



# Buckley Annex Sustainability Program

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LRA Board of Directors  
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# Lowry Sustainability Story

- **Urban, mixed-use community with homes, schools, jobs and parks all within walking distance**
- **Site-wide salvage, concrete recycling, tree farm**
- **Preservation of historic buildings**
- **Full range of housing types, prices. Commitment to affordable housing. Many “green built” and energy efficient.**
- **Enhanced open space with native landscapes**
- **Public amenities—parks, schools, library, recreation center**
- **Community governance structures—LCMA, LF, LCLT**
- **Buckley Annex – a step further**



# Buckley Annex Sustainability Plan

- **Transportation**
- **Waste**
- **Water**
- **Energy**
- **Community**



# Net Zero Neighborhood

**A neighborhood that generates as much energy as it uses over the course of a year.**

**Energy Efficiency + Renewable Energy**

**Energy Demand – Onsite Renewable – Offsite Renewable = 0**



# Project Challenge Statement

**How can Buckley Annex advance Lowry's position as a leading urban community with a high standard of sustainability?**

**What solution would be financially feasible, technologically viable and acceptable to the market, that meets our development timeframe?**



# Resources

**National Renewable Energy Laboratory**  
**Colorado Governor's Energy Office**  
**Xcel Energy**  
**EnergyLogic, Inc.**  
**RNL Design**  
**Design Workshop**  
**Living City Block**  
**Integral Real Estate Development**  
**Oakleaf Energy Partners**  
**Fort ZED**  
**Suntalk Solar Energy Solutions**  
**Clean Energy Collective**  
**Orten, Cavanagh & Holmes**  
**20+ homebuilders**  
**Multiple commercial, multifamily developers**





# Terms

**Sustainable Site Design**  
**LEED-ND**

**Energy Efficient Homes**  
**HERS Index**  
**Energy Star 3**

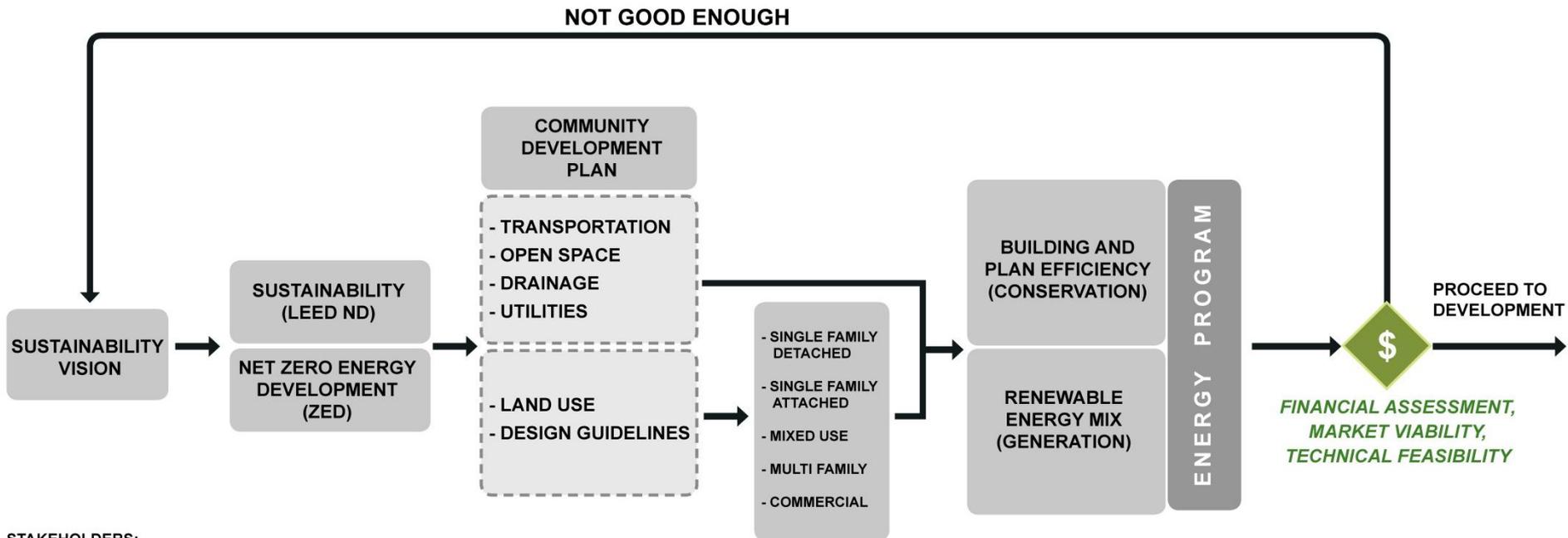
**Energy Efficient Buildings**  
**LEED (Certified/Silver/Gold/Platinum)**  
**ASHRAE 90.1+**

**Community-wide Renewable Energy**  
**Energy District**  
**Solar Garden**  
**PPA**



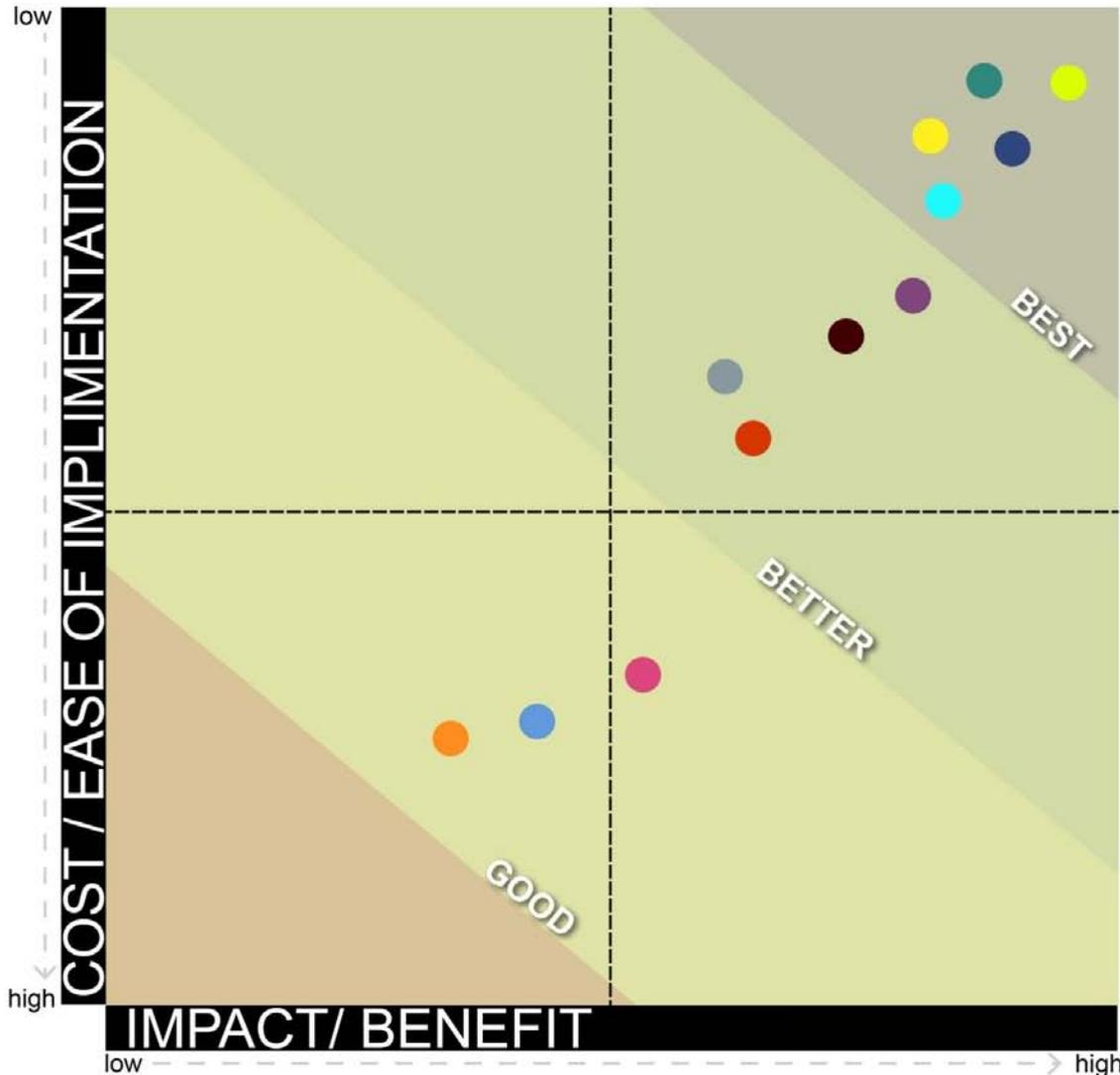
# Energy Balance Process Diagram

## MODELLING AND FINANCIAL ANALYSIS



- STAKEHOLDERS:**
1. COMMUNITY DEVELOPER (LRA)
  2. CCD SPONSOR
  3. VERTICAL DEVELOPERS
  4. END USERS
  5. RESOURCE GROUP (NREL, XCEL, ETC.)

# Evaluate & Select Elements of Sustainable Development



Example diagram

Sample legend of elements

- Bike paths + racks
- Community garden
- Energy star appliances
- Ground loop (air/fluid)
- LEED building
- Natural gas service
- Plug-in electric vehicle connection
- Smart meters
- Solar garden
- Solar rooftop (ready)
- Thermal storage
- Solar/ LED street lighting

# Illustrative Site Plan



# **Energy Research Single Family Detached**

- **20+ homebuilders interviewed**
- **All have attained energy efficiency beyond code**
- **Energy Star 3 = HERS 65**
- **HERS index of 40 is an attainable target**
- **All builders questioned feasibility of a net zero standard**
- **Appraisers, lenders, investors give little or no value to sustainability factors**
- **Net zero sales have not been robust**
- **How to get from HERS 40 to HERS 0 (net zero)?**

# **Energy Research Single Family Detached**

- **Must be integrated into home price, not presented as an option or upgrade**
- **\$500,000 buyer resists additional costs at \$5,000-\$10,000 if itemized**
- **Must qualify for the mortgage increase of approx \$18,000, additional monthly payment of \$90**
- **Savings of \$1,500-\$2,000/year in utilities**
- **Net positive \$500 to \$1,000/year**

***If economic advantages can be sold, and buyer can qualify for additional mortgage amount, it's a viable approach***

# Energy Star 3

- **Additional \$3,000**
  - **Energy Star appliances**
  - **High performance framing, thermal**
  - **HVAC, mechanical, windows**
- **HERS Index 65**
- **Consumer acceptance**
- **90% of homes required in LEED ND**

# **Energy Research Single Family Attached**

**Similar to single family detached, but:**

- **Few models, comps**
- **PV infrastructure complicated**
- **HOA easement issues**

# **Energy Research Multifamily**

- **There are examples of market LEED certified projects, however, none have attained net zero**
- **There are institutional net zero developments**
- **Building roof cannot hold enough solar panels to provide all of the energy required by tenants**
- **Some tenants will pay more for green features**

# **Energy Research Commercial**

- **No significant retail net zero projects**
- **Some institutional projects have achieved net zero**
- **Developers may comply with LEED for core and shell**
- **Tenants highly unlikely to meet LEED for internal finish**
- **Tenant rents would be higher**

# RNL Energy Demand/Generation Study

## Photovoltaic Systems

### LRA Master Plan



Street and Park PV											
Type	Total Energy		% PV	% Cont.	PV Energy		PF		PV Size		
Street & Park Lights	42,328	kWh	100%	100%	42,328	kWh	1315	kWh/kW	32	kW	
Open Parking Lights	15,361	kWh	100%	100%	15,361	kWh	1315	kWh/kW	12	kW	
Parking Garage Lights	81,994	kWh	100%	100%	81,994	kWh	1315	kWh/kW	62	kW	
<b>Total</b>	<b>139,683</b>	<b>kWh</b>			<b>139,683</b>	<b>kWh</b>			<b>106</b>	<b>kW</b>	
District Pumps PV											
Type	Total Energy		% PV	% Cont.	PV Energy		PF		PV Size		
Pumps	492,750	kWh	100%	100%	492,750	kWh	1315	kWh/kW	375	kW	
<b>Total PV</b>					<b>9,054</b>	<b>MWh</b>				<b>6,833</b>	<b>kW</b>

For this study it is assumed that on-site photovoltaic systems provide 100% of the renewable energy required to meet the net zero energy balance for the development. The calculations do not include a contingency. However, it would be recommended to include an energy contingency in sizing and designing the photovoltaic system if the project were to be implemented.

The following four pages provide a block-by-block summary of the photovoltaic system requirements. For each block the PV size in both kW and square foot is calculated for each building type and compared with the projected roof area available for PV installation based on assumptions built into the development program. It is assumed that the single family homes will have a gable or similar roof form with half the roof area facing south and available for PV installation. The angle of roof slope is assumed to be 20 degrees or greater. It is assumed that all other building types have a flat roof and that at least 70% of the roof area is available for PV installation. The PV arrays on flat roof areas are assumed to be installed in saw tooth configuration with a tilt angle of 10 degrees facing south. Higher tilt angles in a saw tooth configuration will likely yield less annual energy generation because of self-shading and the required spacing between rows of PV.

**6833**  
kW

# RNL Study

## Executive Summary

### Incremental Cost for Net Zero Energy - LRA Master Plan



Residential Construction Incremental Cost

\$0



Commercial Construction Incremental Cost

\$0



District Geothermal Loop Field Cost

\$5,970,000



Photovoltaic System Cost

\$27,330,409

**Total Incremental Cost**

**\$33.3 Million**

The total incremental cost could be reduced to \$28.4 million if the 20 year PV lease option for the single family homes and townhomes is pursued. Further reduction in total incremental cost could be achieved if the PV procured for the multifamily and commercial buildings is completed with the full benefit of

incentives including the 30% federal tax credit. The 30% tax credit for the PV associated with the multifamily buildings, commercial buildings and infrastructure PV is equal to \$5.7 million. In addition, using financial mechanisms such as power purchase agreements can remove the first cost associated with the PV systems.

# **RNL Study--Comments**

- **Assumes that all heating and cooling loads met through a district geothermal system**
  - **Does not meet development timeline, not currently financeable**
  - **No provision for natural gas consumption**
- **Assumes all photovoltaic systems on site**
  - **Not achievable, need off-site production**

# Energy District Overview

- **Energy provision (electricity) by a single entity to all users specific area; no special fees**
- **Utility provider invests in infrastructure needed to delivery the power**
- **Solar Garden**
- **Cost is recaptured through utility bills to all district users**
- **Cost to users may be lower than Xcel**
- **HOA could administer**

# Energy District Implementation

- **Need a population of district users**
- **Not currently financeable**
- **Feasible in the future**
- **Phased approach**
- **Utilize technological advances, incentives**
- **Actual energy gap, costs known**
- **Regulatory environment**

# National Renewable Energy Lab:

*“Achieving the net zero definition will need to be time-phased with intermediate goals.*”

*Time-phasing offers flexibility to develop an approach to a net zero energy community that is very aggressive in terms of energy but yet recognizes that the energy solution needs to be balanced against budget.”*





# **Solution**

## **Integrated Phased Approach**

- **Adopt a Sustainability Master Plan to address: transportation, waste, water, energy and community**
- **Achieve LEED-ND for sustainable site design**
- **Build to high energy efficiency standards**
- **Research structure for future energy district**