Greening Grants: Minimizing Energy and Environmental Impacts of Federally-Funded Research

May 29, 2015
Consequences from Missing Connections between Sustainability and Federal Research Funding

Kathy Ramirez-Aguilar
Consequences from Missing Connections between Sustainability & Federal Research Funding

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Green Labs Program Manager
University of Colorado Boulder
CU-Boulder Green Labs Program

An important focus- engaging & collaborating with scientists on:

Energy Conservation
Water Conservation
Material Waste Reduction
Hazardous Waste Reduction

Efforts with scientists are based on good will.
There is a lot of good will to be had.

Many scientists care about the environmental footprint of their research, which also often benefits efficient use of research funding.
Funding of Research on University Campuses

Tax Dollars $ 

Federal Grant $
Funding of Research on University Campuses

- Tax Dollars
- Federal Grant
- Procurement: Vendors & Manufacturers
- Direct Costs: Research
- Indirect Costs: F&A (Indirect Costs)
  - Dept Indirect Costs
  - University Indirect Costs
Funding of Research on University Campuses

Tax Dollars

Federal Grant

Direct Costs
  - Research
  - Procurement: Vendors & Manufacturers

F&A (Indirect Costs)
  - Dept Indirect Costs
  - University Indirect Costs

Pays for

University costs to support research
  - Energy
  - Water
  - Trash
  - Safety
  - Maintenance
  - Building Use
  - Custodial
  - Admin
  - IT & More
Missing Sustainability Connections in Univ. Research Funding:

1. Universities generally do not connect building occupants with consumption.

Federal Grant $ → Tax Dollars $ → Procurement: Vendors & Manufacturers $ → Direct Costs $ → Research $ → F&A (Indirect Costs) $ → Dept Indirect Costs $ → University Indirect Costs $ → University costs to support research

- Energy
- Water
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Missing Sustainability Connections in Univ. Research Funding:

1. Universities generally do not connect building occupants with consumption.
2. Granting process & spending of those dollars (direct costs).

Federal Grant $

Tax Dollars $

Direct Costs

Research

Procurement: Vendors & Manufacturers

F&A (Indirect Costs)

Dept Indirect Costs

University Indirect Costs

Pays for $ Energy

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1 X

2 X
Missing Sustainability Connections in Univ. Research Funding:

1. Universities generally do not connect building occupants with consumption.
2. Granting process & spending of those dollars (direct costs).
3. Indirect costs (F&A) process.

Federal Grant $ 

Direct Costs
- Research
- Procurement: Vendors & Manufacturers

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Tax Dollars $
Inefficient Use of Lab Space and Fume Hood Resources

Individual spaces with individual resources leads to “ownership” mentality for space and equipment, which leads to duplication.
Duplication of Equipment
Lack of awareness of what equipment resources exist on campus
Equipment & Processes that Consume More Energy/Water than Necessary

9.9 kWh/day
Inefficient Sample Storage Leading to More Ultra Low Temp Freezers

Do you know what is in your lab freezer?

By inventorying:
Save MONEY, ENERGY and TIME!!!
Ongoing training of scientists to do the same...

EFFICIENCY & RESOURCE USE NOT GENERALLY INCLUDED IN:

- Research decisions
- Purchasing decisions
- Requests for space & fume hoods
Less Money for Research

Funding to support entire research system
Less Money for Research

Funding to support entire research system
Less Money for Research

Funding to support entire research system
## Greater Indirect Costs for Research

<table>
<thead>
<tr>
<th>Univ. Research Labs</th>
<th>SqFt Portion</th>
<th>Energy Portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CU-Boulder (‘10-’11)</td>
<td>20%</td>
<td>43%</td>
</tr>
<tr>
<td>Stanford</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>UC-Davis</td>
<td>33%</td>
<td>~75%</td>
</tr>
</tbody>
</table>

Resources: Shannon Horn, CU-Boulder Facility Management Engineering; Susan Vargas, Stanford Energy Manager, Allen Doyle, UC-Davis Office of Sustainability
Greater Indirect Costs for Research

Energy Water Trash

Energy Water Trash
Greater Indirect Costs for Research

Energy
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Scientists spending more and more time writing grants
NIH request for more funding

Will declining funding stunt scientific discovery in the US?

May 17, 2015 at 10:30 AM ET
Greening Grants is about:

• Reducing the environmental footprint of research

• Effective, efficient use of federal research grant dollars

• Enhancing value from tax-payer dollars

• More money for actual research
Are there connections to grant funding that can encourage:

1. Equipment sharing & avoiding duplication
2. Utilization of managed, shared lab equipment facilities
3. Use of campus lab space and fume hood that fits present researcher needs
4. Selection of lab equipment and processes that energy/water efficient
5. Chemical & freezer sample management & centralized freezer storage
Purpose of this meeting today…

- Raise awareness
- Share some initial actions by federal agencies and universities
- Discussion about ways to connect sustainability to federal funding
- Can it be done without increasing administrative burden?
Initiatives in the UK to Connect Efficiency to Research Funding

Peter James
Supporting World Class Science

Peter James, Director
(Previously Professor of Environmental Management, University of Bradford)

www.effectivelab.org.uk

GOLD SPONSORS:

PLATINUM SPONSORS:

SUPPORTORS:
Lab energy, environmental impacts

- Many are evident and can be tackled directly
  - air quality, chemicals, freezer good practice, fume hood sashes, local equipment sharing, recycling & waste, transport, water etc.
- Many key ones are indirect and not obvious to users:
  - Provision and use of space
  - The ventilation systems behind the fume hood
  - Strategic provision and overall use of equipment
  - Staff productivity and lab procedures/workflows
UK Science Funding

• Direct state support for universities/specialist institutes
  - core based on students & research/teaching ranking
  - specific, generally for science buildings & infrastructure
  - Higher Education Funding Council for England (HEFCE)

• Tuition/postgrad fees (with some extra public support)
• Research Councils – ‘hands off’ competitive bidding
• Foundations, especially Wellcome as a funder/operator
• Targeted public funding – environment, health etc.
• Contract research
UK Drivers for Lab Resource Efficiency

- Funding pressures: more from less
  - 2010 Wakeham Review of Research Councils – [URL]
  - 2011 & 2015 Diamond Reviews of HE – [URL] and [URL]
- Carbon/energy demands
  - Demanding energy and other requirements
  - Collective HE target of 43% CO2 cut 2005-2020 [URL]
- High and rising costs
  - electricity 20c per kWh or more
  - land $600,000 per acre (over 2x NYC, 7x Denver)
Mechanisms (All Non Environmental)

- Research Councils URL
  - 2011-15 target of c $600m savings (3-5% pa)
  - Linking overhead cost recovery to efficiency levels
  - Part funding equipment to encourage sharing
  - Other measures (guidance, procurement etc.)

- HEFCE: Transparent Approach to Costing (TRAC) URL
  - Full economic costing of all research projects
  - Avoidance of cross subsidy
  - Random audits
All research organisations placed in 5 Efficiency Groups, based on:
- absolute level of indirect costs
- improvement over the previous year
A varying ‘penalty’ deduction from indirect cost figures
- 0-6% in year 1 to 0-18% in year 3+
Initially only applied to non facilities element of indirect costs
URL
Research Councils – Equipment Costs

• Full economic costing: Example [URL]
• Only part funding of most equipment
  - under $15,000 treated as direct costs, typically an automatic RC contribution of c 80%
  - $15,000 to $170,000 standard justification, up to 50%
  - over $170,000 science/business case, up to 100%
• Encouraging equipment sharing HE consortia
  - standard inventories
Research Councils – Next Steps?

- More benchmarking
  - equipment performance and use, space utilization
- More focus on facilities efficiency as well as equipment
- Lab/dept efficiency assessment
  - LabRats type Green Lab assessments as a foundation?
- Internal sharing of smaller equipment items & chemicals
- Common standards for more data exchange
- Recommended norms and guidance
- Procurement agreements and bulk purchasing
Salix Finance provides perpetual loans for ‘revolving green funds’ as per Harvard model [URL]

University of Cambridge has a proxy energy devolution scheme with annual consumption targets for Schools and rewards/fines for good/bad performance [URL]

National Union of Students has incorporated the S-Lab Environmental Assessment Framework into its popular ‘Green Impact’ audit scheme [URL]
Conclusions

• Much ‘hidden’ environmental improvement potential - best addressed without too much of a ‘green’ hat?
• Align with good science + organizational agendas - ‘Win win’ actions, Good Laboratory Practice
• Capture ‘hidden’ knowledge e.g. maintenance, technical
• Align carrots and sticks with control and motivation
• Think holistically about equipment: not just databases
• Target big change as well as routine processes
Questions and Discussion
Break
Initial Actions by US Federal Agencies
Addition of Laboratory to the Sustainable Facility Tool & Inclusion of Biomedical Equipment and Supplies Category to the Green Procurement Compilation

Michael Bloom
Sustainable Facilities Tool

- Visit [www.SFTool.gov](http://www.SFTool.gov)
Integration of Sustainability Principles in Grant Development, Review & Award Criteria

Bill Hemmington
Connecting Sustainability to Indirect Cost Recovery (ICR) and Grant Terms & Conditions for Energy Efficient Lighting

Kristen Taddonio
Uniform Guidance CFRs Requiring Equipment Sharing and Avoiding Acquisition of Duplicative Items
Gil Tran
Energy Management: Engaging and Financially Connecting with Electricity Use

Kevin Ng
Energy Management: Engaging and Financially Connecting Occupants with Electricity Use

Better Buildings Summit
May 29, 2015

Kevin Ng
Assistant Energy Manager, PE, CEM
Office of Sustainability and Energy
In 10 years, compounds to +28%
Status quo

• Management of energy usage and costs reside centrally

• The need for culture change:
  
  ➢ Increased utilization of existing spaces
  ➢ Addition of new buildings
  ➢ Persistence of retrofit and rcx savings
  ➢ Preservation of building systems
Energy Management Initiative

- Established in 2010 through Operational Excellence
- Complements existing campus operations and goals
- Consists of four components:
  - Energy Incentive Program
  - Energy Office
  - Energy Use Policy
  - Outreach
Why Occupants?

- Do your occupants of your academic buildings know how much it costs to operate their building each month?

- By the numbers:
  81% students, 14% staff, 5% faculty of which 0.1% are technical staff

- Growing evidence on occupant energy savings
Incentive Program

• Only focuses on electricity use:
  ➢ Controllability
  ➢ Metering system reliability

• Program rules:
  ➢ Square footage apportionment
  ➢ Roll up by Operating Units
  ➢ Availability of energy data
  ➢ Steering Committee
Outreach - marketing

• myPower outreach and marketing campaign to influence individual behavior change
  ➢ Voluntary Power Agents

• Energy competitions in academic buildings and dorms

• Energy presence in main campus
  ➢ Storefront for walk-ins
  ➢ Energy tools and tips to spur individual action
Outreach - technical

- Energy dashboards
- Building surveys
<table>
<thead>
<tr>
<th>Organization</th>
<th>Research Interest</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for the Built Environment</td>
<td>• Occupant thermal comfort&lt;br&gt;• HVAC controls sequences</td>
<td>• Personal comfort systems at Doe Library and Stanley Hall&lt;br&gt;• HVAC setpoint and deadband reset in Stanley Hall</td>
</tr>
<tr>
<td>LoCAL</td>
<td>• Occupant-controlled heating and cooling&lt;br&gt;• Energy dashboards</td>
<td>• Application deployed in Sutardja Dai Hall&lt;br&gt;• sMAP viewer in over 50 buildings</td>
</tr>
<tr>
<td>College of Engineering / Architecture / PG&amp;E</td>
<td>• Building systems energy use and rcx&lt;br&gt;• Automated fault detection for HVAC</td>
<td>• Energy audit and analysis of HVAC, lighting and window shades in Energy Biosciences Building&lt;br&gt;• Pilot application in pneumatic control system</td>
</tr>
<tr>
<td>CITRIS</td>
<td>• Best in class HVAC control sequences</td>
<td>• Pilot project in Sutardja Dai Hall airside systems</td>
</tr>
<tr>
<td>TGIF</td>
<td>• Implement projects to help meet teaching and sustainability goals</td>
<td>• Smart plugs installation at Carleton and South Hall&lt;br&gt;• LED retrofit for microscopes in Valley Life Addition</td>
</tr>
<tr>
<td>Lawrence Berkeley National Labs</td>
<td>• Rapid efficiency feedback for building managers&lt;br&gt;• Whole building measurement and verification (various)&lt;br&gt;• Backpack-mounted building energy modeling</td>
<td>• Deployed in over 60 campus buildings&lt;br&gt;• Evaluate accuracy of forecast by whole building energy algorithm&lt;br&gt;• Pilot data collection and verification in Mulford Hall</td>
</tr>
<tr>
<td>Pacific Northwest National Labs</td>
<td>• Re-tuning of building systems for efficiency using simple tool</td>
<td>• Re-tuning training and assessment of Soda Hall and Hertz Hall</td>
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</table>
Results

- EMI saved $4.4M in two years
- Incentive program monies returned to campus:
  
  Year 1  = $874,000 (8,740,207 kWh)
  $20,000 overage

  Year 2  = $995,000 (9,956,443 kWh)
  +13%

- Active, ongoing, relationships for continuous improvements

mypower.berkeley.edu/sites/default/files/EMIAnnualReport13.pdf
Thank you!
Discussion?

kevin.ng@berkeley.edu
Additional Resources

- EMI Annual Report FY13
- EMI Annual Report FY14
- Incentive Program Background
- Department Energy Surveys
- Case Studies of Partnership and Technical Outreach Success
- Energy Dashboards for comparing buildings, reviewing previous competitions, and checking target and actual performance
Efficiency in the Research Environment: Publicizing Shared Instrumentation and Open Access Facilities

Amorette Getty
Efficiency in the Research Environment: Publicizing Shared Instrumentation and Open Access Facilities

Amorette Getty, PhD

May 29, 2015
Research Instrumentation

National Science Foundation – Major Research Instrumentation Grants:
- $90 Million Total
- 175 awards of $100k - $4 million each
Sustainability: Efficient Use of Resources

• Energy (plug load, increased ventilation req’t)
• Water (cooling, process)
• Material Waste (sample prep waste; haz mat; house utilities)
• Minimize redundant instruments
• Frequency of use (how many hours/day?)
• Availability and access (# users, types of users)
• Knowledge of existence (who knows about it?)
Research Networking Status Quo

Department 1

Department 2

Department 3

www.Che™.ucsb.edu

www.NRI.ucsb.edu

http://www.EEMB.ucsb.edu

Psychological & Brain Sciences
UC Santa Barbara
Collaborative Effort

• UCSB’s Office of Research
  – Motive: Advertise instruments purchased on Shared Instrumentation Grants
  – Provide Funding for WebDev and Intern labor
  – Responsible for ongoing maintenance.

• MRL’s MRFN Office
  – Provided base website code based on MRFN.org

• UCSB Sustainability Intern Office
  – Project management and database population
  – Publicity to other universities and national groups
  – Promote to labs as a big-picture sustainability measure
Single-Discipline Solutions

- www.MRFN.org

- "Shared Experimental Facilities" a core requirement for NSF Materials Science and Engineering Centers (MRSECs)

- 27 of 30 MRSECs are members of the Materials Research Facilities Network to share information about their facilities and experts
Visions of the Future

• More Instruments:
  – All PIs on campus with Shared Instrumentation grants
  – Sustainability Certification - Additional Points awarded to labs listing instruments.
  – Highlight in grant funding requests

• Growth Beyond UCSB
  – Multiple UC Campuses?
  – Form interlinked Shared Research Facilities Networks with compatible protocols.
Thank you! Questions?

sharedinstrumentation.ucsb.edu

sustainability.ucsb.edu/labrats

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Facilities Management Funding to Incentivize Purchases of Energy & Water Efficient Equipment by Labs
Kathy Ramirez-Aguilar
Facilities Management Funding to Incentivize Purchases of Energy & Water Efficient Equipment by Labs

Kathryn A. Ramirez-Aguilar, Ph.D.
Green Labs Program Manager
University of Colorado Boulder
Missing Requests for Efficiency & Conservation in Univ. Research Funding

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F&A (Indirect Costs)
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Facilities Management Funding for Efficient Lab Equipment Purchases

Up to 5 yrs of energy or water savings:

- Equipment replacements
- New equipment

Reach out to CU Green Labs for Facilities Management dollar incentives for your lab
Consolidate from 2 ULT freezers to 1 efficient ULT freezer

44.6 kWh/day

10.5 kWh/day

76% reduction in electricity

$6600 incentive = 6.5 yrs of electricity savings
Low Temp Environmental Chamber: 5.5ºC and Lighting

33.2 kWh/day → 11.2 kWh/day

66% reduction in electricity
$3252 incentive = 5 yrs electricity savings
Break
Open Discussion About Ways to Further Connect Sustainability to Federally Supported Research