

GREEN DEMOLITION CERTIFICATION

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Audience and Use

This certification can be used to validate a responsible building removal by a government agency or building Owner. It may be used for several purposes, such as for issuing a deconstruction permit, for meeting waste diversion goals, or for awarding incentives for “green” demolition practices.

Benefits

This Green Demolition Certification has been developed to provide guidance for governmental agency and industry audiences interested in environmentally and socially responsible management of demolition wastes. Its aim is to provide guidance, and a valid means to qualify a “green” building demolition. Green Demolition exceeds the goal of removing a building from a site for disposal. **It includes the diversion of the maximum amount of materials from the landfill and maximizing social and economic benefits to the community.**

The certification process allows for differences in building types and the context of a particular project at the site and community levels. It uses three major categories of 1) **The Building**, 2) **Planning**, and 3) **Environmental Health and Safety**, and specific criteria within each category. It gives policy-makers a means to validate a “green” demolition when developing demolition debris management regulations and incentives, and to communicate the outcomes of these regulations and incentives. The goals of a green demolition include:

Goals of Green Demolition

- Divert demolition debris from landfills
- Recover materials for reuse and recycling
- Contribute to the environmental and economic health of the community
- Provide a safe and healthful work environment
- Regard necessary building removals as a community development opportunity
- Retain historic building character in a community

GREEN DEMOLITION CERTIFICATION CREDITS

The Green Demolition Certification is earned through a credit system. Credits are awarded based upon compliance with stated criteria. The credits are categorized by 1) ***The Building***, 2) ***Planning***, 3) ***Environmental Health and Safety***, and 4) ***Bonus Credits***. There are also Prerequisites (P) within the *Waste Reduction*, and the *Environmental Health and Safety* categories for which no credits are awarded. Failure to meet a Prerequisite will invalidate the application for certification, regardless of other measures that are completed.

Certification is awarded to any project meeting all Prerequisites and earning twenty-five (25) or more credits from a total of fifty (52) maximum credits available, including two (2) bonus credits.

Some credits are awarded based upon quantifiable measurements with direct documentation, such as tipping fee receipts or invoices. Other credits are awarded through documentation by a letter, drawing, or other documents. Documentation by a letter on the responsible parties' letterhead affirming completion of the credit criteria is a common form of documentation in this system. This self-certification will allow the deconstruction contractor to reduce the additional administrative burden of the certification process and requirements for third-party consultants. The certifying authority will reserve the right to audit or confirm the completion of these self-certified credits through site visits or requests for further documentation.

The procedure for using the certification is as follows:

1. Complete certification form for preliminary analysis of "easy" credits.
2. Look for additional credits if needed to reach minimum of 25 credits.
3. Prioritize additional credits based upon cost and technical feasibility.
4. Determine proposed strategies to achieve all credits being sought.
5. Implement project, insuring proper documentation of credits to be sought.
6. Document achievement of credits using certification form and appropriate backup documentation.
7. Submit certification form and backup documentation for approval.

THE BUILDING

1.1 Site

Green Demolition is a holistic approach to the process of removing buildings. It is concerned with all of the impacts from the process, including impacts on the building site and surrounding properties, streets, and neighborhoods. Selective deconstruction has the capacity to inherently reduce these immediate environmental impacts through hand labor and smaller equipment. An important goal of “green” demolition is the least possible disturbance or interruption of the non-building footprint site and surrounding areas.

Possible Credits	1.1 SITE	Documentation Required
1	Leave all vegetation in place unless salvaged for reuse.	1. Pre- and post demolition photographs 2. And/or site plan with tree survey and protection plan.
1	Building site is filled, graded, and seeded with ground cover after building removal.	1. Site landscape plan for post-demolition conditions and /or photographs for verification
1	Erosion and sedimentation control plan.	1. Erosion and sedimentation plan outlining measures taken.
2	Minimize environmental impacts from the building removal such as noise, dust, traffic, and equipment/material placement and storage upon surrounding properties and streets.	1. Site plan of deconstruction project indicating adjacent buildings, sites and streets. 2. Site plan will indicate ingress/egress routes for vehicles, workers/visitors parking, placement of roll-offs, site trailer and equipment, materials storage, work areas, fencing, etc.

Total Possible Site Credits = 5

1.2 Materials Recovery

The intent of this credit is to measure the project’s resource conservation by considering the types of materials that are recovered, and the best effort to recover the maximum amount of materials that are *recoverable*. The measure of resource conservation to be used is the “embodied energy” of the materials that are recovered. ***The embodied energy of a material is the amount of energy required to extract, process and transport a material for installation into a building.*** While there are other environmental impacts in the creation of building materials, the embodied energy provides a single number that can be used to compare different types of materials with different embodied energy.

The recoverable materials are those that can be reused and recycled based upon the condition of the materials and the available reuse and recycling infrastructure in the community. The intent of these measures is to reward a “best effort” at materials resource conservation when faced with the specific materials within a particular project. A best effort avoids unduly penalizing a project that does not recover a large amount of materials when faced with severe technical or economic constraints.

How to Use the Materials Recovery Worksheet

In order to calculate the Materials Recovery credits, a ***Materials Recovery Worksheet*** is provided. It is used as follows:

- 1) Use the menu of basic materials provided – Column A (See Appendix A)
- 2) Enter the quantity of each basic material type in the existing building – Column C
- 3) Enter the estimated recoverable amount of each material– Column D
- 4) Enter the quantity of materials that are actually recovered – Column F

Use the accompanying Excel Spreadsheet called “Calculations” to perform the calculations required for completing the Materials Recovery Worksheet. See Appendix A for an example of the spreadsheet. The spreadsheet has a menu of common building materials. *Use the material that is closest to the building material found in the building.* For example, various appliances are placed in the HVAC Equipment and Appliances category. Enter the amount of materials using the measurement that is highlighted in yellow in the Excel spreadsheet. A total weight in tons and total MillionBTUs will be calculated.

Example calculation:

1,000 square feet of acoustic ceiling tile (ACT) at 1 pound (#) per square foot is 1,000 S.F. x 1 #/S.F. = 1,000 #s x 1 ton per 2,000 #s = **0.5 tons existing inventory** – enter into Column C

Assume 90% of the ACT is recoverable - **0.5 tons** x 0.9 = **0.45 tons recoverable** – enter into Column D

If **0.225 tons** of ACT are actually recovered – enter into Column F

The recovered embodied energy is - **0.225 tons** x **13 MMBTUs per ton** = **2.93 MMBTUs** of embodied energy recovered – enter into Column G

The disposal is - **0.5 tons** existing – **0.225** recovered = **0.28 tons disposal** – enter into Column H

After all the materials have been documented, then the totals can be used to calculate the Materials Recovery credits achieved:

To calculate the **percentage of materials recovered to materials recoverable**, divide the total of Column F by the total of Column D - $0.225 / 0.45 = 0.5 \times 100 = 50\%$

To calculate the **percentage of embodied energy recovered to the embodied energy existing**, divide the total of Column G by the total of Column E – $2.9 / 6.5 = 0.45 \times 100 = 45\%$

To calculate the **recovery percentage**, divide the recovered amount 0.225 tons by the existing inventory 0.5 tons = $0.225/0.5 = 0.45 \times 100 = 45\%$

Materials Recovery Worksheet

A	B	C	D	E	F	G	H
Material	Embodied Energy (Million BTU/Ton)	Existing Inventory (Tons)	Recoverable (Tons)	Embodied Energy Existing (Million BTU)	Recovered (Tons)	Embodied Energy Recovered (Million BTU)	Disposal (Tons)
Acoustic ceiling tile	13	0.5	0.45	6.5	0.225	2.93	0.28
Aluminum	200						
Asphalt shingle roofing	14						
Brick	4						
Carpet	46						
Ceramics	13						
Clay tile	4						
Concrete	1.2						
Concrete masonry unit	1.2						
Copper	14						
Drywall/plaster	3						
Engineered wood	10						
Fiberglass	20						
Glass	20						
Gypsum drywall	3						
HVAC Equipment and Appliances, etc.	66						
Metals	30						
Plastics	100						
Plywood	4						
Polystyrene	80						
Vinyl/linoleum flooring	75						
Vinyl siding	75						
Wood	4						
Total		0.5	0.45	6.5	0.225	2.9	0.28
I. Materials Recovered / Recoverable (%)					50%		
J. Embodied Energy Recovered / Existing (%)						45%	
K. Recovery (%)							45%

There are three sub-sets of credits available in the Materials Recovery category.

I. Materials Recovered / Recoverable (%) (3 credits)

25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 3 credits

J. Embodied Energy Recovered / Existing (%) (3 credits)

25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 3 credits

K. Recovery (%) (4 credits)

25-50% = 1 credit, 51-75% = 2 credits, 76-100% = 4 credits

Total Possible Materials Recovery Credits = 10

1.3 Waste Reduction

Green Demolition is foremost the diversion of debris from landfills in order to avoid the economic and environmental costs associated with disposal, and encourage value-adding to what was considered waste. The direct costs of waste include tipping fees, the loss of habitat and biodiversity, groundwater or soil contamination from debris, and the ongoing costs to open, maintain, close, and monitor landfills.

While credits are awarded for a best effort on a building with limited salvage in the Materials Conservation category, the Waste Reduction category values the fact that recovery of materials from larger buildings will have an absolute benefit over recovery of an equal percentage of recovery of the materials from a smaller building.

Waste Reduction Credits are determined by two main factors:

- 1) The total volume of the building
- 2) The percentage of recovered materials

A minimum of 20% diversion from landfill by mass of the existing building materials is a prerequisite for any building of any size.

Method for Calculating Waste Reduction

1. Complete **Materials Recovery Worksheet**.
2. Calculate the total existing building volume and find the row in the **Waste Reduction Worksheet** that is associated with the correct range of volumes listed in the left hand side of the Waste Reduction Worksheet.
3. Look along the bottom of the **Waste Reduction Worksheet** to find the column associated with the percentage of materials recovery to the total building materials mass. This percentage comes from the total of Column H of the **Materials Recovery Worksheet** called Recovery %.
4. A minimum of 20% of total building materials mass must be recovered in order to receive the green demolition certification.
5. Look for the intersection of the row that is the building volume range and the column that is the recovery percentage range. The number of credits awarded for Waste Reduction is the intersection of these two pieces of information.

Example calculation:

A building that is 60' long and 30' wide and two-stories (20' high) will have a volume of 60' x 30' x 20' = 36,000 cubic feet / 27 cubic feet per cubic yard = 1,333 cubic yards (C.Y.). This volume would be in the 2nd row from the bottom of the worksheet, more than 500 C.Y. and less than 1,500 C.Y. If 45% of the building materials are recovered (the 3rd column from the left) then 1 credit will be awarded.

By comparison - a 150' x 75' x 25' building = 281,250 cubic feet / 27 cubic feet per cubic yard = 10,416 C.Y. with a 45% recovery will result in (find <15,000 row and 36-50% column) 6 credits.

Waste Reduction Worksheet

Total Building Volume (length x width x height = C.Y.)	>15,000	P	6	8	10	10	10	
	<15,000	P	4	6	8	10	10	
	<9,000	P	2	4	6	8	10	
	<4,500	P	1	2	4	6	8	
	<1,500	P	0	1	2	4	6	
	<500	P	0	0	1	2	4	
			20	20-35	36-50	51-65	66-80	81-100
			Recovery (%) to Total Mass (weight)					

P = prerequisite

Documentation

1. Plan and elevations of building are required to demonstrate the building total volume.
2. Invoices and receipts for all salvage and recycled materials to document transfer of the materials from the building site to a reuse store, a broker, a direct buyer, or a recycling facility are required to document the total diversion of materials from landfill.

Total Possible Waste Reduction Credits = 10

PLANNING

2.1 Land-Use

This credit is awarded for either a building removal at an urban infill site to make use of existing urban infrastructure for redevelopment, or where removal of the building allows for the creation of green space, or mitigates future disaster damage by removing buildings in areas that are prone to disaster.

Possible Credits	2.1 LAND USE	Documentation Required
1	Selective dismantling is the “best” option after rehabilitation and relocation options are deemed infeasible.	1. Letter by the Owner on company or personal letterhead.
1	In-fill of blighted areas, mitigation in natural areas, or disaster debris removal where rebuilding will not take place.	2. Letter and or map indicating the site and future plans for construction at an urban site, or preservation at a rural site.

Total Possible Land-Use Credits = 2

2.2 Industry Building

The Industry Building credits of the Green Demolition Certification are intended to validate the infrastructure that will make materials salvage economically viable.

Possible Credits	2.2 INDUSTRY BUILDING	Documentation Required
1	A first time application for a Green Demolition Certification	1. Letter on deconstruction company letterhead.
1	If the building removal project is undertaken by a combined deconstruction and used building materials resale or recycling business.	2. Letter on deconstruction and/or reuse business company letterhead stating that the reuse or recycling business is a component of the deconstruction contractor business.
1	If the Green Demolition Certification is used to achieve and/or validate a construction and demolition (C&D) waste management permitting process.	3. Copy of local ordinance or regulation that requires C&D recycling or management as part of permitting process.

Total Possible Industry Building Credits = 3

2.3 Community Building

Green Demolition can support the economic development of communities by providing jobs and job-skills training, and affordable building materials. At the same time, maintaining a community's irreplaceable historic fabric should be rewarded. The certification provides a credit for removal of buildings that are not on the National Register of Historic Places, as an important component of a community's architectural and building fabric.

Possible Credits	2.3 COMMUNITY BUILDING	Documentation Required
1	Use of a job-training program and/or apprenticeships.	1. Letter on letterhead of job-training program, or apprenticeship sponsor, affirming use of job-trainees for duration of deconstruction project.
1	Portion of the recovered materials is donated to a non-profit providing or using affordable reused building materials for housing or to support construction of housing.	1. Letter on letter head of receiving non-profit stating amount and use of materials to support affordable housing creation.
1	Removal of <u>non</u> -National Register of Historic Places listed building only.	1. Letter from local government or historic preservation entity, affirming that the building is not a listed building.

Total Possible Community Building Credits = 3

2.4 Materials Management Plan

Careful planning is essential to the success of a Green Demolition. Ensuring that the demolition contractor and all workers are aware of the techniques and goals for material recovery will improve recovery rates. Material flow away from the building is as complicated, and needs to be as carefully coordinated, as material flow onto the site during a construction project.

The most fundamental green demolition planning strategy is having a use or market for the recovered materials before work begins. The development of sales strategies for the recovered materials such as on-site sales, bulk sales, use of media, design for reuse of materials into new projects all provide the foundation for a high recovery rate for the proposed project.

Possible Credits	2.4 MATERIALS MANAGEMENT PLAN	Documentation Required
1	The green demolition is directly associated with a renovation or construction project that utilizes the recovered building materials.	<ol style="list-style-type: none"> 1. A listing of the materials that are recovered that are intended for reuse within a one-year time frame at the same site or other projects. 2. A letter on company letter head of the Owner or Owner’s representative affirming the use of the listed materials into a specific project by name and address.
1	Fifty (50) percent of all recovered materials are redistributed within a 50-mile radius of the project site in the first transfer from the building site.	<ol style="list-style-type: none"> 1. A letter on deconstruction company letterhead stating reuse/recycle distribution of at least 50% of materials to locations and businesses within 50 miles of deconstruction site directly from the site.

Total Possible Materials Management Credits = 2

ENVIRONMENTAL HEALTH AND SAFETY

3.1 Worker Health

Supervision and training are prerequisites for a safe and efficient project and work place. Treating accident prevention as both a top-down and bottom-up activity will insure full communication and shared responsibility amongst all members of the deconstruction company. Although safety has its own reward of no injuries, an incentive program for workers to exceed minimums and receive rewards for best practice is common in the construction industry. Some incentive programs are based upon company spirit and others are more pragmatic using salary bonuses or other kinds of in-kind benefits such as bonuses, meals, goods, T-shirts, preferred parking spaces, and awards, as examples. ***Worker health and productivity are the basis of any successful enterprise*** and since Green Demolition Certification is based upon exceeding the minimums, credits for training and safety rewards are important components of the certification.

Possible Credits	3.1 WORKER HEALTH	Documentation Required
3	Contractor or job supervisor has been trained in Green Demolition Certification.	1. Certification that the job supervisor or contractor has received green demolition training as per The Deconstruction Institute guidelines.
3	Workers have been trained according to Green Demolition Certification training or training approved by the National Association of Demolition Contractors and/or OSHA, for demolition safety.	1. Training plan for green demolition and training log for workers as prepared by the contractor.
3	Worker safety and performance incentive plan that exceeds minimum safety and contract requirements is created and implemented on the green demolition site.	1. Record of safety incentive plan or record of accident free days by company to indicate no serious accidents reportable under OSHA Form 200 requirements within the last 6 months can both be used to qualify for this credit.

Total Possible Worker Health Credits = 9

3.2 Hazardous Materials

Green Demolition Certification requires the correct and safe handling and disposal of all hazardous materials. Since Green Demolition can involve more hand labor than traditional mechanical demolition, workers may be subjected to a greater exposure to hazards. For the health of workers and the environment, the most prudent standard of care should be followed, including all Federal, State and local regulations.

Possible Credits	3.2 HAZARDOUS MATERIALS	Documentation Required
P	Asbestos survey and abatement as per OSHA and NESHAPS regulations using certified and licensed asbestos survey and abatement contractor(s).	1. A copy of survey and clearance
P	Lead work plan is developed and implemented as per OSHA CFR 29 1926.	1. If the building is surveyed and does not contain any lead-based paint (LBP) then the lead work plan is fulfilled by the LBP survey. 2. If the building contains LBP, then the plan must include all OSHA requirements for worker protection in a lead environment as required
3	Any lead-based painted materials exceeding 0.06 % lead content are either disposed of, or abated prior to redistribution to the general public.	1. Acknowledgement by the green demolition entity that it understands and addresses LBP issues is rewarded with three credits
3	The hazardous materials management plan includes proper recycling and disposal of all other hazardous materials besides asbestos and lead-based paint, including refrigerants, chemicals and paints, mercury, PCBs, etc.	1. This is documented by descriptions of hazardous materials and/or invoices and receipts from hazardous materials disposal facilities

Total Possible Hazardous Materials Credits = 2 Ps + 6

3.3 Job Safety

Providing a safe environment for all workers involved with Green Demolition is essential. Therefore the Job Safety elements of the Green Demolition Certification are all prerequisites.

Possible Credits	3.3 JOB SAFETY	Documentation Required
P	A pre-demolition engineering survey is required before the start of work and to be used in the preparation of the project work plan	1. Copy of engineering survey of project.
P	A Job Safety Plan is a requirement and to be prepared and communicated to all workers and supervisory personnel before commencement of project	1. Copy of Job Safety Plan for project.
P	A designated safety officer to monitor all job-site safety concerns and enforce the job safety plan is a requirement.	1. Letter on deconstruction company stating name of Safety Officer, qualifications and contact information.
P	Although deconstruction may be accomplished with a partial utilities cut-off, insuring the highest standard of care outside the building prior to the start of work	1. Documentation of utilities cut-off with date before start of project, and date of project start.

Total Possible Job Safety Credits = 4Ps + 0

3.4 Bonus Credits

Up to two (2) bonus credits are allowed in the Green Demolition Certification. One (1) credit is allowed for use of the Rainforest Alliance “SmartWood Rediscovered Wood Program” certification of salvaged, reused and recycled wood products. This includes recovery of wood from demolition and deconstruction. This certification is classified as “neutral” under the Forest Stewardship Certification Program.

Possible Credits	3.4 Bonus Credits	Documentation Required
1	The company performing the deconstruction or receiving the recovered materials has been certified under the SmartWood Rediscovered Wood Program.	1. Copy of SmartWood Rediscovered Wood certification document.
1	An innovative strategy, or project as claimed by deconstruction or reuse entity.	1. Letter on company letterhead.

Total Possible Bonus Credits = 2

GREEN DEMOLITION CERTIFICATION FORM

Category	Possible Credits	“Easy” Credits	Additional Credits	Proposed Credits
The Building	(P + 25)			
1.1 Site	5			
1.2 Materials Recovery	10			
1.3 Waste Reduction	P + 10			
Planning	(10)			
2.1 Land-Use	2			
2.2 Industry Building	3			
2.3 Community Building	3			
2.4 Materials Management Plan	2			
Environmental Health and Safety	(P + 15)			
3.1 Worker Health	9			
3.2 Hazardous Materials	P + 6			
3.3 Job Safety	P			
Bonus Credits	(2)			
3.4 SmartWood Rediscovered Wood	1			
Other Innovation	1			
TOTAL POSSIBLE CREDITS	P + 50 + 2			

P = Prerequisites

Submit form with documentation for receipt of Green Demolition Certification.

Prepared by: _____

Appendix A - Materials Weights Conversions and Embodied Energy Categories

	#/s.f.	#/v.l.f.	#/l.f.	#/each	MMBTU/ton
Acoustic Ceiling Tile	1				13
Aluminum Conduit			3		200
Asphalt Shingles	2.4				14
Brick					4
16"x16" chimney / pier		145			
20"x32" chimney		264			
48"x48" chimney		1000			
12"x12" pier		100			
single wythe - 3 hole	30				
solid brick				9	
Carpet	2				46
Ceramics					13
porcelain sink				20	
toilet				40	
1/4" ceramic tile	5				
Clay Tile on Mortar	20				4
Concrete					1.2
1" concrete floor topping	12				
4" concrete	50				
6" concrete	75				
Concrete Masonry Unit					1.2
4" CMU	30				
4" CMU filled cells	40				
8" CMU	30				
8" CMU filled cells	50				
Copper					14
copper roof	1				
1/2" copper pipe			0.33		
Drywall / Plaster					3
plaster - 3/4"	5				
plaster and wood lath	8				
Engineered Wood					10
1/2" fiberboard	0.75				
3/4" OSB Plywood	2.3				
5/8" OSB Plywood	1.8				
Fiberglass					20
6" fiberglass insulation	4.2				
fiberglass tub with shower enclosure				80	
Glass - 1/4"	3				20
Gypsum Drywall					3
1/2" drywall	2				
5/8" drywall	2.8				
Metals					30
metal siding	1				
hollow metal door w/ trim and frame	2.5				
metal roofing	2.5				

Appendix A - Materials Weights Conversions and Embodied Energy Categories (cont.)

	#/s.f.	#/v.l.f.	#/l.f.	#/each	MMBTU/ton
3/4" steel pipe			1.13		
2" cast iron pipe			3.35		30
sheetmetal ductwork			4		
4" cast iron pipe			9.9		
steel sink				10	
Metal ACT grid	2				
metal tub				75	
iron bathtub				300	
HVAC Equipment and Appliances					66
2x4 fluorescent fixtures				25	
range hood				25	
water heater - 30 gallon				50	
window air-conditioner				50	
water heater - 40 gallon				75	
2x2 fluorescent fixtures				15	
dishwasher				100	
washing machine or dryer				100	
range/oven - countertop				100	
air handler or heating unit				200	
refrigerator				200	
Warm air furnace				300	
Residential electric heat pump				300	
ceiling light fixtures				5	
ceiling fan				15	
Plastic Shower Stall				75	100
Plywood					4
1/2" plywood	1.5				
1/4" veneer paneling	0.5				
3/4" plywood	2.4				
Polystyrene - 1" Insulation	0.2				80
Vinyl/Linoleum					75
1" PVC pipe			0.15		
1/4" vinyl /linoleum flooring	1				
Vinyl Siding	0.75				75
Wood					4
1x3 beadboard	1				
wood hollow-core	1.5				
1x board	3				
Southern yellow pine T&G flooring	3				
window from 36"x48" to 36"x60"	4				
Oak - red/white 1x3	4				
2"x6" decking	5				
window from 24"x24" to 30"x48"	4.5				
Heartpine T&G flooring	5				
wood shakes	6				

Appendix A - Materials Weights Conversions and Embodied Energy Categories (cont.)

	#/s.f.	#/v.l.f.	#/l.f.	#/each	MMBTU/ton
window equal to and less than 24"x24"	5				4
wood solid core door	3.5				
2x4			2		
2x6			3		
2x8			4		
4x4			4		
2x10			5		
2x12			6		
4x8			8		
6x6			9		
4x10			10		
4x12			12		
6x8			12		
6x10			15		
8x8			16		
8x10			20		
10x10			25		
base cabinet			35		
mantlepiece			35		
wall cabinet			35		
wood stairs from floor 4 risers				200	
wood stairs from floor 8 risers				400	
wood stairs from floor 12 risers				600	

#/s.f. = pounds per square foot
 #/v.l.f. = pounds per vertical linear foot
 #/l.f. = pounds per linear foot
 #/each = pounds per each item
 MMBTU = million British thermal units