving activities and the idea was with a little incentive they might do it and in the long run they would save money and he asked if I would throw out for your consideration, remember we had Dave McFarland and some others testifying if I would put out these amendments. He explained the amendments. If someone wants to move the amendments please do so.

**Senator Wardner moved the amendments. Seconded by Senator Warner.**

**Chairman Holmberg:** Would you call the roll on the amendment #01001 on 2299.

**A Roll Call vote was taken. Yea: 12; Nay: 1; Absent 0. Motion carried.**

**Senator Warner:** Roxanne, how does this show up on the budget? It's interest free loans that should come back. Does it show up on the bottom line?

**Roxanne Woeste, Legislative Council:** The Bill as amended now would provide a \$1 million appropriation from the Permanent Oil Tax Trust Fund so on our Budget Status Reports you would see that money coming out that fund. In a sense it's a transfer from one fund to a newly created fund.

**Senator Wardner I move a DO NOT PASS AS AMENDED. Seconded by Senator Christmann.**

**A Roll Call vote was taken. Yea: 12; Nay 1; Absent 0. Senator Wardner will carry the Bill. The hearing was closed on SB 2299. (Meter34.49)**

11.0739.01001  
Title.

Prepared by the Legislative Council staff for  
Senator Laffen

February 15, 2011

PROPOSED AMENDMENTS TO SENATE BILL NO. 2299

Page 1, line 10, remove "or political subdivisions"

Page 1, line 12, replace "fifteen" with "eight"

Page 1, line 14, replace "resources" with "permanent oil"

Page 1, line 15, replace "\$10,000,000" with "\$1,000,000"

Renumber accordingly

Date: 2-17-11  
Roll Call Vote # 1

2011 SENATE STANDING COMMITTEE ROLL CALL VOTES  
BILL/RESOLUTION NO. 2299

Senate Senate Appropriations Committee

Check here for Conference Committee

Legislative Council Amendment Number 11.0739.01001

Action Taken:  Do Pass  Do Not Pass  Amended  Adopt Amendment  
 Rerefer to Appropriations  Reconsider

Motion Made By Wardner Seconded By Warner

Senators	Yes	No	Senators	Yes	No
Chairman Holmberg	✓		Senator Warner	✓	
Senator Bowman	✓		Senator O'Connell	✓	✓
Senator Grindberg	✓		Senator Robinson	✓	
Senator Christmann	✓				
Senator Wardner	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Krebsbach	✓				
Senator Erbele	✓				
Senator Wanzek	✓				

Total (Yes) 12 No 1

Absent 0

Floor Assignment \_\_\_\_\_

If the vote is on an amendment, briefly indicate intent:

Date: 2-17-11  
Roll Call Vote # 2

2011 SENATE STANDING COMMITTEE ROLL CALL VOTES  
BILL/RESOLUTION NO. 2299

Senate Senate Appropriations Committee

Check here for Conference Committee

Legislative Council Amendment Number \_\_\_\_\_

Action Taken:  Do Pass  Do Not Pass  Amended  Adopt Amendment

Rerefer to Appropriations  Reconsider

Motion Made By Wardner Seconded By Christmann

Senators	Yes	No	Senators	Yes	No
Chairman Holmberg		✓	Senator Warner	✓	
Senator Bowman	✓		Senator O'Connell	✓	
Senator Grindberg	✓		Senator Robinson	✓	
Senator Christmann	✓				
Senator Wardner	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Krebsbach	✓				
Senator Erbele	✓				
Senator Wanzek	✓				

Total (Yes) 12 No 1

Absent 0

Floor Assignment Wardner

If the vote is on an amendment, briefly indicate intent:

**REPORT OF STANDING COMMITTEE**

**SB 2299: Appropriations Committee (Sen. Holmberg, Chairman)** recommends **AMENDMENTS AS FOLLOWS** and when so amended, recommends **DO NOT PASS** (12 YEAS, 1 NAYS, 0 ABSENT AND NOT VOTING). SB 2299 was placed on the Sixth order on the calendar.

Page 1, line 10, remove "or political subdivisions"

Page 1, line 12, replace "fifteen" with "eight"

Page 1, line 14, replace "resources" with "permanent oil"

Page 1, line 15, replace "\$10,000,000" with "\$1,000,000"

Renumber accordingly



2011 TESTIMONY

SB 2299

SB2299



TESTIMONY TO THE SENATE APPROPRIATIONS COMMITTEE  
JANUARY 28, 2011  
LONNIE J. LAFFEN, AIA, LEED

My name is Lonnie Laffen, Senator from District 43 in Grand Forks. In my other life I am an architect of 27 years. You will notice two credentials behind my name. AIA stands for American Institute of Architects and LEED stands for Leadership in Energy and Environmental Design. The two would suggest that I am passionate about energy conservation as it relates to buildings, so today I bring to you a bill intended to save our state both energy and money (and I can only guess that you've heard that before).

North Dakota owns and operates 22 million square feet of building space. Virtually all of it was built prior to today's energy conservation breakthroughs such as high efficiency lighting, digital temperature controls and heat recovery systems. We have learned over the past ten years that it is possible to significantly reduce our energy consumption by making small physical and operational changes to our buildings. The average savings is typically \$1 per square foot. That equates to an annual savings of \$22M for North Dakota.

I am proposing three steps to help make that happen and have introduced three bills. This bill is actually the middle step but I'd like to explain all three.

1. The first step (SB2296) would create a database that will track the annual usage of gas, electricity and water for each of the state's buildings. This will do two things:
  - a. It will quickly highlight our energy hogs and help us focus our efforts where we get the quickest payback.
  - b. It will give us an ongoing record to see what works and what doesn't and verify that we are, in fact, getting value and savings as we implement changes.
2. The second step is this Bill SB2299 which picks off the low hanging fruit by making small physical changes to our buildings that we know will save energy and money. Changes such as lighting retrofits, mechanical retrofits, heat reclamation systems and digital controls capable of shutting down systems automatically at night.
3. The third step is SCR 4011 which would create an overall plan to manage our public building energy use and sustainability going forward. A key component of the plan is to create policy for ongoing operations. Oklahoma State University has created and implemented such a plan. They have 8M square feet of space, have

spent \$1.9M and saved \$12M. The numbers are easily verified because they too started by creating the database I described in step 1.

This Bill would create a \$10M revolving loan fund that our state agencies could use to make small energy updates. The loans would be interest free and paid back by the savings. The projects would need to have paybacks less than 15 years and no one building could use more than \$100,000. The idea is to continually make improvements to our buildings, continually lower our state's energy cost and continually replenish the loan pool.

The state does have two other programs already in place:

1. The State Facility Energy Improvement Plan uses appropriated funds or bonds to make improvements at a bigger scale. The projects in this program have spent \$10M and are yielding \$1.4M in annual savings.
2. Guaranteed Energy Savings Contracts is the second program. It allows private sector companies to do the projects themselves, finance them and then pay themselves back with the savings. This group of projects has spent \$22M and yields annual savings of \$2.2M. The private companies mostly focus on the large projects where the paybacks are profitable for them – typically around \$2M.

This revolving loan fund would give us one more tool in the box and make it easier for our state agencies to make small energy improvements and to cut out the middle man. The bill suggests that the revolving loan pool would come from the Resources Trust Fund which was created in 1980 to construct water related projects and to fund energy conservation programs. No dollars from the Resources Trust Fund have ever been used for this second purpose. According to OMB the fund will generate \$282M in fiscal year 2011, 2012 and 2013. I understand that we have a lot of water related needs in North Dakota and the bill's sponsors would certainly defer to your expertise if you have a better fund to use. I would suggest however that we can fund a lot of water projects with \$22M per year.

North Dakota has more heating degree days than any other state in the lower 48 and that's not bad news. It means we have more opportunity to save money than anyone else.

TESTIMONY IN SUPPORT OF SB 2299  
ND SENATE APPROPRIATIONS COMMITTEE  
FRIDAY, JANUARY 28, 2011

#2

Kim Christianson, Vice Chair – ND Alliance for Renewable Energy

(Included with this testimony is an opinion piece that I wrote and submitted on behalf of NDARE, which was printed in both the Grand Forks Herald and the Bismarck Tribune. It is included for background information.)

Chairman Holmberg, Committee members, if you turn back in my testimony you'll find two pictures of Schafer Hall at Bismarck State College which illustrate a very successful energy efficiency project undertaken nearly 20 years ago. As you can see in the first photo, the building was designed with glass curtain walls facing southwest and northeast. Unfortunately, it quickly became apparent that these walls did little to combat the elements – either freezing cold temperatures or very high heat. I recall being told that temperature readings varied by up to 10 degrees depending on where students sat in the room – right next to the glass exterior wall versus the hallway wall. BSC participated in a Department of Energy matching grant program to fund a project that replaced the glass curtain walls with insulated wall panels and smaller, operable windows. At the time, projects were required to have “payback periods” of under 10 years, but because it was a competitive program, successful projects likely had payback periods of 5 – 7 years.

To this day, former BSC President, Kermit Lidstrom, speaks glowingly of this project. Because in addition to the substantial energy and cost savings realized by BSC, the project resulted in greatly improved comfort, much better working conditions for students, faculty and staff, and a more modern looking facility – improved aesthetics.

This is just one example of the type of projects that could be implemented in public buildings throughout North Dakota as a result of this bill.

2

As many of you know, in late 2010, a national organization called the American Council for an Energy Efficient Economy (ACEEE) completed a ranking of state policies and programs related to energy efficiency. Among the 50 states and the District of Columbia, North Dakota was ranked dead last, or 51<sup>st</sup>, scoring 1.5 points out of a possible 50 points. I don't fully agree with their ranking methodology and feel strongly that we didn't receive certain ranking points we were entitled to. Nonetheless, we badly trail other states. And North Dakota has the highest average number of heating degree days of any state outside of Alaska. (The forecasted low in Grand Forks this coming weekend is -15 degrees, a significant improvement over some recent low temperatures there!)

North Dakota is a leader in all sorts of energy development – from lignite coal, to oil and gas, to wind energy, biofuels and biomass potential. There is no reason our state can't lead in energy efficiency programs and policies. (We do have a leadership position with the Weatherization Assistance program.)

Energy efficiency programs create jobs for HVAC contractors, insulation installers, lighting contractors, engineers and architects, door and window sales people and installers, roofers, and more.

A statewide survey conducted in late 2010 by NDARE, through the UND Bureau of Governmental Affairs, indicated very strong support for high standards of energy efficiency in public buildings (85%) and even stronger support for the funding of both water and energy projects through the Resources Trust Fund (88%). The full survey can be viewed at [www.ndare.org](http://www.ndare.org).

If you approve the funding of a public buildings energy efficiency revolving loan fund of \$10 million, there would remain a biennium balance of just under \$323 million for water projects. In the 1990 primary election, voters approved the Resources Trust Fund as a constitutional trust fund to be used for two purposes – water and energy. It's time to more fully recognize their wishes.

Chairman Holmberg and committee members, NDARE urges your support of SB 2299. Thank you.

## USE RESOURCES TRUST FUND FOR ENERGY

In his December budget address, Governor Dalrymple laid out a thoughtful and aggressive agenda to guide North Dakota through the next biennium, from July 1, 2011 through June 30, 2013. North Dakota legislators will now consider his recommendations and make decisions based on their best judgments and public input.

In his proposed budget, Governor Dalrymple specifically mentioned using the Resources Trust Fund for various large-scale water projects, including the Devils Lake outlet and the Red River diversion channel. Water project advocates know that the Resources Trust Fund is a substantial source of funding for state water initiatives, but many North Dakotans are unfamiliar with the Fund and why it was established.

The Resources Trust Fund (RTF) was originally created through passage of an initiated measure in 1980. At that time, the RTF received 10 percent of the 6.5 percent oil extraction tax. In the June, 1990 primary election, North Dakota voters approved the RTF as a constitutional trust fund with the provision that the principal and income of the fund could be legislatively appropriated for two purposes: constructing water related projects, including rural water systems; and, funding energy conservation programs.

The ND Century Code Section 57-51.1-07 further clarifies the purposes of the RTF by stating it is available for legislative appropriation to the State Water Commission for planning and constructing water-related projects, and to the Industrial Commission for energy conservation and development of renewable energy sources, for cogeneration system development studies, and for waste product utilization programs and studies. The legislature also amended section 57-51.1-07 to provide that 20 percent of the oil extraction tax collections be deposited in the RTF.

According to the ND Office of Management & Budget, the Resources Trust Fund has generated over \$230 million from FY 1994 through FY 2010, and state officials project the fund will generate an additional \$282 million in fiscal years 2011, 2012 and 2013 alone.

**No dollars from the Resources Trust Fund have ever been used for energy conservation, renewable energy, or waste product utilization projects!**

The North Dakota Alliance for Renewable Energy is an advocacy organization with members representing growers groups, investor-owned utility companies, rural electric cooperatives, state agencies, economic development groups, colleges and universities, banks, manufacturers, and more. Its purpose is to find common ground and opportunities, and to develop strategies to make North Dakota the preeminent state for development and use of renewable energy.

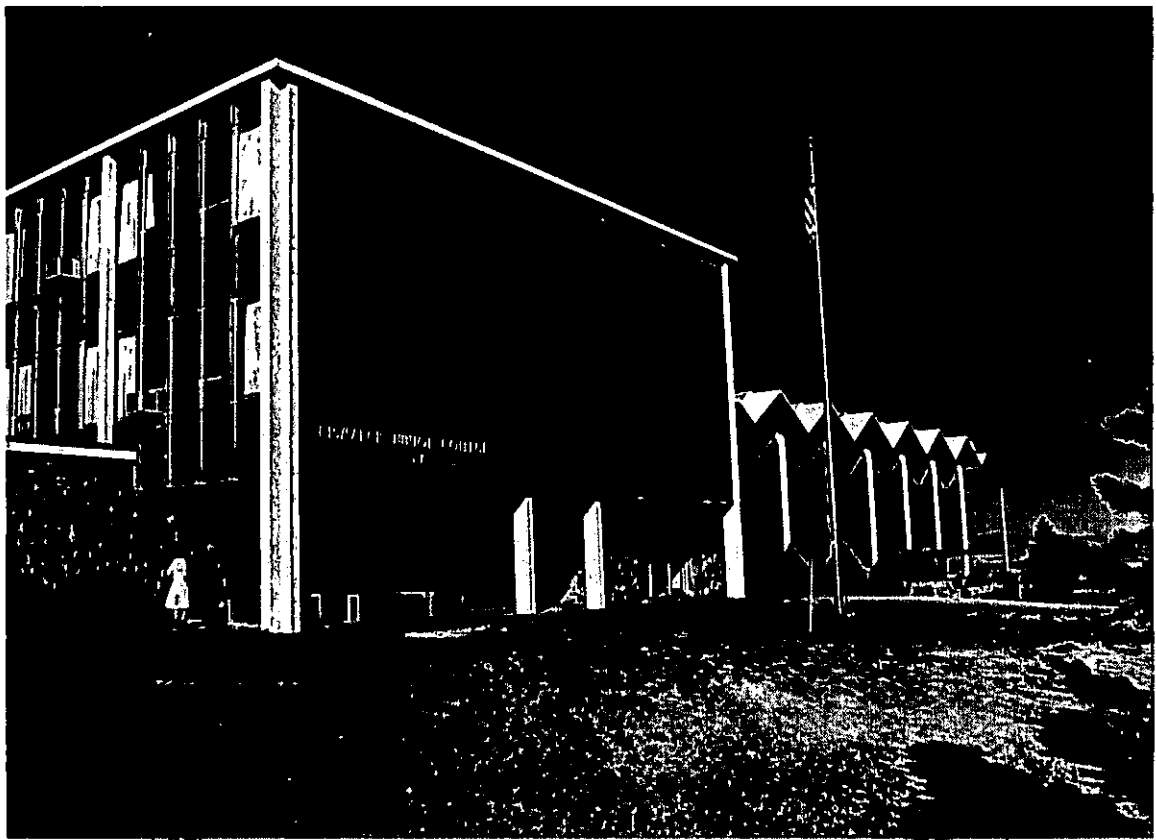
NDARE has developed and adopted renewable energy and energy efficiency policies for 2011, including a proposal to utilize a small percentage (3 percent or approximately \$10 million) of the projected 2011 – 2013 RTF monies for energy efficiency programs that will benefit all North Dakotans.

For example, NDARE proposes the creation of a revolving loan program that would provide low-or-no-interest loans to schools and public buildings throughout the state to undertake efficiency studies and implement energy efficiency improvements, paid back within a certain timeframe through utility savings. Other potential uses of the funds include energy efficiency education and outreach efforts through the NDSU Extension Service; establishment of an energy efficiency center or "one-stop shop" for information, training and assistance with energy efficiency efforts; and a statewide competitive program to encourage city and county energy efficiency programs and initiatives.

A November, 2010 statewide survey paid for by NDARE and completed by UND's Office of Governmental Affairs indicated very strong support for energy efficiency programs and, more specifically, for use of a portion of the Resources Trust Fund for energy related activities.

Nobody disputes the importance of water projects in North Dakota. NDARE as a group is on record supporting the use of most RTF dollars for priority water projects. But there is sufficient funding in the Resources Trust Fund to undertake energy efficiency and other energy programs that will benefit all North Dakota citizens. It is long overdue that the full wishes of North Dakota voters be recognized.

Kim Christianson, Vice-Chair  
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#3

**DEPARTMENT OF COMMERCE TESTIMONY ON SENATE BILL 2299  
JANUARY 28, 2011, 9:30 A.M.  
SENATE APPROPRIATIONS COMMITTEE  
HARVEST ROOM  
SENATOR RAY HOLMBERG, CHAIRMAN**

**ZACHARY WEIS – STATE ENERGY ENGINEER, ND DEPARTMENT OF COMMERCE**

Good morning, Mr. Chairman and members of the committee, my name is Zac Weis and I serve as the State Energy Engineer in the office of Renewable Energy and Energy Efficiency at the North Dakota Department of Commerce.

The Department of Commerce is neutral on SB 2299. I wanted to use this opportunity to provide you some brief information about how our office currently supports energy efficiency and answer any questions you might have.

Through programs such as the State Energy Program and the Energy Efficiency and Conservation Block Program we have helped promote energy efficiency and fund energy conservation measures in our state facilities and public buildings throughout the state.

Our office has also helped with the introduction of Guaranteed Energy Savings Contracts into our state. These Guaranteed Energy Savings Contracts or performance contracts are a tool for facilities to receive an energy audit, and arrange for low interest financing for energy improvements.

We also continue to administrate the State Facility Energy Improvement Program, which allows state facilities to perform energy conservation projects with funding provided by state appropriated funds or state bonds.

Mr. Chairman and members of the Committee, that concludes my testimony and I am happy to entertain any questions.

3

January 11, 2011

44

**Draft**  
**Water Coalition Funding Priorities Outline**

**Regional Infrastructure Development Projects:**

	2011-13	2013-15	2015-17	2017-19	Total
Devils Lake Flood Control/Outlet Water Treatment	\$100 million \$20 million	----- \$20 million	----- -----	----- -----	\$100 million \$40 million
Flood Control - Fargo	\$45*/ \$30 million	\$75 million	\$75 million	\$75 million	\$300 million
RRVWSP	\$20 million	\$40 million	\$80 million	\$80 million	\$220 million
SWPP/NAWS	\$25/ \$12 million	\$23/ \$50 million	\$19/ \$20million	---/ \$10 million	\$159 million
Western Area Water Supply	\$25 million	\$5 million	-----	-----	\$30 million
<b>Total</b>	\$232 million	\$213 million	\$194 million	\$165 million	\$849 million

**Local Infrastructure Development Projects:**

	2011-13	2013-15	2015-17	2017-19	Total
General Water Management	\$30 million				
Irrigation	\$6 million	\$6 million	\$3.5 million	\$3.5 million	\$19 million
Missouri River	\$1 million	\$1 million	\$1 million	\$1 million	\$4 million
MR&I Municipal Rural	\$25 million \$46 million	\$55 million	\$35 million	\$15 million	\$151 million
Weather Modification	\$1 million	\$1 million	\$1 million	\$1 million	\$4 million
<b>Total</b>	\$109 million				

*\* This was allocated by the 2009 Legislative Session*

2

Dave McFarlane with McFarlane Inc Grand Forks. Our firm provides comprehensive energy solutions to commercial building customers.

Of the 50 States + PR, ND ranks # 51 in Energy Usage per square foot of building area. We are in last place.

This year ND finally adopted the International Building Code establishing energy efficient construction methods in new construction projects. Until now ND was only a handful of states that did not have a state building code.

3 bills are in process in the ND State legislature

- 1 Develop a state wide energy policy
- 2 Set up a state wide data base to track the energy usage in buildings
- 3 Set up a funding source to fund energy savings projects.

Separately each bill makes sense. Together they form a powerful basis for comprehensive energy management for the state.

The bill being discussed in this committee provides \$10,000,000 for a pool to fund these projects. Since the pool will be replenished by the energy savings, the only cost to the state is the loss of interest had these funds been invested.

However an energy project with a 5 year pay back has a 20% ROI and one with a 10 year payback has a 10% ROI...This exceeds most investment ROI right now.

We know these projects work.

\$100,000 in GF County Office in 2001 =	\$140,000 per year
\$ 65,000 in GF County Court House in 2007=	\$45,000 per year
\$ 60,000 in GF County Correction Center in 2009 =	\$35,000 per year.

This averages \$1 per square foot.

We have been able to reduce the energy usage in buildings by 30% and increase comfort.

Problems occur when agencies don't have up front funding sources to complete the project.

This bill would remove the hesitancy by providing the funding source.

It will lower the energy costs for the state. Should result in lower taxes, and will provide jobs for firms such as ours.

I am asking you to support this legislation

# COMMISSIONING

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## Technical RCx For Office

By Dave McFarlane, Member ASHRAE

**T**echnical retrocommissioning (RCx) is the systematic process where corrective action is taken to make an existing building conform to the owner's current facility requirements. Two approaches to RCx are in common use: process and technical. These approaches parallel the process and technical approaches taken in new building commissioning.

### Process RCx

The process RCx approach relies on the testing, adjusting and balancing report (made by others), the temperature control sequences shown in the contract documents and a review of the plans and specifications to determine corrective action. Minimal time is spent obtaining site data.

### Technical RCx

The technical RCx process requires the RCx team to determine the actual flows, temperatures and pressures for the various building systems and compare the actual control sequences to known energy-efficient control sequences.

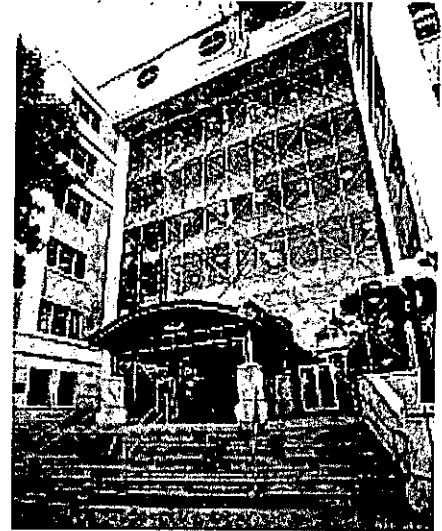
The team confirms proper operation of all dampers, control valves, variable frequency drives (VFDs) and other equipment. Controls are calibrated to scheduled setpoints and proper control loop response time is verified.

Electrical systems are checked. Thermal imaging is used to determine loose connections. Power quality analysis is used to determine low voltage, low power factor or load imbalance in electrical systems and proper grounding is confirmed. Lighting systems are evaluated for efficient ballasts, lamps, occupancy control, daylight harvesting and lighting levels.

The building envelope is evaluated for air infiltration, building pressurization and glazing efficiencies.

### Technical RCx in Practice

Our firm recently used the technical RCx process to reduce the energy use in the new Grand Forks County Office Building, a six-story 140,000 ft<sup>2</sup> (13 000 m<sup>2</sup>) building completed in 2000. The county commissioners were concerned with the building's relatively high energy costs of \$1.40/ft<sup>2</sup> (\$15/m<sup>2</sup>) as compared



Grand Forks County Office Building.

to the \$0.90/ft<sup>2</sup> (\$9.67/m<sup>2</sup>) originally anticipated.

This office building houses social services, public health and safety, taxation, county auditors, property records and administration. The entire sixth floor contains meeting rooms and the county commissioners' offices.

The RCx team met with the commissioners' building committee, design engineers, and building maintenance staff to understand their concerns. During these meetings, we learned that the maintenance staff was overriding the original temperature setpoints in response to occupant complaints.

The technicians checked equipment for flows and operation. The building's mechanical and electrical system controls were compared to scheduled building occupancy periods. The plans and specifications were reviewed to understand the systems, types of equipment used, and actual operations data provided information for modeling. Data loggers provided actual space temperature variation measurements.

The blue line in *Figures 1* through *3* shows the energy use before changes were made. The first two years' energy use was determined from actual gas,

# COMMISSIONING

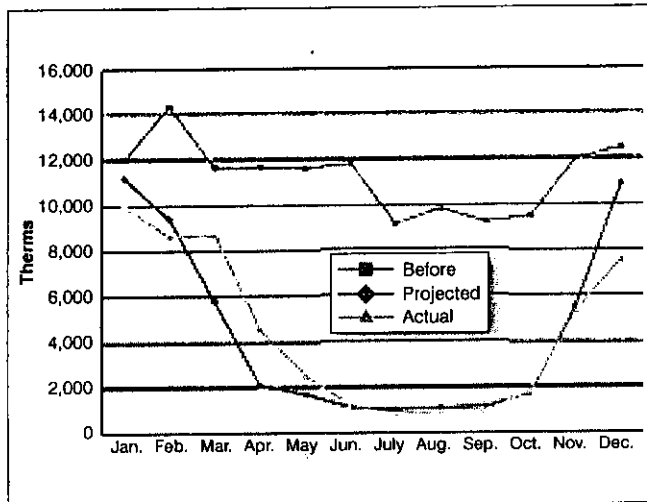


Figure 1: Grand Forks County Office Building natural gas use.

electric and off-peak fuel oil billings. Field readings provided actual data for input into DOE-2 energy modeling software. The completed model was calibrated to the known energy use and accurately predicted monthly energy use.

## Discovery Phase

The discovery phase is the first phase of the technical RCx and optimization process. The RCx team learns how the building currently operates. Discovery is accomplished by investigating and testing building systems, as well as listening to the occupants, owners and maintenance staff.

The following issues were found:

### Design

- A 5% cooling and a 30% heating safety factor were used in design.
- Air change rates were maintained at eight air changes per hour in the office spaces and 15 changes per hour in the large meeting and conference rooms.
- ASHRAE 99.6% design percentile (*ASHRAE Handbook—Fundamentals*, Ch. 14, Annual heating and humidification design conditions) was used for load calculations.

### Operational

- Variable frequency drives on the heating pumps ran at 100% output.
- Hot water leaked past the two-way heating valves on many reheat coils even when the valves were supposed to be 100% closed.
- The duct static pressure sensor was set to control at 2 in. (500 Pa) of static pressure. Most VAV boxes were throttled back to reduce airflow because of the high static pressure.
- The fresh air dampers opened whenever the air handlers started to maintain the night setback temperature. The HVAC system mistakenly cooled the building down to the setback temperature of 55°F (13°C).

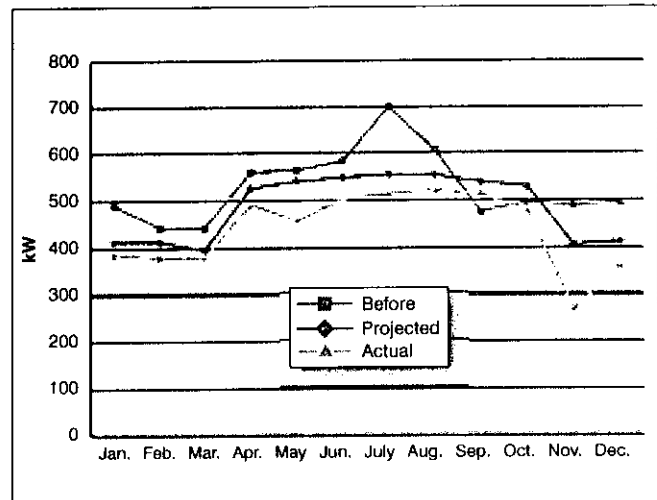


Figure 2: Grand Forks County Office Building electrical demand.

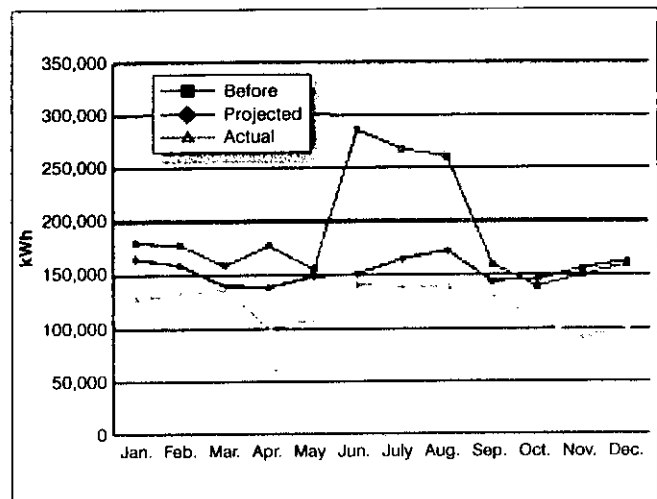


Figure 3: Grand Forks County Office Building electrical use.

- The building ran in the occupied mode for 16 hours per day, while only being occupied for 10 hours.
- Meeting rooms used high airflow rates when the rooms were empty.
- Discharge temperature controllers on air handlers were set to control at a constant temperature of 55°F (13°C).
- Building exhaust fans ran 24/7.
- Data logging showed that space temperatures varied by more than 7°F (3.8°C). Most thermostats required a differential of 5°F (2.7°C) before full output occurred.
- Occupants were able to adjust all space thermostats to the full 55°F to 85°F (13°C to 89°C) range of the thermostat, causing complaints when rooms were left in full heat or full cool.
- The unoccupied setpoints on VAV boxes had the same flow as the occupied setpoints. Interior zoned VAV boxes were set to the same unoccupied airflows as the exterior zones.
- Electric baseboard radiation was energized whenever the outdoor temperature was below 50°F (10°C).

- The boiler reset temperature was reduced to 120°F (49°C) during the summer, which caused inadequate reheat and corresponding cool spaces in the summer.
- Most VAV boxes required constant reheat, showing excessive amounts of air were used in the ventilation of the building.
- Excessive outside air was validated with CO<sub>2</sub> readings of 400 ppm inside the building and 350 ppm outside the building.
- Although a full outdoor air economizer was used on the air-handling system, the chiller was energized at 50°F (10°C) outdoor air temperature.
- Many of the minimum and maximum VAV airflow settings had been changed in response to occupant complaints.

### Evaluation Phase

Phase II of the technical RCx and optimization process involves evaluating the data and determining the actual design requirements based on current building occupancy. During the final steps of Phase II, facility improvement measures (FIM) are outlined and evaluated for cost, cost savings and comfort improvements.

### New Design Evaluation

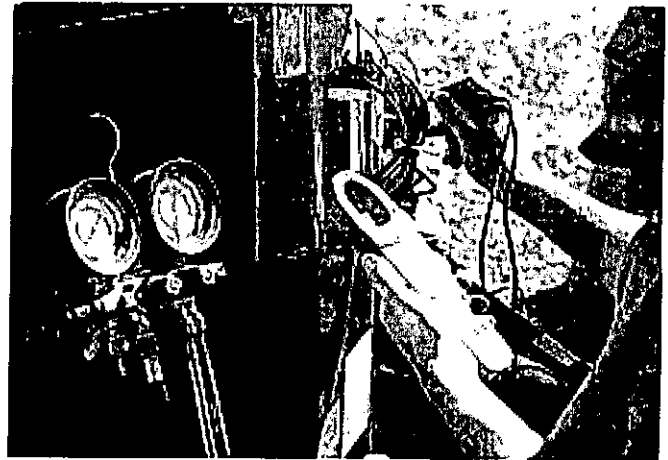
- Airflows and water flows were recalculated based on the ASHRAE 99% data, using actual room loads and eliminating safety factors. These changes lowered the building's airflow, corresponding reheat requirements and electrical use. Winter temperatures were set at 72°F (22°C) and summer temperatures at 75°F (24°C). While additional saving could be found by lowering the space temperature setpoints to 68°F (20°C), commissioners were not willing to sacrifice occupant comfort for savings.
- VAV minimums were evaluated when lowered from eight to four air changes per hour.
- CO<sub>2</sub> levels were evaluated when controlled at 800 ppm.

### Identifying, Correcting Operational Issues

- A closed discharge valve on the piping heating system caused the pressure sensor to always read a low differential. Once opened, the VFD controlled pump returned to setpoint control and reduced pressure, which stopped the reheat coil valve leakage.
- A VAV fan system pressure setting of 1.25 in. (311 Pa) was used as the basis for new energy improvement calculations. The system was able to operate at 1.25 in. (311 Pa) by eliminating one undersized duct leading to a VAV box inlet. The entire building was operating at an unnecessarily high static pressure because of the restriction to this one VAV box.

### Evaluating Improved Operational Issues

- Control sequences modifications were evaluated that kept the fresh air dampers closed on night setback. The



Technician verifies chiller operation.

sequence that cooled the building down on night setback would be removed from the control sequence.

- Occupancy times corresponding to actual occupant requirements were evaluated.
- Interior zone VAV boxes were evaluated at zero airflow settings on night setback.
- Occupancy sensors and lighting interlocks on all conference and meeting room VAV boxes were modeled. In the unoccupied mode, the room would be maintained at 72°F (22°C) with reduced airflow rates using the standby mode of the VAV box controller. The control sequence would increase the airflow only when the lights were on and the occupancy sensors energized.
- Unoccupied VAV minimum setpoints would be set below the occupied values.
- Building exhaust fans would be shut off in the unoccupied mode.
- Mixed air and discharge temperatures would be reset from 55°F to 60°F (13°C to 16°C), depending on cooling and humidity control requirements, based on outside air temperatures.
- The chiller would activate at a 58°F (14°C) outdoor temperature.
- The boiler temperature would be reset between 200°F and 140°F (93°C and 60°C). An upper limit of 200°F (93°C) was set because the conservative winter design temperature in our area is -30°F (-34°C). The lower limit of 140°F (60°C) provided adequate reheat to larger conference spaces during summer months.
- Baseboard electric radiation would be deactivated until the outside air temperature was 30°F (-1°C). Electric baseboard heaters would be cycled every five minutes to reduce electric demand.
- The data automation system would be modified to control all thermostats. Occupants would still have the ability to adjust the thermostat setpoint dial full range; however, the direct digital control (DDC) system would only allow a two degree change from the predetermined setpoints.

# COMMISSIONING

- Control parameters would be adjusted to maintain control within  $\pm 0.5^\circ\text{F}$  ( $\pm 0.3^\circ\text{C}$ ).

An overall energy plan where  $\text{CO}_2$  levels were specified to be maintained at 800 ppm and space temperatures set at  $72^\circ\text{F} \pm 2^\circ\text{F}$  ( $22^\circ\text{C} \pm 1^\circ\text{C}$ ) in the winter and  $75^\circ\text{F} \pm 2^\circ\text{F}$  ( $24^\circ\text{C} \pm 1^\circ\text{C}$ ) in the summer was presented to the commissioners. The building maintenance staff was given a digital thermometer to monitor complaints. Occupant complaints would be considered invalid if the space conditions fell within the constraints listed earlier.

This energy policy was one of the more important parts of the program. Before the implementation of these guidelines, maintenance staff would react to perceived complaints and make adjustments to flows, temperature set-points, VAV box settings, etc., to try to keep occupants happy. This new policy eliminated unnecessary system adjustments.

The DOE-2 energy-modeling program used to predict energy use was rerun with the proposed improvements. The red lines on *Figures 1* through *3* show the reduced energy costs if the energy improvements were implemented.

Energy modeling was conducted by the University of North Dakota's energy management manager, who also consults on building energy modeling.

The new predictions showed the potential to reduce energy costs by more than \$68,000 per year (based on 2002 costs).

## Implementation Phase

Phase III implements the changes evaluated in Phase II. The cost to perform this work was \$100,000 with projected savings of \$68,000 per year. The Grand Forks County Commission voted to proceed with the recommendations and to implement the energy policy. During the implementation phase, the building maintenance staff worked with the RCx team to gain a better understanding of the system.

The building now operates in a manner consistent with the commissioners' original expectations. Because of the enhanced tuning of controllers, room temperatures are maintained within  $0.5^\circ\text{F}$  ( $0.3^\circ\text{C}$ ) of setpoint and were verified by trend logs. The original \$68,000 predicted savings actually resulted in a \$91,000 savings. Because of improved temperature control and the new energy policy, occupant complaints have been reduced by 90%. People stop complaining when they know that their space is being maintained within agreed upon temperature ranges.

FIM Description	Cost	Projected Savings	Simple Payback (Years)
Reduce Airflows	\$25,000	\$7,540	3.31
Reset Discharge Temperature	\$800	\$4,708	0.17
Reduce Occupied Run Time	\$700	\$7,976	0.09
Reduce Outside Air	\$7,500	\$27,432	0.27
Reduce AHU Static Pressure	\$2,000	\$2,068	0.96
Reduce Pump Pressure	\$500	\$2,072	0.24
Eliminate Leaking Reheats	\$2,500	\$8,368	0.30
Improve Control Sequences	\$5,000	\$5,000	1.0
Investigative Costs/Misc.	\$56,000	\$2,836	19.7
<b>Total</b>	<b>\$100,000</b>	<b>\$68,000</b>	<b>1.47</b>

**Table 1:** FIM analysis (costs in 2002).

Energy Component Yearly Use	Pre-Modification Use	Predicted Use	Actual Use
Gas (Therms)	135,234	52,760	52,939
Electrical (kWh)	2,273,000	1,852,500	1,453,280
Demand (kW)	6,344	5,831	5,249

**Table 2:** Phase IV of the technical RCx process documents the improvements.

## Documentation Phase

Phase IV of the technical RCx process documents the improvements.

The green line on *Figures 1* through *3* shows actual monthly energy use. The county auditor entered actual energy use from energy bills on spreadsheets developed for this project, and the results to date show the actual energy savings continue to exceed projected savings. This reduction has been maintained for the past seven years.

Because of the increase in utility cost between 2002 and today, the county now sees yearly savings of more than \$140,000. Overall, yearly energy consumption is now 85,000 Btu/h·ft<sup>2</sup> (267 750 W/m<sup>2</sup>). The original expenditure of \$100,000 has generated more than \$1.2 million in energy savings.

The comprehensive technical RCx approach shown in the article can be used in most buildings with sophisticated HVAC systems and used to reduce energy by 20% to 35% in most buildings.

*Dave McFarlane is president of McFarlane Inc., in Grand Forks, N.D. He was chair of the National Environmental Balancing Bureau's Building Commissioning Committee.* ●