Subcommittee Name
Planning and Zoning Recommendations

Executive Summary:

IRC 2018 and New Mexico Residential Energy Codes are the current building codes adopted in Los Alamos County. These apply to new construction and to renovation modifications requiring a permit, not to unaltered homes. Los Alamos codes requiring a permit are extensive in their applicability, but do not cover interior changes without plumbing or electrical changes.

The county should consider a local overlay code to address the steps needed to reduce greenhouse gas emissions and other sustainability issues. Several cities, both large and small, have supplemental codes commonly referred to as "green codes" which address issues beyond current requirements. Green codes for other cities vary from expediting permitting, reducing permit costs, enhancing tree cover, to detailed construction techniques that supersede the code. Some jurisdictions have put their green codes to a public vote before implementation.

Eliminating or reducing the need for energy use is the most effective way to minimize greenhouse gas emissions. Conversion of natural gas consumption to electricity requires careful planning to assure that greenhouse gas emissions are actually reduced. Since the building code covers all aspects of building, and landscaping, an overlay code can incorporate other sustainability recommendations discussed in the LARES committee report.

Some issues to address include:

1) The overlay code should encourage energy efficiency improvements such as adding double pane (or triple pane) windows and attic insulation to existing homes that are not being renovated. The code should also incorporate requirements for the future by requiring preparation for heat pump installation (conversion from natural gas heating) and preparation for solar readiness. Establishing a method to subsidize the costs will be important to assure that least energy efficient residences are converted.

2) The county should consider using the "design to" concept rather than a third party audited installation. The cost of third party audits with certifications is not insignificant and can deter installations for energy reduction projects.

3) The international residential building code of 2018 does not incorporate energy standards for appliances, as the standards are set by the Federal government. The county should consider narrowing the list of Federally allowed appliances to the more energy efficient ones, such as energy star appliances, for installations throughout Los Alamos County.

4) The county should set an example with its purchasing and contracting. The county has an environmental preference policy but it requires justification to choose the least emitting option, not justification to choose away from the lowest emitting option.

5) The county should include some commercial zoning in every section of town.

Discussion:

In general buildings consume 40% of US energy which can be a mix of fossil fuels and other sources. The 1972 energy crisis encouraged energy efficient homes as the building codes responded to current events. The 40% number may not apply specifically to Los Alamos given the LANL transportation but for energy produced and consumed within Los Alamos it is relevant as the age of the building stock is predominantly pre-1972. For reference, the 1970 Uniform Building code, predecessor to the current International Building Code, focuses on structural strength and barely mentions insulation. Most pre 1970 homes have 2 to 3 inches of insulation in the attic.

IRC 2018 and the New Mexico energy code are the current building codes adopted in Los Alamos County. Recent changes to the building code focus on the building envelope. The code has significantly changed the R value required for insulation (to minimize heat loss) and changed the solar heat gain coefficient required for windows. New homes and retrofits requiring a permit will have far less energy requirements than the typical home in Los Alamos, NM. Buildings not retrofitted remain the issue.

To address improvements beyond the standard building code several cities and towns have a "Green Code" that applies in addition to the required code. Most of the green codes focus on expedited permitting for new construction with energy saving projects or reduced permitting costs. These may not be a sufficient incentive for Los Alamos construction. Portland, Oregon has a green code that funds new energy conservation projects but Los Alamos needs proven ideas implemented to reduce greenhouse gases. Seattle's new code eliminates new fossil fuel connections for heating and eliminates new electric resistance heating, essentially requiring electric heat pumps for heating. Seattle new homes must have electrical connections at gas fired appliances in preparation for a switch to electric, and provide connections for solar readiness. The Alburquerque green code provides expedited permitting review for LEED and HERS building permits. The Denver, Colorado green code was passed with a public vote and provides financing options for energy efficient construction. Holland, Michigan has a fund to rebate 20% of the energy improvements as well as a fund to borrow $5000 to $30,000 at a fixed low interest and pay it back via the electric bill. Several states have established funds to cover the pre-weatherization issues such as addressing moisture, wiring, structure, and wiring issues that are not covered by federal programs. There are many ideas listed above the county could incorporate.

Recommendation 1:

To start this discussion I would like to thank Ben Hill, an architect and member of the subcommittee for this work. He modeled a typical 1950's residence and changes to current code to reflect the changes in energy loss.

Chart 1 reflects the difference for a residential dwelling with typical 1956 construction and with energy efficiency improvements added. From the chart, single pane windows are the largest heat loss for the home at 40% of the total heat loss. Conversion to multiple pane windows will make the largest difference in home energy consumption. Current code for windows requires a higher insulating value, commonly known as the R value, which is based on not just climate but also elevation. Los Alamos's R value is different than Albuquerque and costs for windows will be higher than most of the rest of the state. To meet the new requirements for Los Alamos some double panes are available but for most manufacturer's triple panes will have to be installed. At this time the industry is adjusting to the new requirements and costs are higher and supplies are limited. Given the high cost of window replacement but the higher energy savings associated with replacement some enticement will be needed to help homeowners pursue this path. Increased efficiency gains would still be significant if 2015 code double pane windows were installed or if the R value for the rest of the state was used but the current code does not have an allowable exemption. Changes made without replacing the windows from a single pane are without value as single pane windows are essentially holes in the wall letting the heat out. Replacing single pane windows should be considered a priority to achieve energy loss goals from housing and reduce CO2e emissions. The extent of single pane windows left in the community is an unknown factor. The county could consider collecting this data as part of the assessor information it collects for building information for tax purposes.

Less expensive and the next step after windows are replaced is adding attic insulation. Chart 1 reflects adding 12 inches of attic insulation . This is effectively R49, the new 2018 code, if blown over the typical 3 inches found in 1950's construction. This is fairly easy and significantly less expensive than windows. It is an attainable goal for houses with attics. This change in the attic alone combined with windows reduces the overall energy demand of a house by 60%. Mobile homes and flat roofs are not suitable for this conversion and other opportunities must be found.

Adding exterior insulation to walls is the next most effective method but must be carefully engineered to control where the dew point falls in the wall to avoid mold issues. Next in line is crawl space insulation which can be difficult to install , thus more expensive, due to limited access especially in older homes.

Homeowners who have the most opportunity to reduce energy use, such as those with single pane windows and without additional insulation added in the attic above pre-construction

levels, may need assistance to incorporate these changes. Establishing a fund to help these homeowners pay for the energy reductions over time, while meeting New Mexico's anti donation law, should be addressed. The fund should also cover pre- weatherization issues such as asbestos demolition, addressing mold concerns, structural and wiring issues, and other modifications necessary to install energy use modifications that reduce greenhouse gas emissions. Pre-weatherization modification costs have been a factor in not pursuing energy retrofits as the costs can be significant.

The above changes are all reflected in the current code so new homes and additions requiring retrofits are covered. However, requirements to prepare the buildings for a clean energy future are not. As clean energy becomes more available and natural gas, propane, or fuel oil are phased out, preparing the home for heat pump installation and preparation for solar readiness is not addressed. Adding connections at the time of build so that the conversions can be made conveniently will help everyone transition. One of the differences between natural gas and heat pump installations can be vent sizing to avoid velocity induced noise. Engineering this out at the design stage will ease implementation and be less irritating.

Timing for the change to heat pumps and solar installations must be carefully managed. Electricity is not as efficient as natural gas for energy use, in fact it can be 3 to 5 times higher. This is a substantial change for any power grid, and changes can be complex and expensive. Adding the connections now and later moving to installations will have the overall effect of reducing greenhouse gas emissions.

The council should be aware that older manufactured homes, aka mobile homes, cannot easily be retrofitted and must be addressed separately. Manufactured housing constructed prior to 1976 codes are much less energy efficient than newer models. HUD has identified the following measures for earlier homes as :

- Install energy-efficient windows and doors
- Add insulation to the belly
- Make general repairs (caulking, ducts, etc.)
- Add insulation to your walls
- Install insulated skirting
- Install a belly wrap
- Add insulation to your roof or install a roof cap.

Careful attention must be addressed to dewpoint and vapor barrier issues to avoid mold concerns and corrosion issues. Still, these measures achieve only a 30% reduction in fuel gas usage. Manufactured housing is available with energy star ratings and is eligible for a state tax credit but non-energy star models can still be purchased.

Recommendation 2:

The county should consider a “design to” concept rather than specifying a LEEDS or HERS design. These require third party audits, which is nice for assurance but drives costs up. In Los Alamos we simply need energy savings improvements installed, not third party assurance. The county should consider waiving permit fees for projects involving only energy saving modifications. For energy savings modifications, a simple list of modifications that would not need a permit review or a permit fee could be maintained and replaced with a notice that the work and a description of the work was being performed. This is a practice maintained for industry by some clean air authorities in the USA. Making the process extremely simple and convenient should be the goal for energy savings projects.

Recommendation 3:

Federal law sets the standard for energy star appliances but non energy star appliances can still be sold. Implementing in the green code a requirement that only “energy star” appliances can be sold or installed within Los Alamos County will reduce energy use and consequently green house gas emissions (Co2e). The county could consider this for permits as well as an addendum to their business license process. Los Alamos requires a business license for all companies doing work in the county. As noted on the business license page for the county:

"Any person, group, organization, business or entity proposing to engage in business within the County and that is required by the state to pay gross receipts taxes on its business is required to apply for a business registration or business license and pay the applicable fee." (Los Alamos Code of Ordinances, Chapter 12)

From the code of ordinances Chapter 12 business is defined as :

“Business means any commercial enterprise, trade, occupation, calling, profession, vocation or activity engaged in, conducted or carried on by any person, his agent or employee, or by the use of automatic machines, except newsracks, for the purpose of gain, benefit or advantage, either direct or indirect, on which state gross receipts tax is paid or payable. A charitable organization shall be deemed to be a business if it is required to pay gross receipt taxes on a business conducted in the county.”

Given the wording, this will capture not only local stores but “off the hill” stores that install appliances in Los Alamos County. This will not capture all appliances as some are self-installed but will capture a greater percentage than are being installed now and greenhouse gas emissions will be reduced over time.

Recommendation 4:

Los Alamos code Section 31-262 contains the environmental purchasing clause. It is fairly weak compared to codes required by authorities regulating industry. In the Los Alamos 2020 code it is:

“An additional preference factor of up to five percent for environmentally preferable purchases may be applied for any competitive procurement. If a preference factor is to be applied, it will be noted in the solicitation”.

Compare this to industry requirements:

”Attach a description of why the proposed air pollution emission control strategy is the best available for the process at the time of application submittal. This can take the form of a written explanation or, for larger projects, a top-down best available control technology analysis (BACT).”

BACT, the best available control technology, is applied across all of the USA. It is a process that requires justification away from the least polluting purchase, otherwise the least emitting equipment must be purchased and installed. An older rule of thumb was $2000 per tonne of annual emissions was an expectation set by regulators. This top down philosophy, rather than bottom up philosophy, has created change when replacement in kind was being sought but an exact model replacement was not available for purchase. The county should consider adopting the philosophy change, incorporate an evaluation of CO2e emissions in their purchasing and contracting and increase the level of justified increase in costs from 5%. Awareness drives change.

This recommendation should be applied to all public entities in the county such as the Los Alamos Public school system, not just the county, as support for a cleaner environment.

Recommendation 5:

And last but not least Los Alamos is a small community but transportation from each mesa to town still occurs for almost every need. Encouraging community gathering , walking, biking or reduced driving to a store, while at the same time meeting a need can be achieved. Some mesas have easy access to a commercially zoned area where a store or coffee shop could be located. Others such as Barranca and North Mesa do not. There are natural gathering areas near schools where communities tend to gather that would be convenient for a small section of commercial zoning. The county is in the process of transferring land and rezoning to residential areas near the middle school but has not included any commercial zoning. Zoning a lot as commercial does not ensure that there will be a project that will materialize , but not zoning any commercial space does ensure that there will never be a store, coffee shop, or other community gathering place. This is directly controlled by the council with its zoning policies.

Chart 1

Design Temperature and Fuel Type Inputs https://www.builditsolar.com/References/Calculators/HeatLoss/HeatLoss.htm

Title	Typ LA Home circa 1956			
Design outdoor Temperature	Degrees F	9		
Heating Degree Days	Degree F - day	6330		
Natural Gas	0.84		85%	Furnace Efficiency
Electricity				

Area and Rvalue Inputs

	Area (sqft)	Rvalue	UA (BTU/hr-F)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)
Ceiling 1	961	11	87.4	5329	13.3
wall 1	850	11	77.3	4714	11.7
Doors	40	2.5	16	976	2.4
Windows	162	0.9	180	10980	27.3
Crawl space wall	526	9	58.4	3565	8.9
Infiltration	total volume of the heated space of the house cubic feet				
	Typical Air Changes Per Hour:				
	0.33 -- very tight -- minimum for health				
	0.5 -- tight -- new, careful construction				
	1.0 -- leaky -- typical existing construction??				
	House Volum (cubic ft)	Air Changes p	UA (BTU/hr-F)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)
Whole House	4695	1	85	4226	6.5
Int. Heat Gains	These are heat gains from warm bodies, lights, appliances, ...				
	This is heat that your furnace does not need to provide.				
	Number of Occupants		Internal Gains (BTU/hr)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)
	3		1362	-1362	-11.9

Summary

Item	UA (BTU/hr-F)	Design Loss (BTU/hr)	Year Loss (Million BTU/	Fuel Cost (US dollars)	Ten Year Cost 10% infla $"s	Green-house Gas (lb CO2)
Ceiling Loss	87	5329	13.3	$131.00	2089	1874
Wall Loss	77	4714	11.7	$116.00	1848	1657
Window Loss	196	11956	29.8	$294.00	4688	4204
Crawl space wall	58	3565	8.9	$88.00	1398	1253
Slab Loss	0	0	0	$0.00	0	0
Infiltration	138	8441	208	$208.00	3310	2968
Totals	**556**	**34005**	**271.7**	**$837.00**	**13333**	**11956**

Revisions		
Ceiling add 12" blown in insulation		Heating with electricity @ .12/KWH
Walls add 2" exterior insulation & stucco		less infiltration due to new windows
Upgrade windows & Doors		
Crawl space -Add 3" exterior insulation and Stucco		

Area and Rvalue Inputs

	Area (sqft)	Rvalue	UA (BTU/hr-F)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)	% Difference
Ceiling 1	961	49	19.6	1196	3	22.56%
wall 1	850	22	38.6	2357	5.9	50.43%
Doors	40	5	8	488	1.2	50.00%
Windows	162	3.4	47.6	2906	7.2	26.37%
Crawl space wall	526	24	21.9	1337	3.3	37.08%
Infiltration	total volume of the heated space of the house cubic feet					
	Typical Air Changes Per Hour:					
	0.33 -- very tight -- minimum for health					
	0.5 -- tight -- new, careful construction					
	1.0 -- leaky -- typical existing construction??					
	House Volum (cubic ft)	Air Changes p	UA (BTU/hr-F)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)	
Whole House	4695	0.5	42	2578	6.4	
Int. Heat Gains	These are heat gains from warm bodies, lights, appliances, ...					
	This is heat that your furnace does not need to provide.					
	Number of Occupants		Internal Gains (BTU/hr)	Design Loss (BTU/hr)	Yearly Heat Loss (million BTU/yr)	
	3		1362	-1362	-11.9	

Summary

Item	UA (BTU/hr-F)	Design Loss (BTU/hr)	Year Loss (Million BTU/	Fuel Cost (US dollars)	Ten Year Cost 10% infla $"s	Green-house Gas (lb CO2)
Ceiling Loss	20	1196	3	$52.00	835	654
Wall Loss	39	2357	5.9	$103.00	1644	1288
Window Loss	56	3394	8.5	$149.00	2368	1856
Crawl space wall	22	1337	3.3	$59.00	933	731
Slab Loss	0	0	0	$0.00	0	0
Infiltration	42	2578	6.4	$113.00	1798	1409
Totals	**179**	**10862**	**27.1**	**$476.00**	**7578**	**5938**

Assumes 200% heat pump efficiency
3.8KW for heating and 3.8KW for other = electrical 20 PV panels 0

	Area (sqft)	Cost	Total
Attic Insulation	961	$1.75	$1,681.75
2" Insul & Stucco	850	$7.00	$5,950.00
Doors	2	$1,200.00	$2,400.00
Windows	11	$1,000.00	$11,000.00
3"Insul & Stucco	526	$7.50	$3,945.00
5.625kW Solar PV	5,625	$3.25	$18,281.25
Solar Tax Credit	26%	10%	-$6,581.25
Heat Pumps	1	$8,000.00	$8,000.00
Upgrade elec service			$3,500.00
			$48,176.75

Alt Tax Credits			
Uprgade elec service			$3,500.00
Battery Storage			$3,500.00
5.625kW Solar PV	5,625	$3.25	$18,281.25
Solar Tax Credit	26%	10%	-$9,101.25
		TTL	$16,180.00

US rate of 1.5 lbs CO2 per KWH
3,959 KWH / 329KWH month for heating
If electricity is wind or solar

Other tax credits my be available for certain upgrades:
http://www.emnrd.state.nm.us/ECMD/CleanEnergyTaxIncentives/cleanenergytaxincentives.html
https://www.nm-prc.org/wp-content/uploads/2021/06/New-Mexico-TRM-2018_ErrataFINAL_04102019.pdf
https://www.energystar.gov/about/federal_tax_credits

References:

Later in final report

References: