# The University of North Carolina at Chapel Hill

# Strategic energy and water plan—2017

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*Cover Photographs by Jessica Herfurth*

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# Executive Summary

This year, UNC-Chapel Hill reports a 33% overall reduction in energy usage and a 53% reduction in potable water usage since the base year, FY2002-03. This reduction represents $344M in avoided energy costs and $40M in avoided water costs over that time period.

For demand side management in FY16 and FY17, the University focused on air flow reduction projects at several research laboratory buildings. These five projects represent about $4.4M in total project funding with estimated annual energy savings of $1.75M and simple payback periods ranging from 2 to 4 years. Projects at Genetic Medicine and MBRB research lab buildings, funded in FY15, are complete. These two projects have generated $640,000 of annual energy savings, representing energy reductions of 12% and 28%, respectively. The remaining air flow reduction projects at MBRL, Taylor Hall, and Thurston Bowles are currently in design or construction. As an extension of the ongoing ECM monitoring program, the Building Optimization Program (BOP) addressed campus buildings that were showing a trend of increase in energy usage. The BOP projects are low cost HVAC repair and recommissioning activities performed with in-house staff. During FY16 and FY17, these projects impacted nine buildings with a combined budget of $273,500. Work is complete in five buildings with two buildings now having a year of metered usage for compare. For those two buildings, the annual energy consumption was reduced about 10%, for a combined annual savings of $31,500. These projects had attractive simple payback periods of less than three years.

On the supply side, UNC-CH has initiated an alternative energy project that will install a 491 kW ground-mounted PV array with 600 kWh of battery storage. This project is under design and will bid in late Fall 2017. The PV array will offset Duke Energy power purchases and the battery storage unit will allow options for shedding load during peak energy cost periods on the Duke Energy system. The project has a total budget of $1.7M with an anticipated 20-year payback.

## Energy Consumption Summary

| Year | Energy Cost Avoided | Square Foot Cost ($ / GSF) | Energy Cost ($ / MMBtu) | Energy Intensity (Btu / GSF) | Energy Intensity Change |
|---|---|---|---|---|---|
| 2002-03 | - | $3.53 | $18.22 | 193,502 | - |
| 2003-04 | $2,574,607 | $3.45 | $18.83 | 183,400 | -5% |
| 2004-05 | $4,652,644 | $3.56 | $20.18 | 176,581 | -9% |
| 2005-06 | $11,248,512 | $3.62 | $22.41 | 161,495 | -17% |
| 2006-07 | $8,125,957 | $4.00 | $23.28 | 171,648 | -11% |
| 2007-08 | $15,061,496 | $4.16 | $26.06 | 159,694 | -17% |
| 2008-09 | $12,889,637 | $4.72 | $28.21 | 167,358 | -14% |
| 2009-10 | $20,287,078 | $4.84 | $30.97 | 156,406 | -19% |
| 2010-11 | $27,017,595 | $4.78 | $32.50 | 147,037 | -24% |
| 2011-12 | $38,152,581 | $4.75 | $35.37 | 134,144 | -31% |
| 2012-13 | $43,465,689 | $4.68 | $36.27 | 129,085 | -33% |
| 2013-14 | $39,520,282 | $4.72 | $35.36 | 133,465 | -31% |
| 2014-15 | $37,806,877 | $4.79 | $35.06 | 136,597 | -29% |
| 2015-16 | $40,126,175 | $4.70 | $35.24 | 133,391 | -31 |
| 2016-17 | $43,283,028 | $4.57 | $35.52 | 128,755 | -33% |

*Table 1: $344M in cost avoidance since FY2002-03 and 33% reduction in energy intensity. Energy Services Buildings, leased facilites and UNC Hospital facilites are excluded.*

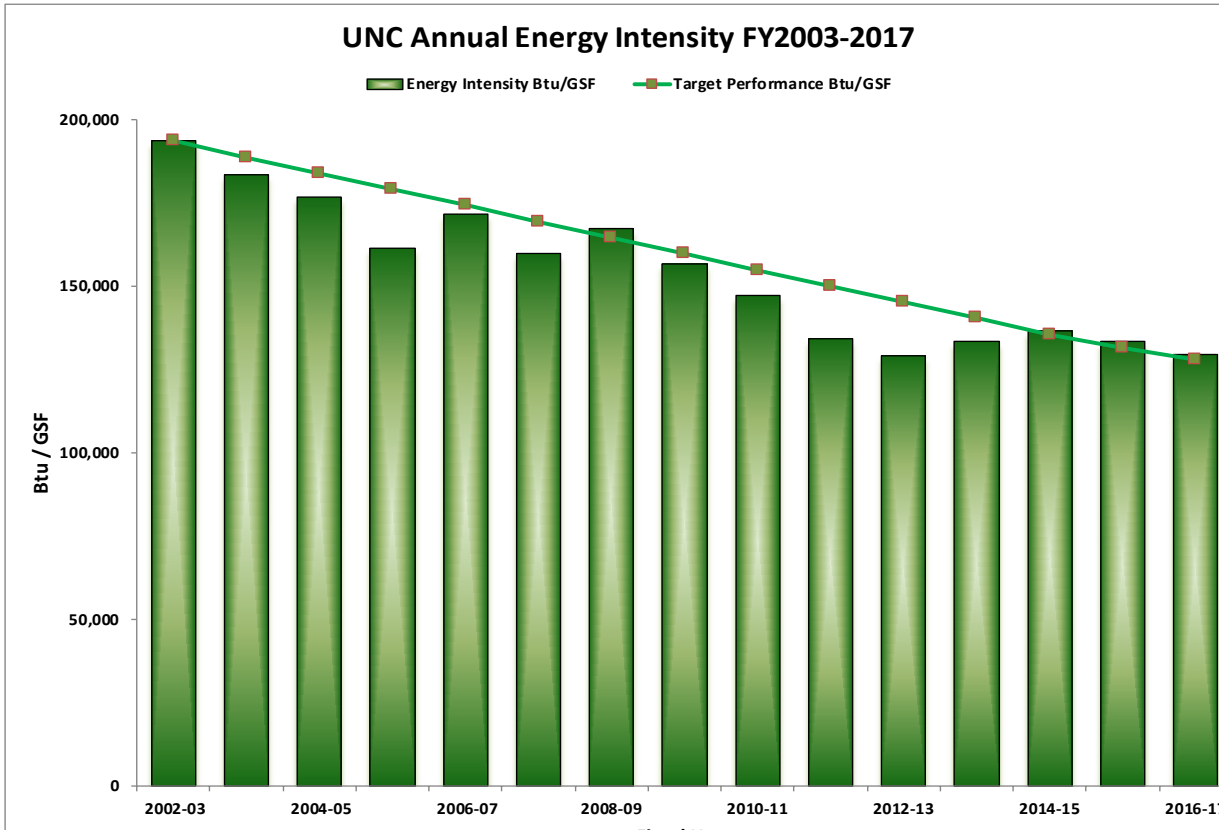


*Figure 1: Annual Energy Intensity reduced by 33%, exceeding the target established by NC Senate Bill 668 of 30% reduction by FY2015.*

# Energy-Demand Management

Demand management initiatives at UNC have been very effective in reducing energy usage per square foot as indicated in Figure 1. Since FY2003, the University has seen substantial growth of 40% in building square footage; 13,477,719 GSF in FY2003 to 18,728,315 in FY 2017. For this same time period, the University overall total energy consumption has decreased from 2,607,959.5 MMBtu to 2,423,407.9 MMBtu. Currently, the University has exceeded the FY2015 target of 30% reduction required by NC General Statute 143-64.12. Goals for years beyond FY2015 have not been mandated although the university community has been considering voluntary goals to achieve even greater energy use intensity savings.

## Energy Conservation Measures (ECM) and Building Optimization Program (BOP)

The ECM program targets the following low investment opportunities in 150 buildings across campus representing about 12M gsf or approximately 63% of central campus gsf.

- ECM1 - Raise air handler supply temperature by 3 deg F
- ECM2 - Implement HVAC unoccupied setback/shutdown
- ECM3 - Change minimum cooling airflow set points
- ECM4 - Identify and eliminate simultaneous heating and cooling
- ECM5 - Implement temperature standards: Summer 76 - 78, Winter 69 – 71
- ECM6 - Enable all heat recovery loops and economizers
- ECM7 - Engage campus community to shut off lights and equipment

The initial, formal implementation of the ECM program occurred in FY10 and the program continues to be monitored by Energy Management (EM) and Energy Management Control System (EMCS) staff with attention focused on those buildings where energy use is creeping back up. The key seven ECMs remain the focus with deficiencies being identified and corrected. This program achieved $4.5M in avoided energy costs for FY16 and FY17.

The Building Optimization Program is an in-house, recomissioning effort that reaches deeper into building system deficiencies with a focus on making repairs to equipment (e.g. damper actuators and linkages, leaking steam, hot water, and chilled water valves), developing improved control sequences, and tuning of control loops to enhance system performance. This program was initiated in late FY15 and has impacted systems in nine buildings. Work is complete in five buildings and 1-year history available for two buildings, Davie and Bondurant. The following graphs show savings associated with these two projects. For these two buildings, expenditures were $14,055 for Bondurant and $54,238 for Davie. The respective, resulting annual savings of $29,975 and $22,358 generate attractive simple payback periods of .5 and 2 years. UNC is planning to continue with this program due to its effectiveness. The challenges are adequate funding and dedication of staff resources that have multiple job responsibilities.

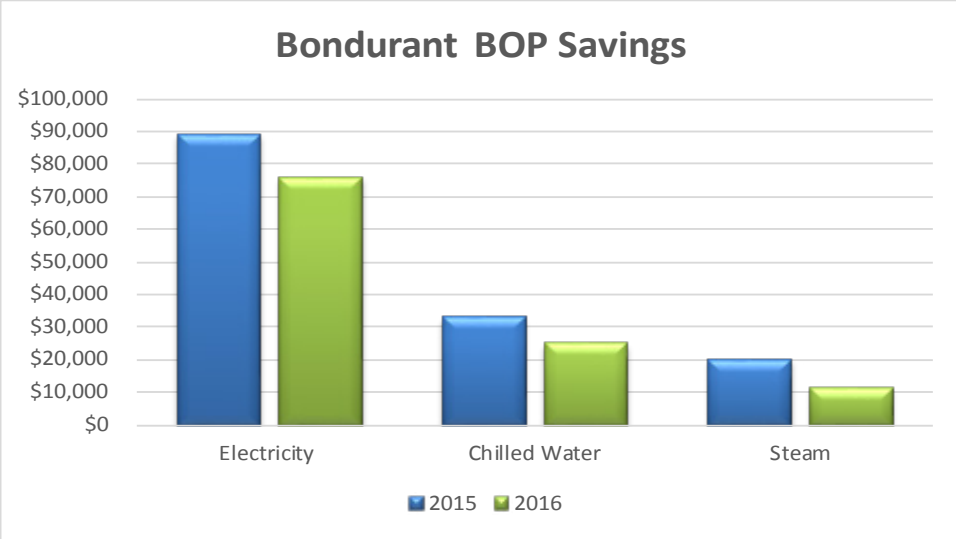


*Figure 2: Electricity, Chilled Water, and Steam Savings for Bondurant Hall*

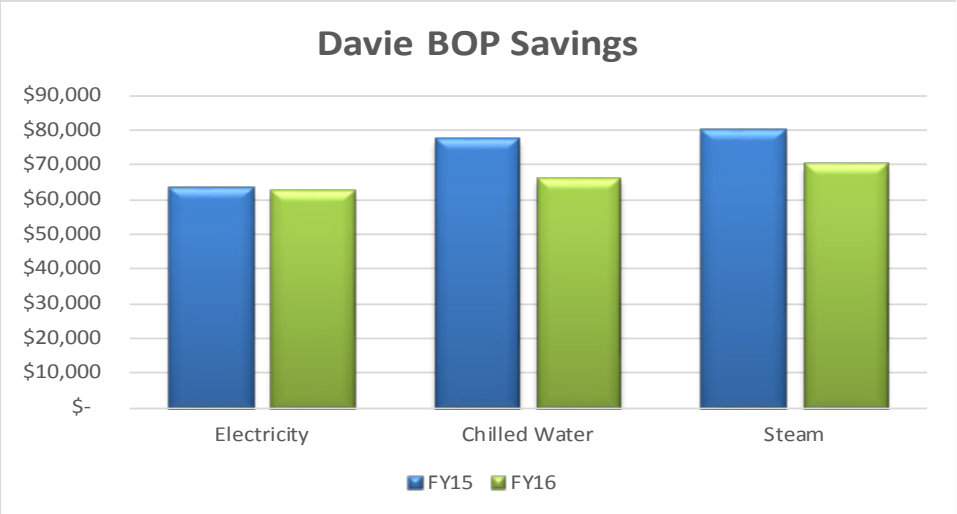


*Figure 3: Electricity, Chilled Water, and Steam Savings for Davie Hall*

## Dedicated Energy Projects

For FY16, UNC committed $1,675,180 to funding of dedicated energy projects, including $580,000 for air flow reduction project at Molecular Biology Research Lab (MBRL); $505,000 for LED lighting upgrades across campus; $352,000 at Morehead Chemistry to replace steam pre-heat valves and outdated steam still with RO/DI system. The remaining funds were used for other smaller HVAC improvement projects.

The two FY15 airflow reduction projects at Medical Biomolecular Research Building and Genetic Medicine were completed in FY16. UNC Environment, Health and Safety now allow a minimum of 6 air changes per hour in research lab spaces. This allows for a significant reduction from the existing air flow requirements. At MBRB, the project resulted in a 28% reduction in energy use and $390,000 in savings. At a project cost of $1,041,080, this project resulted in a very attractive simple payback period of less than 3 years. Similarly, the project at Genetic Medicine resulted in an overall 12% reduction in energy and annual savings of $250,000. This project had a cost of $490,000 resulting in a payback period of less than two years. The MBRB project was highlighted at the 2017 State Energy Conference and the Genetic Medicine project won an American Council of Engineering Companies of NC (ACEC-NC) Engineering Excellence Award.

FY17 has a similar focus on air flow reduction projects with Thurston Bowles and Taylor Hall as the two buildings identified as having attractive paybacks for this type of project. The table below identifies the estimated savings and the projects are currently being designed.

| | Project Budget | Estimated Annual Savings | Simple Payback Period |
|---|---|---|---|
| Taylor Hall | $520,000 | $189,700 | < 3 years |
| Thurston Bowles | $1,300,000 | $758,000 | < 2 years |

*Table 2: Estimated project savings for air flow reduction*

## Winter Break Initiatives

For FY17, UNC observed a formal one-week closure of the University during Winter Break. During this time, the University implemented a Winter Holiday 2016 Energy Saving Initiative to reduce energy consumption by lowering temperatures in buildings and turning off lights and unnecessary equipment. The initiative started Friday night, December 23 at 10:00 p.m. and ended Sunday night, January 1. Research labs, animal facilities and designated health care facilities that are critical to the University's mission were not included in this energy saving initiative. Estimated savings from this program are $123,000.

## Capital Projects

NC General Statute 143-135.35-40, addresses Performance Standards for Sustainable, Energy-Efficient Public Buildings. These standards apply to major facility renovation and construction projects. The following capital projects fall under these standards or have a strong energy focus.

Dogwood Parking Deck Lighting Upgrade – This is a $3,000,000 LED lighting upgrade project. Construction started in March 2015 and completed in November 2016, with majority of new fixtures in place by August 2016. A comparison of energy use in FY15 to that in FY16, shows an annual energy reduction of 53% as a result of the new, energy efficient lighting fixtures. As a result of this successful project, UNC Transportation is moving forward with LED retrofit projects for additional parking decks.

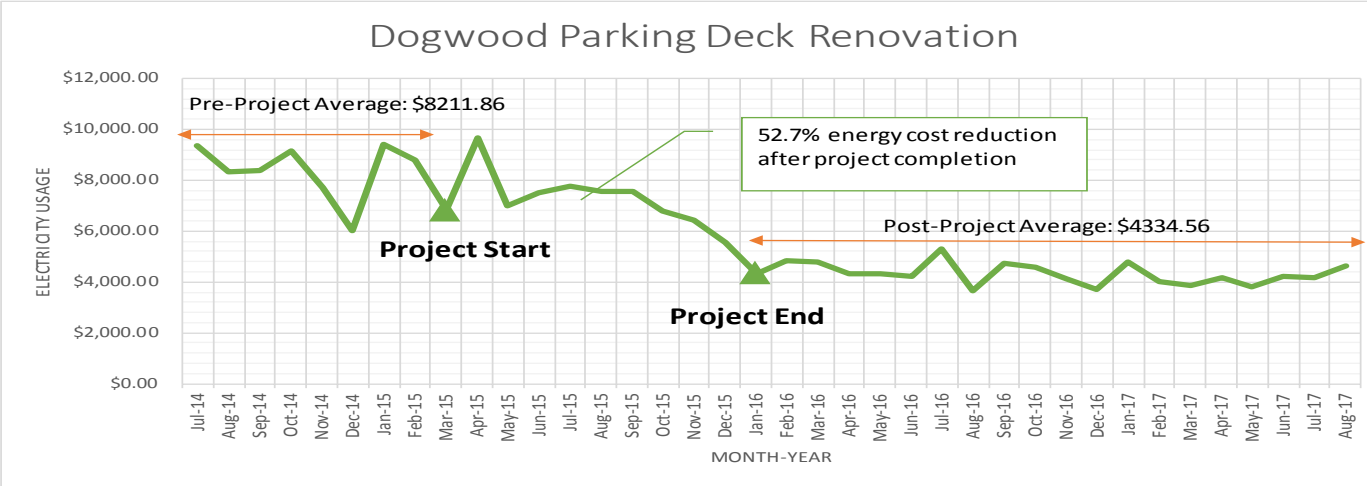


*Figure 4: Dogwood Parking Deck*

Mary Ellen Jones – This is an existing research laboratory building that has been taken off line for a complete renovation. The building occupies 221,618 gsf and prior to being taken off line had an average energy consumption of 97,862.9 MMBtu per year. The Energy Model prepared by the design team estimates the proposed building to have an annual energy consumption of 34,495.1 MMBtu; a substantial reduction in energy consumption. The Energy Model also indicates the proposed building consumption to be 15.5% less than the modeled baseline building based on ASHRAE 90.1-2010 standards. The construction work is about 50% complete with project completion targeted for September 2018.

Solar and Battery Storage Project – This project is in the design phase and will consist of a 491kW ground mounted PV array with 600kWh of battery storage. Energy Services will operate this integrated system to maximize energy savings potential on the supply side. The PV array will allow Energy Services to shift load off the Duke Energy system, resulting in reduced demand charges from Duke Energy. With the battery storage component, Energy Services will have flexibility to charge batteries from the grid during off peak hours and discharge batteries during peak hours. This allows for some significant cost savings opportunities. This installation will be on the Carolina North Campus, which has a peak electrical load of 1.181MW. The project is expected to be an innovative supply management approach and Energy Services is using this project to gain better understanding of how effective a PV and Energy Storage system can be in shifting demand and reducing electrical energy cost. If project proves to be effective in energy demand reduction, this concept may be pursued on a larger scale. Project construction

## FY2018-FY2019 Planned Initiatives

FY18 through FY19, the University will continue to implement the ECM and BOP programs. The aging legacy building control systems continue to present a challenge; with limited visibility at the Energy Management Control Systems control center and limited programming enhancements. UNC is preparing a long-range plan for replacing these systems and as new DDC control systems are being installed, control sequences are updated; including changes that result in energy savings.

UNC is developing an updated campus lighting plan that focuses on LED lighting standards for new buildings and building renovations. UNC has implemented many LED lighting retrofit projects and although the energy savings is recognized, there are still a few problem installations; especially for recessed can fixture types. UNC is continuing to work with the lighting industry to try and address these concerns. In the past, lighting retrofit projects have focused on corridors and stairwells where lights are on for long hours. As the LED lamp and fixture industry continues to mature, the initial purchase costs are decreasing resulting in more favorable payback periods, even for lights that are not on 24 hours each day. UNC will be re-evaluating earlier LED lighting retrofit analyses using the current light fixture cost to determine those projects that will now have payback periods of ten years or less. Other options being considered with hopes for funding are increased use of occupancy sensors and pilot project using daylight harvesting. UNC had a design firm conduct a daylight harvesting analysis and report the findings. This report surveyed 50 Academic Affairs buildings scored each of these on a basis of daylight available, occupancy type and duration, and the cost to implement. The highest scored areas have the best potential for daylight harvesting. Fordham Hall was one of the highest scored buildings and a good candidate for further scope development as a pilot project.

Dedicated energy projects will continue to be a key component to the energy efficiency initiatives and potential projects are identified in the appendix of this report.

Another focus for FY18 and FY19 will be further implementation of an energy analytic software to allow for more automated analysis of energy performance at buildings. Currently, the software is being deployed at the utility meter level but it has the capability to monitor much deeper in the HVAC control system. The software platform automatically analyzes data from building automation systems, energy, water and other resource metering systems and other smart devices to identify issues, patterns, deviations, faults and opportunities for operational improvements and cost reduction. Users establish rules that are unique to their operation and the software evaluates current conditions against these rules, to identify system faults and performance drops.

# Energy-Supply management and Distribution

## Cogeneration Facility

Cogeneration Systems operates several modern energy production facilities to serve the greater UNC campus and UNC Hospitals. Its facilities have been nationally recognized for efficiency, reliability, and superior environmental performance.

The primary purpose of the central plants is to generate and distribute steam which is used for heating, cooling, humidification, domestic hot water heating, sterilization and distilled water production among other uses. Many of these steam uses are mission critical applications such as humidification in UNC Hospitals burn center. We accomplish the mission of supplying steam to our customers with exceptional reliability, providing steam designed service an average of 99.975% of the time over the last five years. At the same time we co-generate electricity at our primary facility where approximately 20% of the annual electricity used by the campus is produced. This co-generated power is produced at an efficiency approximately double that of a typical power plant.

The existing steam distribution system has more than 45 miles of underground steam and condensate piping. As these underground systems have been modified and upgraded to accommodate campus growth over the last 20 years, the distribution system has seen a reduction in losses of nearly 50%, resulting in approximately $1,000,000 in annual fuel savings. As the distribution system undergoes additional changes to meet the needs of an expanding campus, further efficiency improvements are incorporated where appropriate.

Cogeneration Systems owns and operates a landfill gas collection system where refuse gas is used to generate electricity and is flared. During fiscal year ending 2017 the system captured over 200 million cubic feet of landfill gas containing approximately 118 million cubic feet of methane. At a global warming potential of at least 21 times that of CO2 this methane destruction is a very significant benefit to the environment. A portion of the collected landfill gas was simultaneously used to produce approximately 6.7 million kWh of electricity during the fiscal year, which in turn prevented an additional 4.9 million pounds of CO2 from being released by the local power utility.

## Electric Distribution Systems

UNC-Chapel Hill's Electric Distribution Systems (EDS) has recently reached the halfway point in relamping of outdoor lighting with LED light sources, having replaced 565 street and parking lights and 1,160 walkway lights. These 1,725 lights previously used high pressure sodium or metal-halide lighting technology and were replaced with more efficient LEDs, which results in an estimated annual energy savings of approximately $43,000. The longer life of the LED lights will also result in an annual maintenance savings of $16,000, for a total annual savings of $60,000. EDS will continue its LED relamping program to achieve higher levels of savings. In addition to the energy and maintenance savings, the more attractive illumination color improves the nighttime appearance of the campus.

EDS employs 341 "smart" meters out of a total of 488 meters installed. Of these 341 "smart" meters, 276 are connected to the SCADA network by fiber. These meters not only provide all electrical billing

information, eliminating the need for a meter reader to physically come to them to obtain monthly usage information, they also capture important power quality information to help diagnose problems on the electric system and provide higher resolution energy usage data.

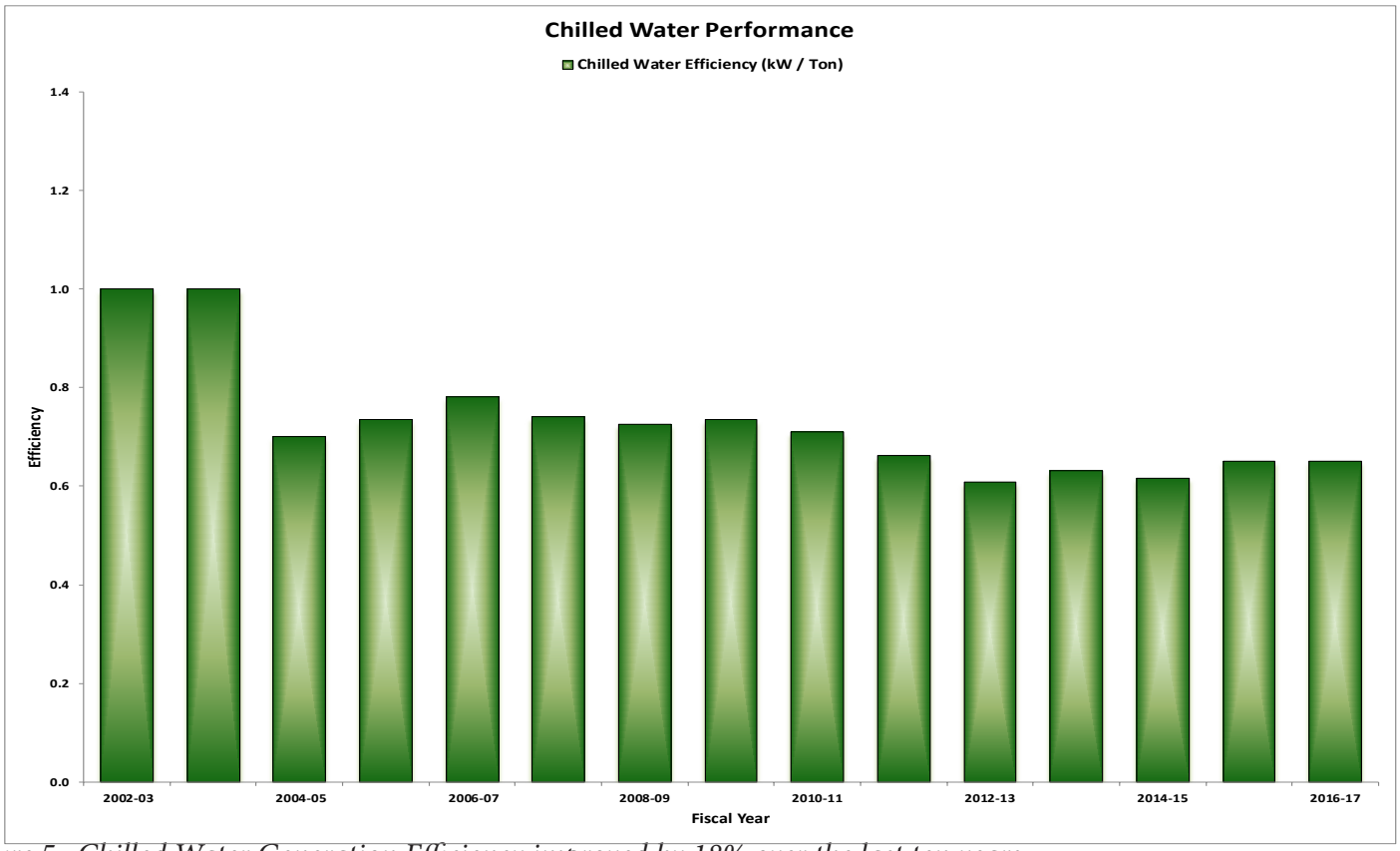


*Figure 5: Chilled Water Generation Efficiency improved by 18% over the last ten years.*

## Chilled Water Department

The University has one of the most sophisticated chilled water generating systems in the world. Chilled Water, which is used to cool buildings and equipment, is provided by either the District Cooling Systems comprised of a network of chiller plants and underground piping or by stand alone chillers dedicated to individual buildings.

The District Cooling System for the main campus consists of four chiller plants with a combined capacity of 46,650 tons. The plants are interconnected by underground piping and operated as one production system using a networked Supervisory Control and Data Acquisition (SCADA) system. From a single console, operators can manage and balance loads among the chiller plants, use capacity anywhere in the system and continue operating in critical areas despite cooling equipment failure or utility outages.

In FY2016-17, the Chilled Water department continued to work on optimization and efficiencies. The maintenance staff has performed inspections to determine physical and operational conditions of chillers and support equipment. Technicians continue to work on the four year project to replace programmable logic controllers (PLCs) for bridge controls in all buildings. To date, 167 controllers (99% of total, 1 remaining) were replaced. High bay lights in three chiller plants were replaced with LED high bay lights.

# Education and Outreach

## Education

Understanding where energy comes from, how it is used, and the environmental, economic, and social impacts associated with its use are integral to understanding current and future policy-making. Fossil fuel extraction and use are changing the climate. Finding solutions to today's energy challenges is a large and growing field. In response to student demand, the number of energy-related courses available at UNC-Chapel Hill is growing. A new Energy and Climate course is taught by faculty from environmental studies, marine sciences and physics.

Energy is a new focus area for students pursuing an MBA at the Kenan-Flagler Business School. The focus prepares students for various roles in the energy sector and provides students with exposure to the energy value chain as well as the design and management of energy markets. Popular elective courses include Alternative Energy, Energy Project Finance, and Renewable Energy.

Senior campus administrators, students, faculty and staff from across higher education in North Carolina including 17 public institutions and six private university partners convened at the annual Appalachian Energy Summit to share best practices. System-wide, long-term objectives set forth by UNC General Administration include:

- Educating students to be leaders of tomorrow
- Reducing and stabilizing the university system's average annual energy expenditures
- Transforming and stimulating the North Carolina economy
- Positioning the UNC system and private university colleagues as national leaders
- Creating a culture of environmental and economic sustainability

## Integration

In March 2017, the UNC-Chapel Hill Institute for the Environment hosted the fourth-annual N.C. Clean Tech Summit in partnership with the UNC-Chapel Hill Kenan-Flagler Business School Center for Sustainable Enterprise. More than 1,000 people from industry, academia, and government discussed clean technology in North Carolina, an emerging industry involving solar power, biofuels, food security, electric grid modernization, improving energy efficiency, waste reduction, and more. This year, the summit's keynote speaker was Governor Roy Cooper. He spoke about fostering leadership and growth in North Carolina's clean tech industry.

## Study Abroad

The Institute for the Environment at UNC has established a network of field sites with locations both in North Carolina and abroad to enrich undergraduate education. The sites range in location and academic concentration. In North Carolina, students can travel to the coast, the mountains, or stay in the city to study ecology, infrastructure, decision-making, and sustainability. The programs abroad include the Summer Burch Program in Denmark, Germany, and Sweden; Coral Reef Ecology + Management in the US Virgin Islands; Environmental Studies in the Galapagos Islands; and an Energy and Sustainability Field Site in Thailand. Each site focuses on themes specific to that community or region and allows students to explore real-world issues through a combination of course work, field trips, group research projects, and internships.

"The Cheapest energy is the energy you don't use in the first place."

-Sheryl Crow

## Outreach

### Conserving Carolina Recognition Program

The Energy Management energy conservation recognition program recognizes faculty, staff, and students for their energy conservation efforts on campus. The recognition program rewards measurable energy savings efforts for individuals or teams.

### Energy Use Dashboard

The online Energy Dashboard developed by UNC-Chapel Hill's Energy Services Department now includes data on more than 200 buildings. The display provides the ability to monitor interval, monthly and annual utility consumption for steam, electricity, chilled water, domestic water, and reclaimed water.

Making this data visible to the Carolina community is the first step in encouraging environmentally sustainable behaviors. This information also helps occupants, maintenance staff and engineers better understand how these positive behavior changes, coupled with operational changes, can impact greenhouse gas emissions, energy usage and costs.

This data is also used as an important teaching tool. For example, in Morrison Residence Hall, occupants can view and compare the energy consumption with the LUCID energy dashboard. Students use the dashboard to collect and measure data when competing in the Campus Conservation Nationals.

### Other Education and Outreach Efforts

**X-treme Energy Teams:** A packet of energy conservation information created by student interns is distributed to building managers for their use in educating and reminding occupants to conserve energy.

**EcoReps**: Carolina's trained peer-to-peer student sustainability outreach team. EcoReps expand awareness of sustainability initiatives on campus and motivate sustainable behaviors, including energy and water conservation.

**Green Games:** A student-led environmental competition between the UNC housing communities with the goal of promoting sustainable behavior and environmental education.

**Carolina Green Pledge:** UNC-Chapel Hill's Sustainability Office offers members of the campus community an opportunity to make an online pledge to reduce their energy, water, and carbon footprint.

**Green Labs:** Efforts to reduce energy in labs focused on an energy efficient ultra-low freezer replacement program, shut the sash initiative to encourage users to close fume hoods when not being used, installation of water-saving vacuum pumps, and a best practices guide.

**Campus Events:** Employees from Energy Management staffed event booths throughout the year on campus and off. Some of the campus events were Three Zeros Day, Employee Appreciation Day, and New Students' Orientation.

## Student Involvement

### RESPC

The Renewable Energy Special Projects Committee (RESPC) is a student-created and led committee of student government. The committee consists of seven student committee members (five undergraduates, two graduates), an open student group, and ex-officio members who provide advisory and oversight assistance.

The committee was formed as a result of a 2003 campaign to promote renewable energy on campus. They manage and allocate the $4 per semester energy fee that is assessed on all students. The $200,000 raised annually is invested in renewable energy, energy efficiency, energy education, and maintenance.

Projects for FY2016-17 included energy efficiency projects, one education project, and one renewable energy project. On the energy efficiency side, RESPC funded the retrofit of T12 fixtures with LEDs at 210 Pittsboro Street, the Knapp Sanders atrium lighting design update, installation of humidity sensors, and the re-programming and commissioning of temperature controls in Grimes, Manly, Ruffin, and Mangum. RESPC has also funded the construction of a solar array at the Friday Center, as well as the development and presentation of a solar learning module. In total, RESPC allocated $236,202 for the projects above.

In addition, RESPC has led the founding of NC Green Fee Collaborative, which is a group of green fee leaders from five universities in North Carolina: UNC Chapel Hill, NC State University, Appalachian State University, UNC Asheville, and UNC Wilmington.

This coming year, RESPC has two goals. The club would like to collaborate with more student organizations on campus as well as other universities. RESPC also aims to fund more projects that can save energy for the school and increase renewable energy's presence on campus.

### Carolina Campus Community Gardens

The Carolina Campus Community Garden (CCCG) is a program of the North Carolina Botanical Garden and aims to grow vegetables and fruit so that all UNC employees have access to fresh, sustainably grown produce through the shared efforts of staff, students, faculty, and local residents and to serve as a learning community for developing gardening skills, healthy living, social responsibility, and interdisciplinary academic pursuits.

RESPC founded the construction of a passive solar greenhouse for CCCG. The greenhouse includes solar photovoltaic cells to power lights and fans, in addition to typical passive solar features for year round plant cultivation. CCCG hosted a ribbon cutting event in the Spring 2017 where UNC Associate Vice Chancellor for Campus Enterprises Brad Ives, Food for All co-chair Alice Ammerman, and CCCG coordinator Claire Lorch and many others attended.

### Kenan-Flagler Energy Club

The Kenan-Flagler Energy Club provides MBA students with the skills, knowledge, and connections necessary to compete for top energy industry jobs and internships and enhance their value in the workplace. The Energy Club hosts a range of events including the Energy 101 series and career treks to industry hubs and offers opportunities to participate in global competitions.

# Water Resources Management

## Summary

UNC-Chapel Hill's water resources management includes the use of non-potable water and potable water to meet the water needs of the university.

The potable water usage has dropped to nearly half against the baseline year, FY2002-03. This reflects UNC-Chapel Hill's strong commitment to reducing negative environmental impacts and avoiding unnecessary utility costs.

**Potable Water Consumption Summary**

| Year | Water Cost Avoided | Potable Water/ Sewer Unit Cost ($ / mGal) | Potable Water/ Sewer Cost Change | Potable Water Intensity (Gal/GSF) | Water Intensity Change |
|---|---|---|---|---|---|
| 2002-03 | 0 | $3.95 | 0% | 49 | 0% |
| 2003-04 | $41,353 | $3.99 | 1% | 49 | -2% |
| 2004-05 | $185,084 | $4.50 | 14% | 46 | -6% |
| 2005-06 | $315,440 | $3.34 | -15% | 43 | -12% |
| 2006-07 | $606,268 | $5.04 | 28% | 42 | -15% |
| 2007-08 | $932,129 | $5.48 | 39% | 40 | -20% |
| 2008-09 | $1,459,331 | $6.26 | 59% | 36 | -27% |
| 2009-10 | $2,613,194 | $8.56 | 117% | 32 | -35% |
| 2010-11 | $3,467,671 | $9.94 | 152% | 30 | -40% |
| 2011-12 | $4,171,910 | $10.85 | 175% | 28 | -43% |
| 2012-13 | $4,790,987 | $11.13 | 182% | 26 | -47% |
| 2013-14 | $5,242,279 | $11.91 | 202% | 26 | -48% |
| 2014-15 | $5,126,562 | $11.52 | 192% | 26 | -47% |
| 2015-16 | $5,605,100 | $11.59 | 194% | 24 | -52% |
| 2016-17 | $5,722,179 | $11.63 | 195% | 23 | -53% |

*Table 3: $40.2M in cost avoidance since FY2002-03 and 53% reduction in water intensity. Non-potable water usage and cost, leased facilities and UNC Hospital facilities are excluded in the table.*



"All the water that will ever be is, right now."

-National Geographic, October 1993

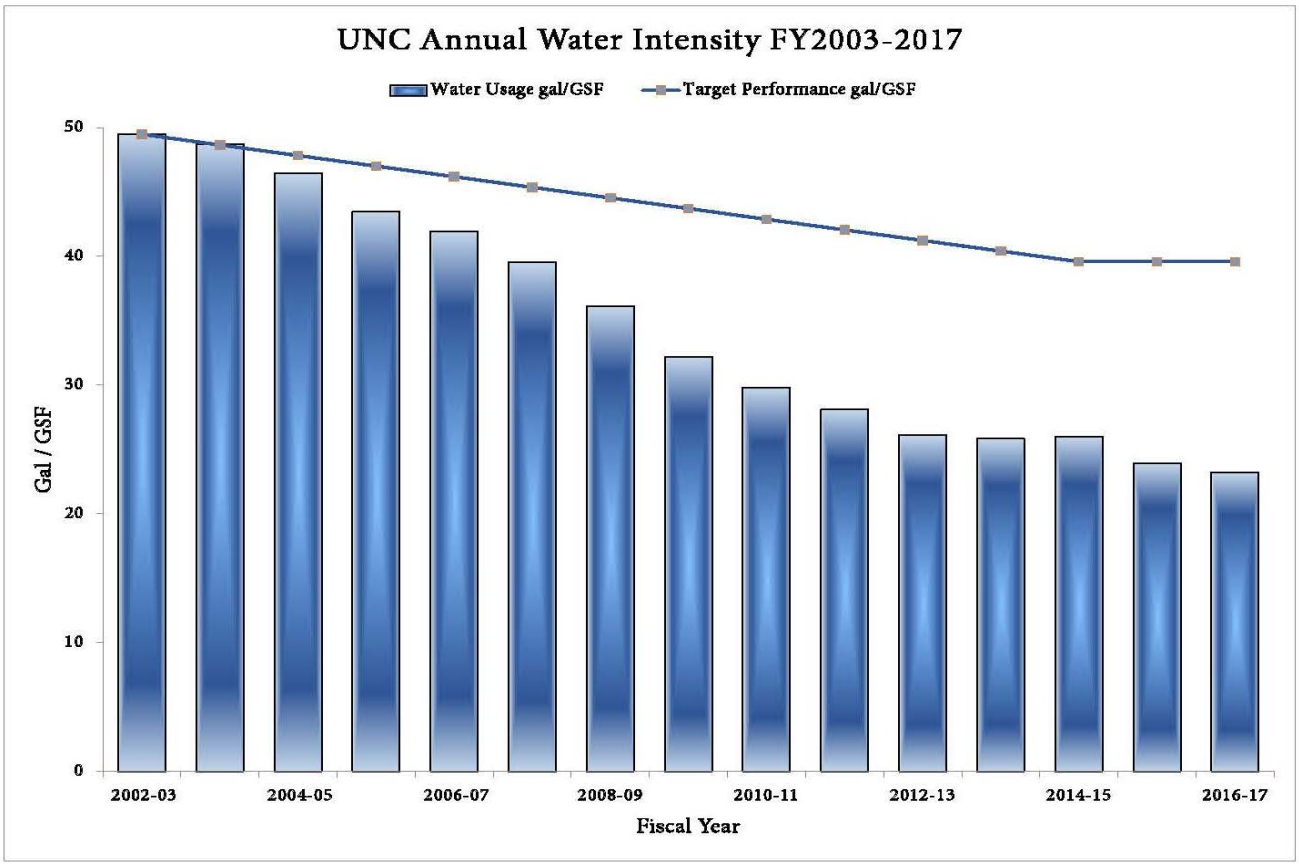


*Figure 6: Annual potable water consumption reduced by 53% to 23 gallons/GSF exceeding the 20% reduction target established by NC Senate Bill 668*

## Potable Water – Summary of Activities

Supply side reductions occur by encouragement and change-over of potable water use to non-potable water use where available and feasible. See non-potable water summary and explanation for more information.

## Non Potable Water – Summary of Activities

UNC-Chapel Hill operates an integrated non-potable water system that supplies non-drinking water for approved uses and thereby reduces the use of potable water. Sources of non-potable water used at UNC-Chapel Hill are reclaimed water, storm-water/rainwater, and condensate.

In FY 2015-2016, the university used 232,402,000 gallons of non-potable water for cooling tower make-up water, toilet flushing, and irrigation. Additionally, in FY 2016-17, five sites were irrigated with rainwater stored in unmetered cisterns.

***In FY2016-17, non-potable use began at the following sites:***

-Marisco Hall (the Biomedical Imaging Research Building) for toilet flushing and landscape irrigation.

-Finley Fields South started use of reclaimed water for irrigation in July.

***Future non-potable water use:***

The Central Campus Athletic Facilities are currently under renovation and are scheduled to come on line in FY 2019. In addition to these fields are two support buildings, one for the Indoor Athletic Field and one for Fetzer Soccer Field, which will have toilet flushing by reclaimed water.

# Air Flow Reduction Projects

### *Genetic Medicine Research Building Airflow Reduction and Recomissioning*

McKim & Creed and UNC were recognized with an Honor Award for Engineering Excellence in Energy for the Airflow Reduction and Recomissioning Project at Genetic Medicine Research Building (GMRB). Built in 2008, the GMRB is one of the largest buildings on campus and included 5 floors of laboratory space.

In the first year of operation following this project, UNC cut energy usage in the GMRB by 12% and netted approximately $250,000 in energy savings while improving overall building pressurization control.

This represents a payback of less than 3 years for the university, far exceeding the original estimated savings of approximately $37,000 per year.

**2017 Engineering Excellence Award**

**Genetic Medicine Research Building**

**Medical Biomolecular Research Building**

### **Medi*cal Biomolecular Research Building***

The MBRB Airflow Reduction project was recognized at the 2017 State Energy Conference as a successful energy savings project. MBRB is a 218,400 SF research lab building first occupied in 2003. The project focused on airflow reduction, particularly in lab spaces; control system upgrades; conversion from constant to variable volume terminals; and occupancy temperature setbacks.

Total project cost was $1,041,080. During the initial 6 months following project completion, the combined energy reduction was 35%, representing a projected annual energy cost savings of $390,000 with a simple payback period of less than 3 years.

# Appendix

## Dedicated Energy Projects at UNC-Chapel Hill

| *Project* | *Building* | *Budget* | *Simple Payback (Years)* | *Status* |
|---|---|---|---|---|
| **FY2016 - FY2017: Active and Completed** | | | | |
| Exterior lighting upgrade | Academic Affairs Building | $50,000 | 7.3 | Construction |
| Replace leaking steam traps | Academic Affairs Building | $65,000 | 1.0 | Complete |
| Daylight harvesting | Academic Affairs Building | $52,000 | TBD | Scope Development |
| Interior lighting upgrades | All Campus | $150,106 | TBD | Scope Development |
| Upgrade sterilizers for water and energy conservation per ESPC | All Campus | $77,000 | 1.0 | Construction |
| 4th and 5th floor - Replace 4-lamp T12 troffers with new LED fixtures | Berryhill Hall | $105, 600 | 7.0 | Complete |
| Airflow reduction | Chapman Hall | $400,000 | 2.5 | Design |
| Lighting and electrical upgrades | Dogwood Parking Deck | $647,100 | 10.7 | Complete |
| Provide Jace AX integration with Circon | Environment, Health and Safety Bldg | $32,100 | 9.4 | Complete |
| Provide Jace AX integration with Circon | Facilities Construction Shops | $32,100 | 5.7 | Complete |
| Upgrade metal halide to LED: racketball courts | Fetzer Hall | $74,805 | 5.0 | Complete |
| Lighting upgrade | Finley Golf Course Road | $20,160 | 10.0 | Design |
| Airflow reduction | Genetic Medicine Research Bldg | $550,000 | 2.0 | Complete |
| Lighting upgrade | Genetic Medicine Research Bldg | $13,850 | 3.0 | Complete |
| Submetering Genomics Greenhouse | Genome Sciences Bldg | $16,080 | NA | Construction |
| Upgrade wall packs to LED-70 | Health Affairs Buildings | $82,800 | 8.0 | Construction |
| Exterior lighting upgrades | Health Affairs Buildings | $50,000 | 7.3 | Construction |
| Submetering hot water loops | Hill Hall HW Vault | $12,675 | NA | Construction |
| Liebert HVAC system optimization | ITS Manning | $400,370 | 7.0 | Design |
| Lighting upgrade - Atrium (design only) | Knapp-Sanders Bldg | $1,500 | NA | Design |
| HVAC control improvements | Lineberger Cancer Research Center | $150,000 | 7.9 | Design |
| Replace/Repair AHU-9 and ERU-9 | McGavern Greenberg | $409,000 | 5.0 | Design |
| Energy Reduction - HVAC in Lobby & Auditorium | Medical Biomolecular Research Building | $108,500 | 3.0 | Design |
| MBRL ventilation reduction | Molecular Biology Research Lab/Glaxo | $580,000 | 3.0 | Construction |
| Repair steam pre-heat valves | Morehead Chemistry | $152,000 | 1.3 | Complete |
| Submetering hot water loops | New West HW Vault | $21,125 | NA | Construction |

| *Project* | *Building* | *Budget* | *Simple Payback (Years)* | *Status* |
|---|---|---|---|---|
| **FY2016-17: Active and Completed** | | | | |
| LED Lighting upgrade | Public Safety Building | $14,692 | 8 | Design |
| Replace dimmed incandescent lighting with LED | Sitterson | $29,600 | 10 | Complete |
| Submetering hot water loops | South HW Vault | $20,800 | NA | Construction |
| Install exhaust fan control to enable occupant scheduling | Tarrson Hall | $18,000 | 1.0 | Construction |
| Replace MH with LED | Tarrson Hall | $9,833 | 7.0 | Design |
| Air flow reduction | Taylor Hall | $520,000 | 3.0 | Design |
| Air flow reduction | Thurston Bowles | $1,300,000 | 2.0 | Design |
| Provide JACE integration with Circon | Wilson Hall | $42,900 | 2.0 | Complete |

| *Project* | *Building* | *Probable Cost* | *Simple Payback (Years)* | *Status* |
|---|---|---|---|---|
| **FY2018 - FY2019: Planned** | | | | |
| Airflow reduction and controls upgrade - New Wing | Lineberger Cancer Research Bldg | $2,105,000 | 4.8 | Awaiting Funding |
| VAV Zone controls upgrade | Carroll Hall | $706,000 | 9 | Awaiting Funding |
| Airflow reduction and controls upgrade | Fordham Hall | $1,370,900 | 8.5 | Awaiting Funding |
| Lighting upgrade- Atrium | Knapp-Sanders Bldg | $57,200 | 8 | Awaiting Funding |
| Airflow Reduction and Controls Upgrade | Glaxo | $900,000 | 5 | Awaiting Funding |

# Energy Mandate

I have read the strategic Energy and Water Plan for my organization. The plan, as presented, supports the reductions required in Session Law 546.

Implemented this 12th day of January 2018

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*Cover Photographs by Dan Sears*