

**Energy-Efficiency and Renewable Energy Options
For Risk Management and Insurance Loss Reduction:
An Inventory of Technologies, Research Capabilities, and Research
Facilities at the U.S. Department of Energy's National Laboratories**

Technical Appendices

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TECHNICAL APPENDICES

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Appendix A

Survey Questionnaire and Instructions

National Laboratory Inventory Survey

(FILL THIS OUT ON THE WEB:

<http://eande.lbl.gov/CBS/Climate-Insurance/welcome.html>)

Laboratory name: Division/Department: Division/Dept. WWW link(s):	Contact: Mailing address: Phone/fax: Email:
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Technology Studied

A. Description

B. Avoided Insurance Losses

C. Resources

1. Research capabilities and skills
2. Research facilities
3. Selected Publications
4. Standards/guidelines/protocols/software tools
5. WWW links

D. Demonstration Projects

E. International Activities

F. Future Projects

G. Collaborations with Insurance Industry

National Laboratory Inventory Survey

Instructions

This survey is designed to obtain information on technologies and projects that reduce insurance losses while saving energy, improving indoor air quality, or providing renewable energy and which are funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE). These instructions provide guidelines for completion of the survey.

**Please fill out the survey on the WWW at:
<http://eetd.lbl.gov/CBS/Climate-Insurance/welcome.html>.**

Otherwise complete this form on a file and send the file via email or on a diskette to Ed Vine (elvine@lbl.gov).

Contact Information

Enter the name of the national laboratory and the division or department. Enter the name, address, telephone number, FAX number, and electronic mail (email) address for the person to be contacted for additional information. Provide links to the World Wide Web (WWW) to your division or department where available.

Sector

The questionnaire is divided into four sectors: buildings, industry, utility and transportation. Provide information for each sector where possible.

A. Technology/Project Description

In a few sentences, describe each energy-efficiency, indoor environmental quality, or renewable energy technology or project that is being researched (or recently developed) in your division (or department). Answer all of the questions below for each technology (one technology per page).

B. Avoided Insurance Losses

If available, estimate the amount of insurance losses avoided (or potentially avoidable) due to the technology being studied. Please provide your assumptions and any references to publications used in documenting your estimation.

C. Resources

For each technology, describe the following:

1. Research capabilities and skills associated with the technology, including those internal to your department as well as those external to your department.
2. Energy-related research facilities (if any).
3. Selected publications (list/reference and send with your response).
4. Energy-related standards/guidelines/protocols/software tools developed as part of the research project (e.g., ASHRAE indoor air quality standards, DOE energy building standards, geographic information systems that identify areas of maximum insurance losses, DOE energy measurement and verification protocols, WINDOW 4.1, NFRC window labels)
5. WWW links to the technology project.

D. Demonstration Projects

Describe any projects demonstrating the use of the technology.

E. International Activities

Describe research activities related to this technology that are being conducted by your organization outside the U.S.

F. Future Projects

Describe any future funded work related to this technology which you are planning to undertake. Do NOT describe your "wish list."

G. Collaborations with insurance industry

Describe any collaborative projects with the insurance industry related to this technology.

Appendix B

Explanation of Insurance Terms and Coverage

EXPLANATIONS OF INSURANCE TERMS AND COVERAGES¹

Commercial Lines

1. BOILER AND MACHINERY COVERAGE

This form of insurance provides important mechanical breakdown coverage generally not available under any other insurance policy. A Boiler and Machinery policy can protect an insured against the effects of catastrophic property loss, such as steam boiler explosion or an expensive breakdown of machinery and equipment. But it's not just the physical damage caused by the explosion or breakdown that's of concern. While repairs are being made, valuable time and profits are lost. Business Interruption coverage protects against this. Often Extra Expense coverage is required to keep the business in operation regardless of cost. Refrigeration Interruption insurance protects against spoilage as the result of a breakdown. Many times these business interruption, extra expense and spoilage losses can be much more extensive than the damage to the equipment itself.

Equally important is the very valuable inspection service that Boiler and Machinery insurance can provide. Not only does this service satisfy most jurisdictional inspection requirements, but it also can benefit the insured by providing sound loss control recommendations that can help assure efficient operation and longer equipment life.

Virtually every commercial business has some type of Boiler and Machinery insurance exposure. Keep in mind that mechanical breakdown coverage encompasses much more than just boilers and pressure vessels. It also can include refrigeration equipment, air conditioning equipment, various types of piping, turbines, engines, pumps, compressors, blowers, gearing, shafting, electric motors, generators, transformers and assorted other types of mechanical and electrical equipment. In fact, many policies are written for insureds who do not own or operate boilers or pressure vessels, but yet have sizable mechanical and electrical exposures.

¹Many of these insurance terms and coverage are taken from "The Complete Glossary of Insurance Coverage Explanations" found on the World Wide Web page: <http://www.lcgroup.com/explanations>.

2. BUILDER'S RISK

Builder's risk insurance indemnifies for loss of or damage to a building under construction. Insurance is normally written for a specified amount on the building and applies only in the course of construction. Coverage customarily includes fire, extended coverage, vandalism, and malicious mischief. Builders risk coverage can be extended to a "special" form as well. The builder's risk policy also may include coverage for items in transit to the construction site (up to a certain percentage of value) and items stored at the site.

3. BUSINESS INTERRUPTION COVERAGE

This form of insurance provides loss of income coverage for a business by replacing the businesses' operating income during the period when damage to the premises or other property prevents income from being earned. It is by means of the business' operating income that the business meets its expenses of payroll, light, heat, advertising, telephone service, etc., and from which the business profit is derived. If a business interruption occurs and the business has to close for several months or operate at a reduced pace because of fire or other perils covered by Earnings insurance, this income will cease or be reduced. The business interruptions are due to fire, lightning, water damage, etc. If the business interruption is due to an interruption in "incoming services" (e.g., electricity and gas), then this is classified as service interruption.

For the purpose of this insurance coverage, "earnings" are defined as the actual loss sustained by the insured as a direct result of business interruption necessitated by damage or destruction of real or personal property. The damage or loss must be caused by the insured perils. Furthermore, "business income" is defined as the sum of total net profit, payroll expense, taxes, interest, rents, and all other operating expenses earned by the business. The amount of coverage the Earnings insurance provides is established on the basis of either the amount of insurance or actual loss sustained for each 30-day period of necessary business interruption caused by damage or loss from covered perils. There are several ways to set up Business Interruption depending upon the particular business: monthly limitations, coinsurance, maximum time period to be paid, etc. In addition to Earnings insurance, it is also advisable to carry Extra Expense insurance.

3.1. EXTRA EXPENSE COVERAGE

If a building was rendered untenable by fire or any other insured peril, it would probably be necessary to secure other quarters to continue business operations. However, the use of such buildings would undoubtedly involve many extra

expenses, such as rent, installation of telephones, etc. Extra Expense insurance covers such expenditures over and above normal monthly expenses.

3.2. CONSEQUENTIAL LOSS OR DAMAGE/CONTINGENT BUSINESS INTERRUPTION

Consequential loss or damage -- as opposed to direct loss or damage -- is indirect loss or damage resulting from loss or damage caused by a covered peril, such as fire or windstorm. In the case of loss caused where windstorm is a covered peril, if a tree is blown down and cuts electricity used to power a freezer and the food in the freezer spoils and if the insurance policy extends coverage for consequential loss or damage, then the food spoilage would be a covered loss. Business Interruption insurance extends consequential loss or damage coverage for such items as extra expenses, rental value, profits and commissions, etc.

4. COMMERCIAL PROPERTY INSURANCE

Commercial property insurance policies provide indemnification to the policyholder for direct damage to insured structures and business personal property (Lecomte 1998). Direct damage to insured structures and business personal property includes payment for the repair or replacement of the damaged property.

5. COMPLETED OPERATIONS LIABILITY COVERAGE

This form of liability insurance provides coverage for bodily injury and property damage rising from completed or abandoned operations, provided the incident occurs away from premises owned or rented by the insured. Operations are deemed completed at the earliest of the following items: (1) when all operations to be performed by or on behalf of the insured under contract have been completed; (2) when all operations to be performed by or on behalf of the insured at the site of the operations have been completed; and (3) when the portion of work out of which injury or damage rises has been put to its intended use by a party other than the contractor or subcontractor.

6. COMPREHENSIVE GENERAL LIABILITY COVERAGE

Under this form of insurance and regarding a covered occurrence¹, the company will pay all sums the insured becomes legally obligated to pay as damages due to bodily injury and property damage. The insurance company has the right to defend any suit against the insured seeking damages on account of such bodily injury or property damage, even if any of the allegations of suit are groundless, false or fraudulent, and to make such investigation and settlement of any claim or suit as it deems expedient. However, the company is not obligated to pay any claim or judgement or to defend any suit after applicable limit of the company's liability has been exhausted by payments of judgements or settlements. Comprehensive general liability provides coverage for damages incurred by third parties (individuals, companies, firms, corporations, etc.) when the insured is legally liable, but does not cover property damage in commercial buildings to the insured (see Commercial Property Insurance).

7. CONTRACTOR'S LIABILITY COVERAGE

7.1. Premises/Operations

The “premises” portion of liability insurance provides for payment on behalf of all sums the business is legally obligated to pay as damages resulting from bodily injury and/or property damage caused by an insured peril and arising out of the ownership, maintenance, or use of premises and operations in progress.

The “operations” portion of liability insurance covers operations in progress and is intended for situations where principal business operations are performed away from the business' premises.

7.2. Completed Operations

This portion of liability insurance provides coverage for possible liability for bodily injury and/or property damage after work is complete and employees have left the job site.

¹ Occurrence means an accident, including continuous or repeated exposure to conditions, which results in bodily injury or property damage neither expected nor intended from the standpoint of the insured.

8. PRODUCT LIABILITY

Product liability is the liability for bodily injury or property damage incurred by a merchant or manufacturer as a consequence of some defect in the product sold or manufactured, or the liability incurred by a contractor after he has completed a job as a result of improperly performed work.

9. PROFESSIONAL LIABILITY

Errors and omissions insurance is coverage for liability resulting from errors or omissions in the performance of professional duties. This is applicable as a general rule to professional business activities such as banking, accounting, law, insurance and real estate.

10. SERVICE INTERRUPTION

Similar to business interruption coverage, this form of insurance provides loss of income coverage for a business by replacing operating income during the period when damage to the premises or other property prevents income from being earned. It is by means of the operating income that a business meets its expenses of payroll, light, heat, advertising, telephone service, etc., and from which a profit is derived. If business interruption is suffered and one has to close for several months or operate at a reduced pace because of fire or other perils, this income will cease or be reduced. The service interruption is due to an interruption in "incoming services" (e.g., electricity and gas). If the interruptions are due to fire, lightning, water damage, etc., then this is covered under Business Interruption.

11. WORKERS COMPENSATION

Workers compensation insurance protects the domestic employee and the employer from the expenses and liabilities associated with a work-related accident. The legal requirements for obtaining this insurance vary widely from state to state, with wages paid or hours worked usually the defining item, not job description.

Personal Lines

1. HOMEOWNERS INSURANCE

Homeowners policies are based on a standard form. All homeowners policies cover two important areas: property and liability. In insurance terms this means that the homeowners policy has two basic components. It covers the homeowners structures and possessions - property insurance - and it furnishes protection against personal liability. Personal liability, as its name implies, means the homeowner is legally obligated to pay money to another person for actions caused by the homeowners, the homeowners family, or the homeowners property. That liability extends to medical payments to others for injuries caused by the homeowners or the homeowners family.

Homeowners insurance usually covers damage to both structures and personal property caused by: (1) fire or lightning, (2) windstorm or hail, (3) explosions, (4) riot or civil commotion, (5) aircraft, (6) vehicles, (7) smoke, (8) theft or vandalism (sometimes called malicious mischief), (9) falling objects, (10) weight of ice, snow or sleet, and (11) freezing of a plumbing, heating, air conditioning or other such household system.

Most catastrophes are covered; for example, wind damage from hurricanes and tornadoes come under the windstorm peril and so are included. Flood and earthquake damage, however, are not covered by a standard policy. There may be exclusions spelled out in the homeowners policy such as neglect, intentional loss, "earth movement," general power failure and even damage caused by war.

Appendix C

National Laboratory Projects

Introduction

Each investigator completed the survey form contained in Appendix A. Some comments on the survey fields are warranted:

1. If a research project was being conducted by two laboratories, the names of both laboratories and the respective contact information were listed.
2. The research projects were categorized into one of four sectors: buildings, industry, utility and transportation. Due to resource limits, we did not collect information on transportation projects. Also, while some projects could be classified under more than one category, we used only one category per project for the project description. Those projects affecting the supply or delivery of energy (e.g., advanced batteries, flywheels, wind, etc.) were placed in the “utility” sector; these kinds of projects could affect insurance losses in the buildings and industrial sectors as well.
3. International activities had to be specific international projects.
4. Future projects had to be specific, near-term projects, rather than wish lists.
5. The Research Agenda items had to specifically target the reduction of insurance losses or risk management.

TABLE C-1. LIST OF PROJECTS

Project Number	Project Title	Page Number
ANL-1	Ceramicrete phosphate ceramic	C-1
ANL-2	Recovering zinc from galvanized steel	C-4
ANL-3	Advanced batteries	C-7
ANL-4	Flywheel energy storage	C-10
ANL-5	Fuel cells	C-13
ANL/ORNL-1	Composite wall systems	C-16
BNL-1	Fan atomized burner and flame quality indicator	C-19
BNL-2	Duct audits	C-22
BNL-3	Software for improving oil-fired heating system venting performance	C-25
BNL-4	Training and certification of oil-fired heating system service personnel	C-28
INEEL-1	Fuel cells	C-30
INEEL-2	Demand-controlled ventilation system	C-33
INEEL-3	Software tools for flywheel design	C-35
INEEL-4	Intelligent air quality monitoring technologies	C-37
LBNL-1	Energy-efficient halogen torchiere replacements	C-39
LBNL-2	Energy-efficient windows	C-42
LBNL-3	Ultraviolet water purification	C-45
LBNL-4	Aerosol-based duct sealing technology	C-48
LBNL-5	Building commissioning	C-51
LBNL-6	Building code compliance	C-55
LBNL-7	Light surfaces and urban trees	C-58
LBNL-8	Geographic information systems for targeting loss-prevention measures	C-61

Project Number	Project Title	Page Number
LBNL-9	Measurement and verification protocols	C-63
LBNL-10	Indoor pollutant source reduction	C-66
LBNL-11	Air jacket for spray booths	C-70
LBNL-12	High-efficiency sulfur lamp uplighter	C-73
LBNL-13	Hydronic radiant cooling	C-75
LBNL-14	Technology for cleanrooms	C-78
LBNL-15	Indoor air quality-related illnesses	C-82
LBNL-16	Mitigating urban heat catastrophes	C-85
LBNL-17	Carbon monoxide sensors	C-87
LBNL-18	Environmental tobacco smoke	C-90
LBNL-19	Radon resistant housing	C-93
LBNL-20	Radon insurance	C-96
LBNL-21	Energy management and control systems	C-99
LBNL-22	Integrated information technology	C-103
LBNL-23	Fuel cells	C-106
LBNL-24	Reducing aerosol deposition on electronic circuits	C-110
LBNL-25	Appliance and lighting standards	C-114
LBNL-26	Motor systems and controls	C-118
LBNL-27	Infrared thermography	C-121
LBNL-28	Daylighting	C-124
LBNL-29	Advanced batteries	C-128
LBNL-30	Cool storage systems	C-131
LLNL-1	Flywheels	C-134
LLNL-2	Zinc-air fuel cells	C-137
NREL-1	Passive solar energy systems	C-140

Project Number	Project Title	Page Number
NREL-2	Parabolic troughs for solar electric power	C-144
NREL-3	Building integrated photovoltaics	C-146
NREL-4	Solar heat and buildings technologies	C-149
NREL-5	Stand-alone photovoltaic systems	C-152
NREL-6	Dispatchable photovoltaic peak-shaving and uninterruptible power supply systems	C-155
NREL-7	Small wind turbine systems	C-158
ORNL-1	Natural refrigerants in air-conditioning and refrigeration equipment	C-161
ORNL-2	Superconducting transformers	C-164
ORNL-3	CFC-free thermal insulation	C-168
ORNL-4	Explosion prevention technology	C-171
ORNL-5	Wind resistant building envelopes	C-174
ORNL-6	Durable roof coating materials	C-176
ORNL-7	Hybrid lighting	C-178
ORNL-8	Cool storage systems	C-181
ORNL-9	High-efficiency clothes washers	C-184
ORNL-10	Building commissioning	C-186
ORNL-11	Refractories in glass production furnaces	C-190
ORNL-12	Recovery boilers in pulp and paper mills	C-193
ORNL-13	Geographic information systems for targeting loss-prevention measures	C-196
ORNL-14	Efficient motor-driven systems	C-201
ORNL-15	Flywheels	C-204
ORNL/NREL-1	Electricity from wood removed from forests to reduce fuel buildup	C-206
ORNL/NREL-2	Advanced desiccant air-conditioning technology	C-209

Project Number	Project Title	Page Number
PNNL-1	Tools for building code development and compliance	C-213
PNNL-2	Microtechnology-based absorption heat pump	C-218
PNNL-3	Building commissioning	C-220
SNL-1	Renewable energy projects	C-224
SNL-2	Solar thermal heat	C-227
SNL-3	Architectural and infrastructure surety	C-229
SNL-4	Photovoltaic systems	C-233
SNL/NREL-1	Solar dish engine systems	C-236