A TALE OF TWO VIEWS ON BEHAVIORAL POTENTIAL

Mithra Moezzi, *Portland State University*

Report Coauthors: Loren Lutzenhiser & Aaron Ingle, *Portland State University*

Behavior Energy and Climate Change Conference

* DISCLAIMER

WHERE ARE THE PEOPLE? (USUAL ANSWER)

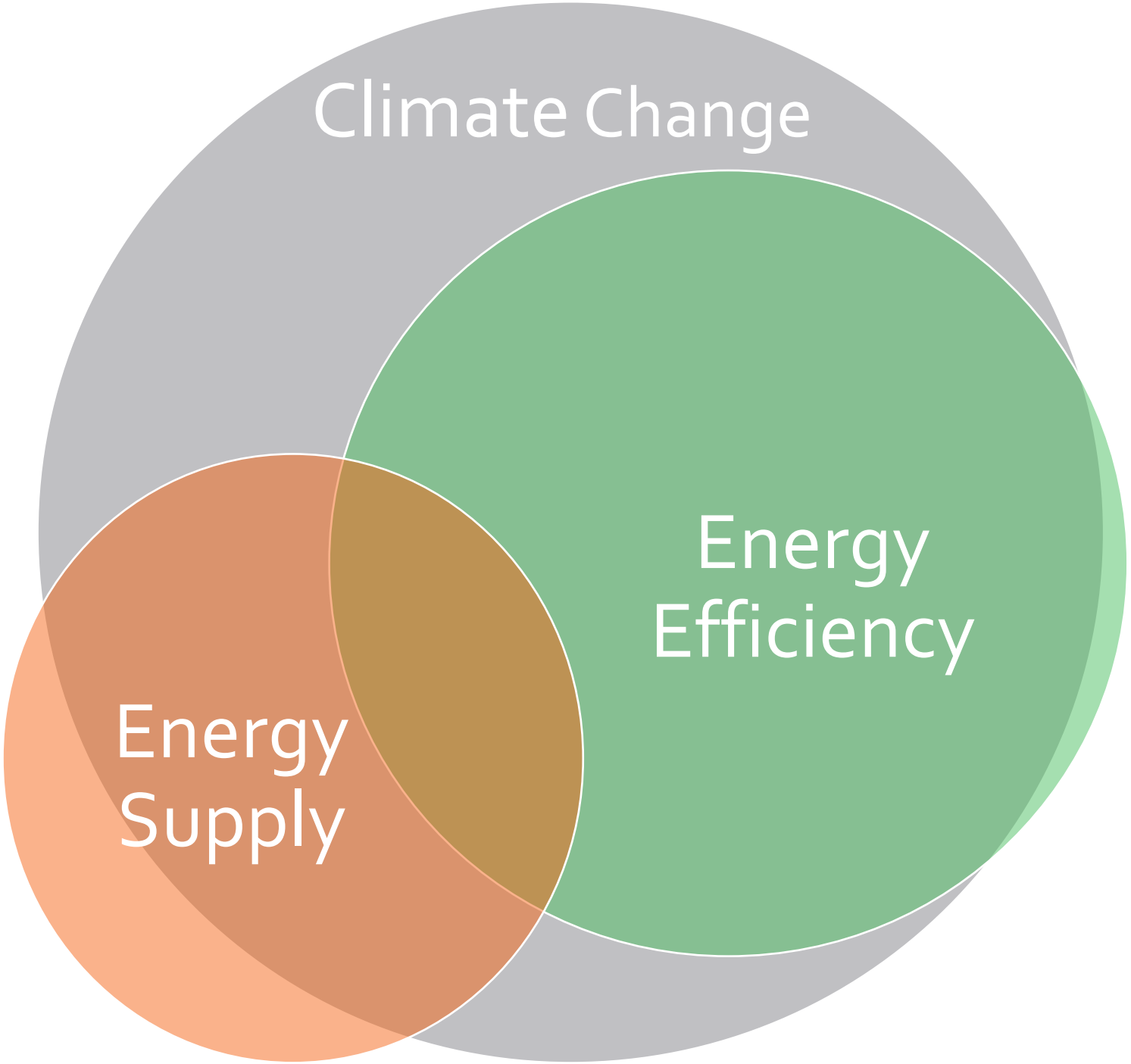
Individual Minds & Actions

WHERE ARE THE PEOPLE?

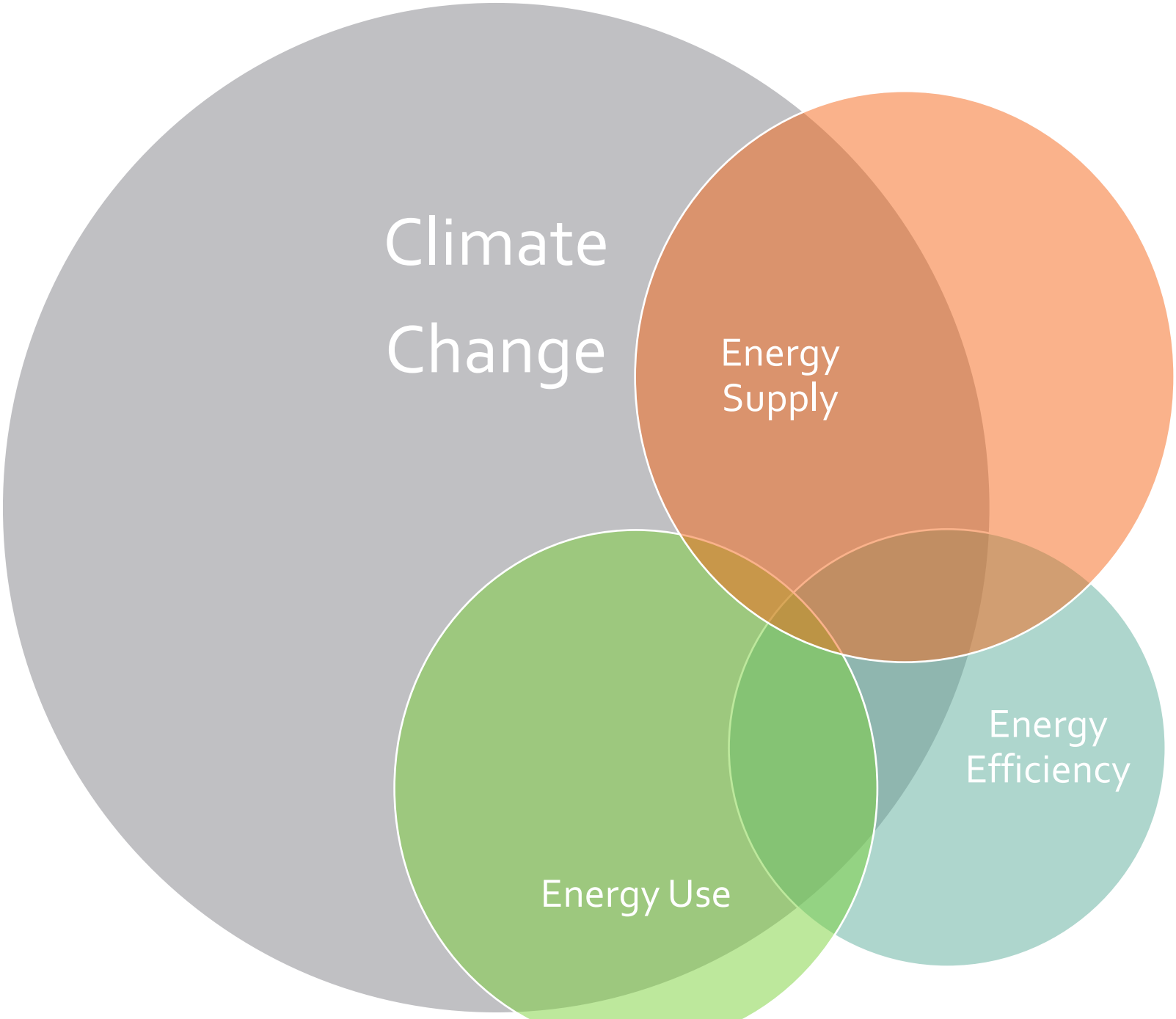
Mental Models	Computational Models	Vocabulary	Statistical Representations & Metrics
Individual Minds & Actions*	Data Collection & Access	Culture	Social Worlds & Interactions
Physical Worlds, Technology Design	Politics, Market Actors	Historical Change	"Basic Needs"

*Usually about energy, environment, money, comfort, and social inclusion narrowly conceived

BEHAVIOR ≠ PEOPLE


Climate Change
Energy Efficiency
Energy Supply

Is the term "energy efficiency" holding us back?



Absolute vs. relative

Emissions not energy

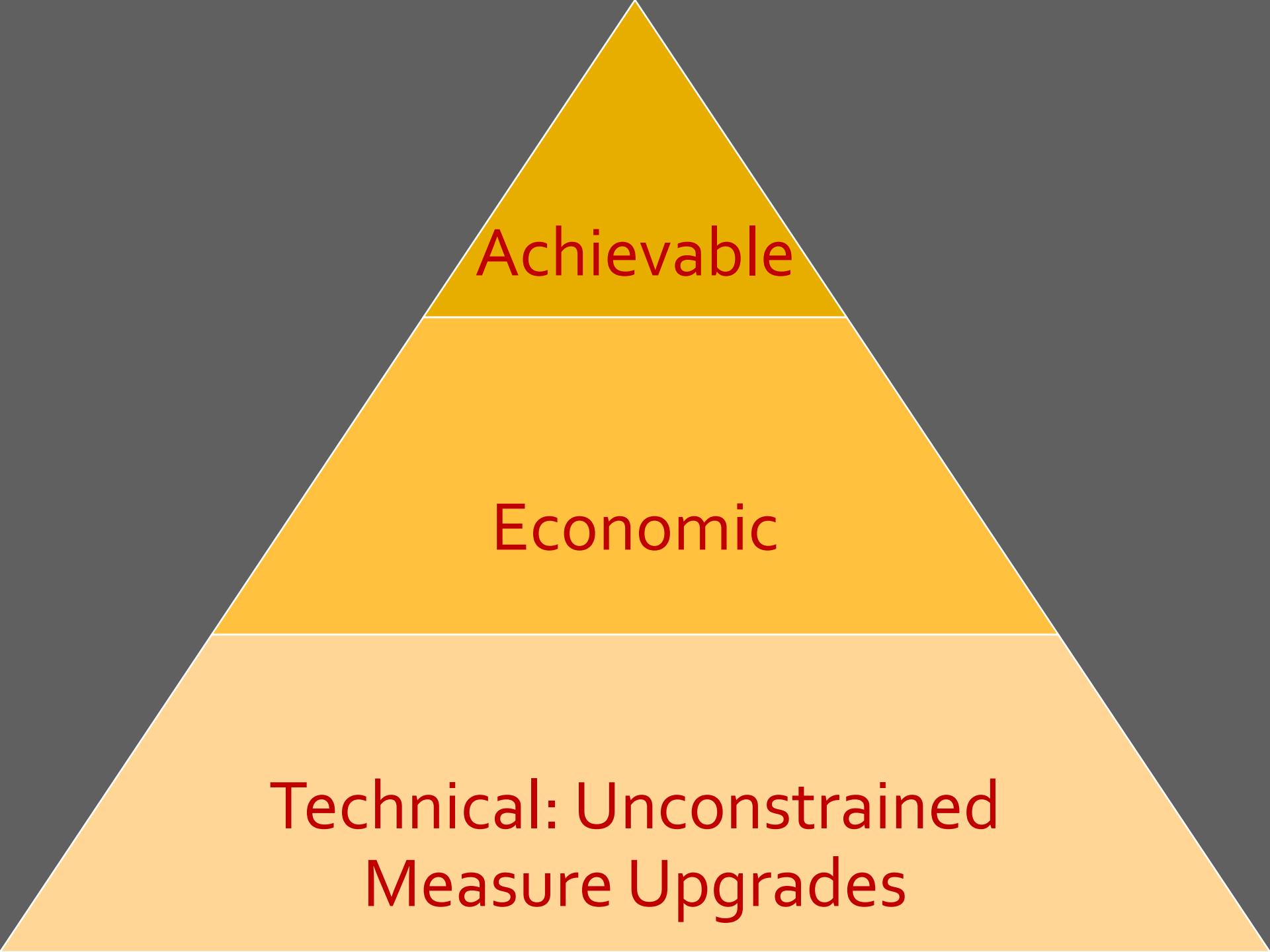
Supply (including time component)

Mega-scale versus marginal scale

Societal adaptation, resilience etc.

Changing environment

http://www.n2growth.com/blog/the-myth-of-potential/


Achievable
Economic
Technical: Unconstrained Measure Upgrades

not wrong … but narrow

how does the model get in the way?

Static: interactions, evolutions missing

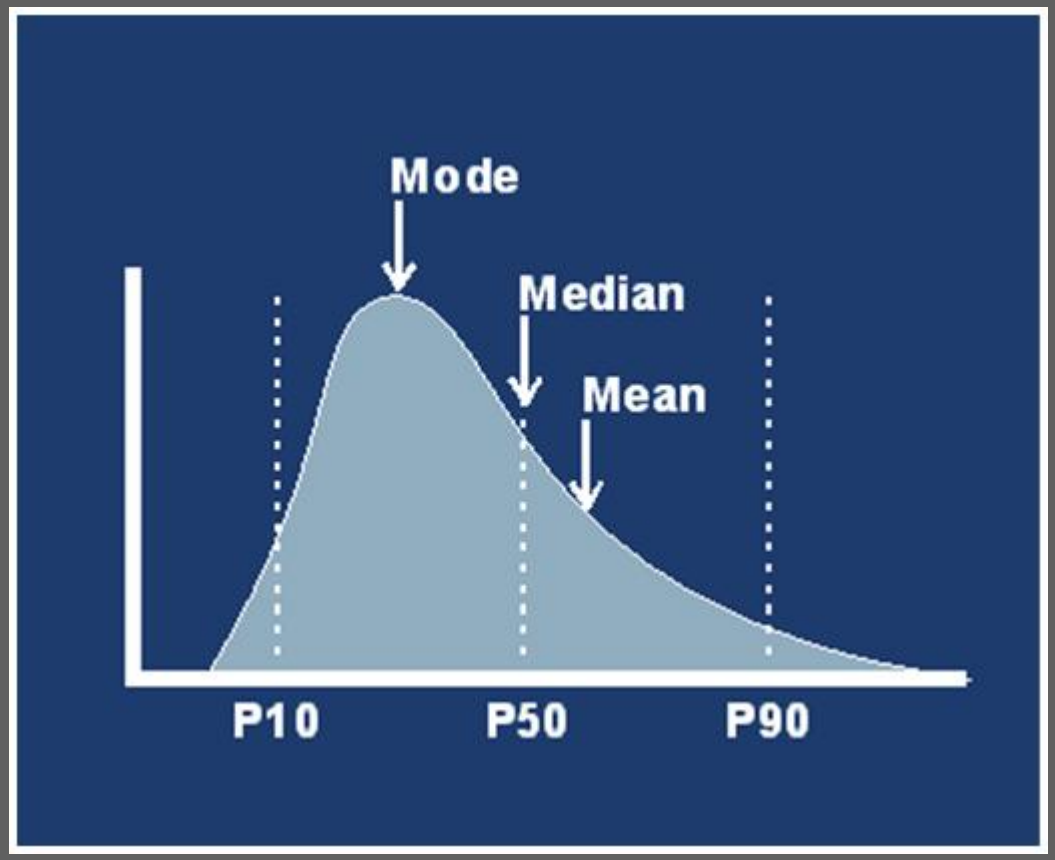
Can hardly see variability or diversity

Average misses everybody, sometimes cruelly so

Focus on “correct behaviors” narrowly conceived

Misses actors’ points of view

Boring



Usually log-normal

PICOS DE AVES

pato

gaviota

aguila

piquituerto

chotocabra

avoceta

pájaro carpintero

papagayo (loro)

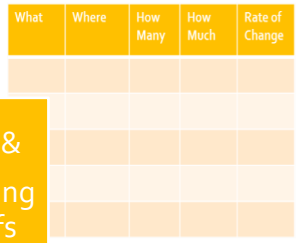
flamenco

kiwi

espatulo

pelícano

VARIABILITY, VARIETY, DIVERSITY, DYNAMICS ROADKILL



Models & Accounting What-Ifs

Metrics

Goals

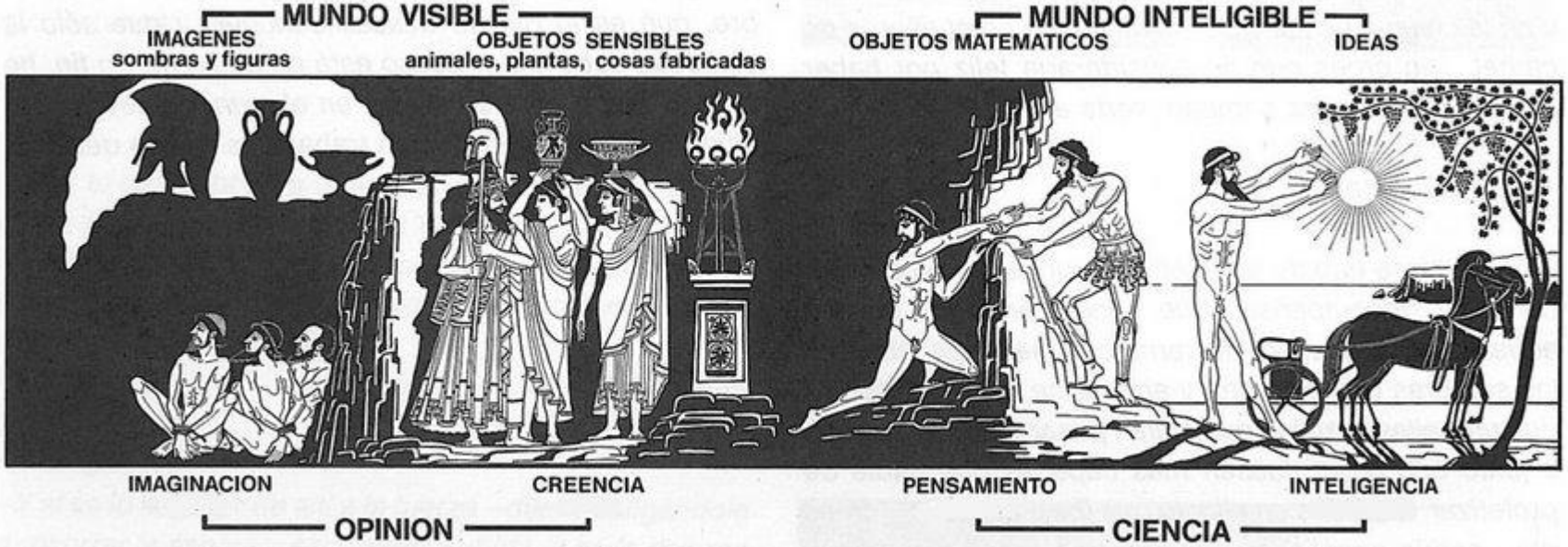
Programs

Plans

Mental Commitments

Data

Visions

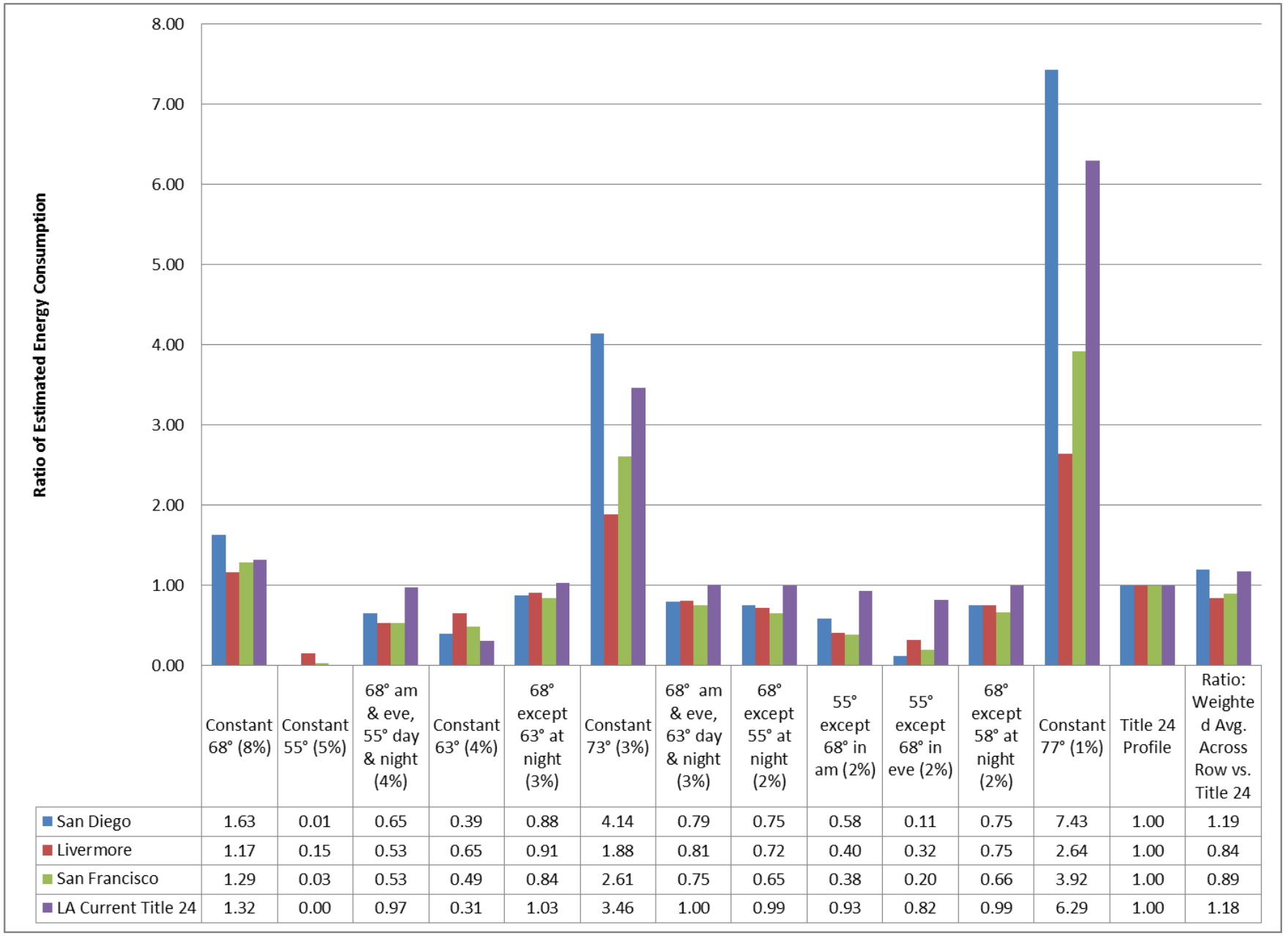


(it ends with the prisoners killing the returnee who has seen the light)

I. ENERGY UPGRADES

BEFORE

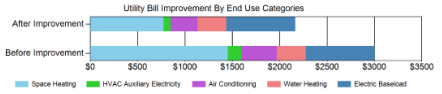
AFTER



	Constant 68° (8%)	Constant 55° (5%)	68° am & eve, 55° day & night (4%)	Constant 63° (4%)	68° except 63° at night (3%)	Constant 73° (3%)	68° am & eve, 63° day & night (3%)	68° except 55° at night (2%)	55° except 68° in am (2%)	55° except 68° in eve (2%)	68° except 58° at night (2%)	Constant 77° (1%)	Title 24 Profile	Ratio: Weighted Avg. Across Row vs. Title 24
San Diego	1.63	0.01	0.65	0.39	0.88	4.14	0.79	0.75	0.58	0.11	0.75	7.43	1.00	1.19
Livermore	1.17	0.15	0.53	0.65	0.91	1.88	0.81	0.72	0.40	0.32	0.75	2.64	1.00	0.84
San Francisco	1.29	0.03	0.53	0.49	0.84	2.61	0.75	0.65	0.38	0.20	0.66	3.92	1.00	0.89
LA Current Title 24	1.32	0.00	0.97	0.31	1.03	3.46	1.00	0.99	0.93	0.82	0.99	6.29	1.00	1.18

Projected Annual Utility Bill Improvement by End Use Category

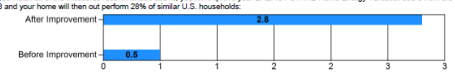
If you install all of the measures recommended above, your annual energy cost savings would be $836 and would change as follows by end use category:



End Use Category	Before Improvement	After Improvement
Space Heating	$1451	$772
HVAC Auxiliary Electricity	$142	$78
Air Conditioning	$377	$283
Water Heating	$304	$304
Electric Baseload	$728	$728
Total Cost	$3002	$2165

Projected Home Energy Yardstick Score

If you install all of the measures recommended above, you will improve your ENERGY STAR® Home Energy Yardstick score from 0.5 to 2.8 and your home will then out perform 28% of similar U.S. households:

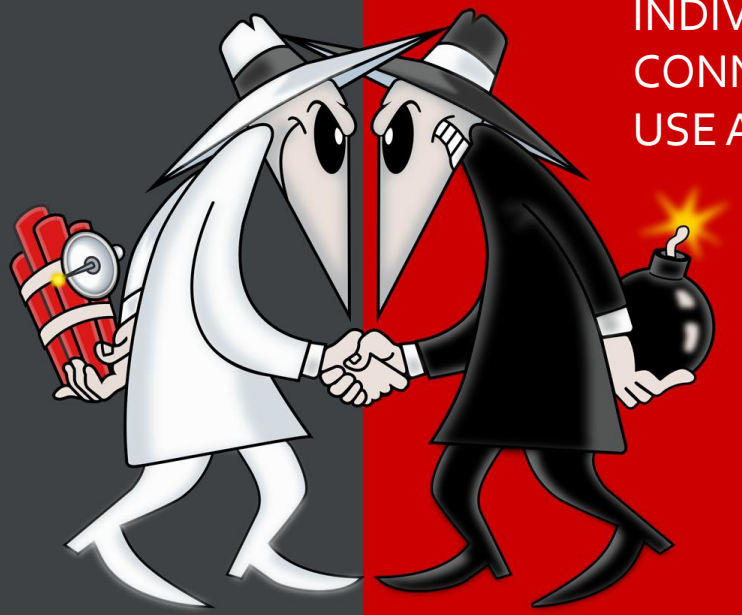


Financial Analysis

The projected energy savings from your home performance project will help it pay for itself. There are a few different ways to look at energy savings. Simple Payback is calculated by dividing the Net Package Price by the Annual Projected Savings, a simple way of calculating how many years it would take for savings to cover the investment. A more sophisticated measure is the Annual After-Tax Rate of Return, which shows the energy savings as an annual percentage return on the net project investment, so that it can be compared to other investments you might make. The Lifetime Savings-to-Investment Ratio (SIR) measures overall lifetime cost-effectiveness by comparing the present value of all energy savings over the life of the installed measures to the Net Package Price. An SIR of over 1 is an indicator that the project will pay for itself through energy savings over time.

Simple Payback and Annual After-Tax Rate of Return	
Energy Saving Measures	$0.00
Total Package Price	$100.00
Rebate (subject to approval)	$0.00
Other Incentives	$0.00
Net Package Price	$100.00
Annual Projected Savings	$836.37
Simple Payback (yrs)	0.1
Annual Rate of Return	836.37%
Lifetime Savings-to-Investment Ratio	75.68

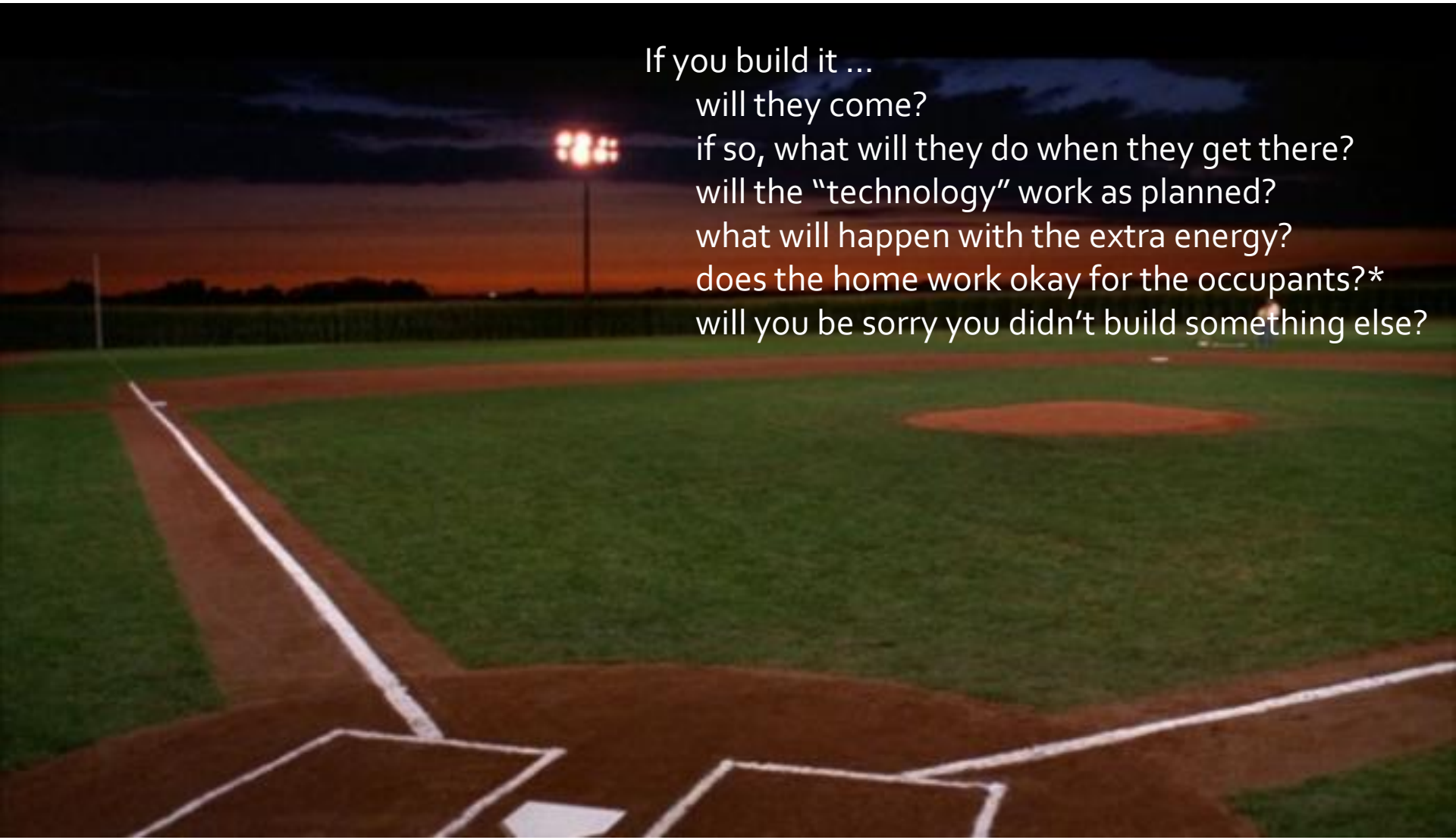
MODELING CORRECT TECHNOLOGY FOR AN "AVERAGE" HOUSE



ENGAGING HOUSEHOLD AS INDIVIDUALISTIC VIA A HUMAN CONNECTOR (& CUSTOMIZED USE ASSUMPTIONS)

II. ZNE VS. PEOPLE

* California Energy Efficiency Strategic Plan calls for 100% ZNE residential new construction by 2020. The definition of ZNE (2014) includes ZNE-ready (highly efficient but without on-site renewables) homes.



*Did programmable thermostats work well at first?

IMAGINING PEOPLE WILL CONFORM TO A TECHNOLOGICAL VISION IS (RISKY)

MAJOR CHANGES TO THE ENERGY SYSTEMS OF A HOUSE ->
MAJOR CHANGES TO A HOUSE ->
CONSEQUENTIAL CHANGES TO LIFE

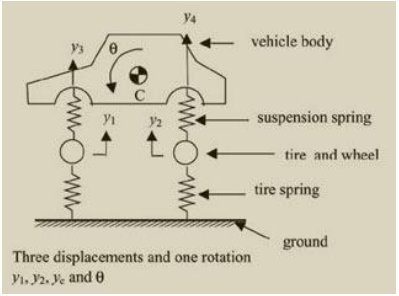
III. IDEALISM VS. WORLD

Artist: David Meridor (https://lebbeuswoods.files.wordpress.com/2010/01/lwb-utop-11.jpg

IV. INTERVENTIONS, REACTIONS, NON-LINEARITY, RIPPLES &THE REST

Technology and behavior aren't separable

Technological ideals are often superficial



Interactions matter and are hard to see

Nothing is only about energy (and things change all the time)

EE IS NOT SO SMART*

Now what?

* "You are not so smart" is the name of a radio/publishing franchise by David McRaney," exploring self-delusion." Everybody self-deludes; there is nothing special about EE on this score.

THE TROUBLES (DO YOU AGREE?)

- Assumptions about people are made up
- We use "averages" but there are no average people or houses
- Efficiency & energy use are not (necessarily) linear in behavior
- We don't have (or don't know of) good tools to deal with variability, diversity, and uncertainty . (If we did, then what?)
- We don't check our work with real world long-term empirical data, or not very much
- Evidentiary protocols don't mesh well with understanding and accounting for people
- We don't want to say anything negative about EE


We don't have enough data to know, say, or do
I need the money
We're doing more good than harm (aren't we?)
Complexity doesn't sell
Complexity doesn't pay
If only we could get people to …

WE DON'T HAVE TO BE STUCK

Measurement sometimes gets in the way

Programs aren't the only thing

Better "data" & rounder analysis

More questions and more honesty

Look outside your model too

Understand the limitations of your evidence

More imagination, less fantasy

Not perfection but can we sail this ship another way?

Funding: PIER Natural Gas Contract No. 500-08-024 (California Energy Commission)

Contacts: Mithra Moezzi : mithra@pdx.edu
Loren Lutzenhiser : llutz@pdx.edu