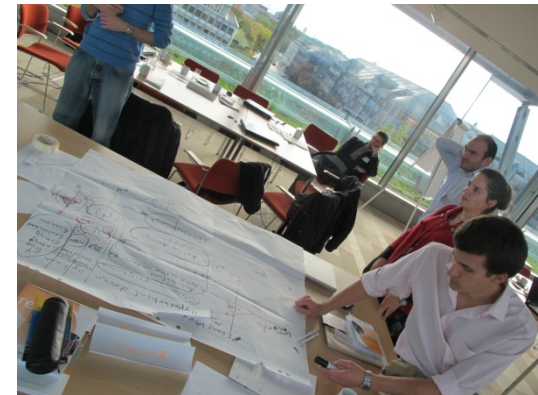




Strategic design for LowEx Buildings

Methods, Design and Building Systems



Inspired and Powered by Gudni Jóhannesson
and Masanori Shukuya

Our Interests

Energy vs.
Exergy

Renewable
production

LowEx
Control

Low temp
Heating and
High temp
cooling

Demand
and Supply

The Occupant

- You spend most of your life time inside!
- How should we build Buildings?
 - First address the occupant
 - Implementation into surroundings
 - High quality buildings with low environmental impact
 - Optimize for performance *and comfort*
(*exergy dependence*)

Passive „vs“ active systems

- Research interests have common threads
- Passive systems are less flexible and integral in the architectural design
- Active systems are often viewed as separate components - *should they?*

Passive Technologies

do not require a control

- Thermal Mass
- Insulation
- Fixed shading
- Window configuration
- Solar design
- Building Geometry
- ...
- Colors

Active Technologies

require a control system

- Space heating
 - Space cooling
 - Ventilation
 - Heat production and storage
 - Electricity production
 - Sewage
 - Lighting and appliances
 - ...
-
- The diagram consists of two blue hand-drawn brackets on the right side. The top bracket groups the first four items of the main list: Space heating, Space cooling, Ventilation, and Heat production and storage. The bottom bracket groups the last three items: Sewage, Lighting and appliances, and ...
- Radiant
 - Convective
 - Electrical heat
 - Fireplace
- Heat recovery
 - Gray water sys.
 - Biotreatment
 - Filtration

Dependency Matrix

	Radiant Heating	Radiant Cooling	Split Units	Natural ventilation	Mecanical Ventilation	Tech X
Radiant Heating	X	+	!?	+	+	
Radiant Cooling	+	X	!?			
Split Units			X			
Natural ventilation				X		
Mecanical Ventilation					X	
Tech X						X

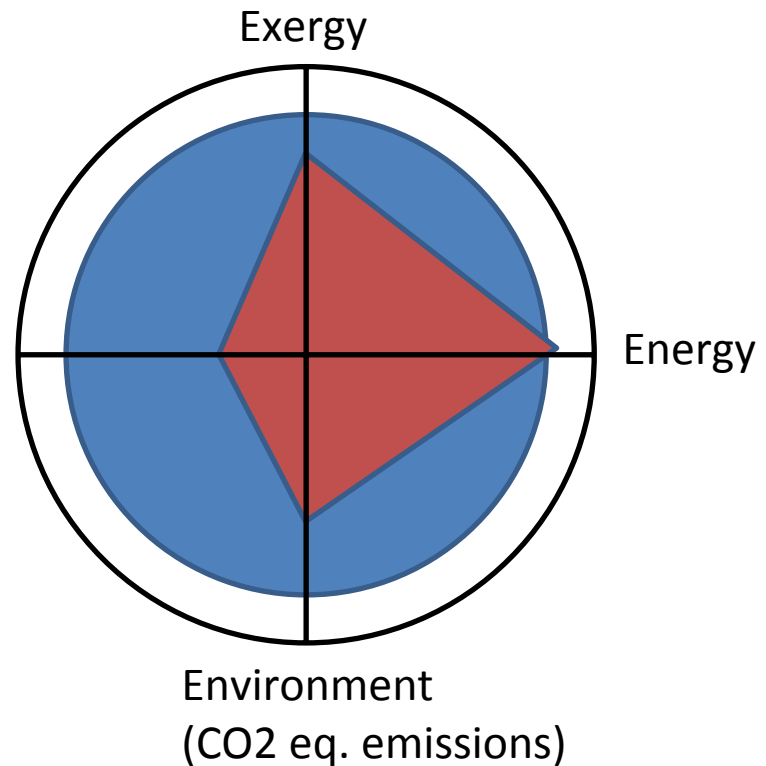
Find feasibility of combinations

Hypothetical design process

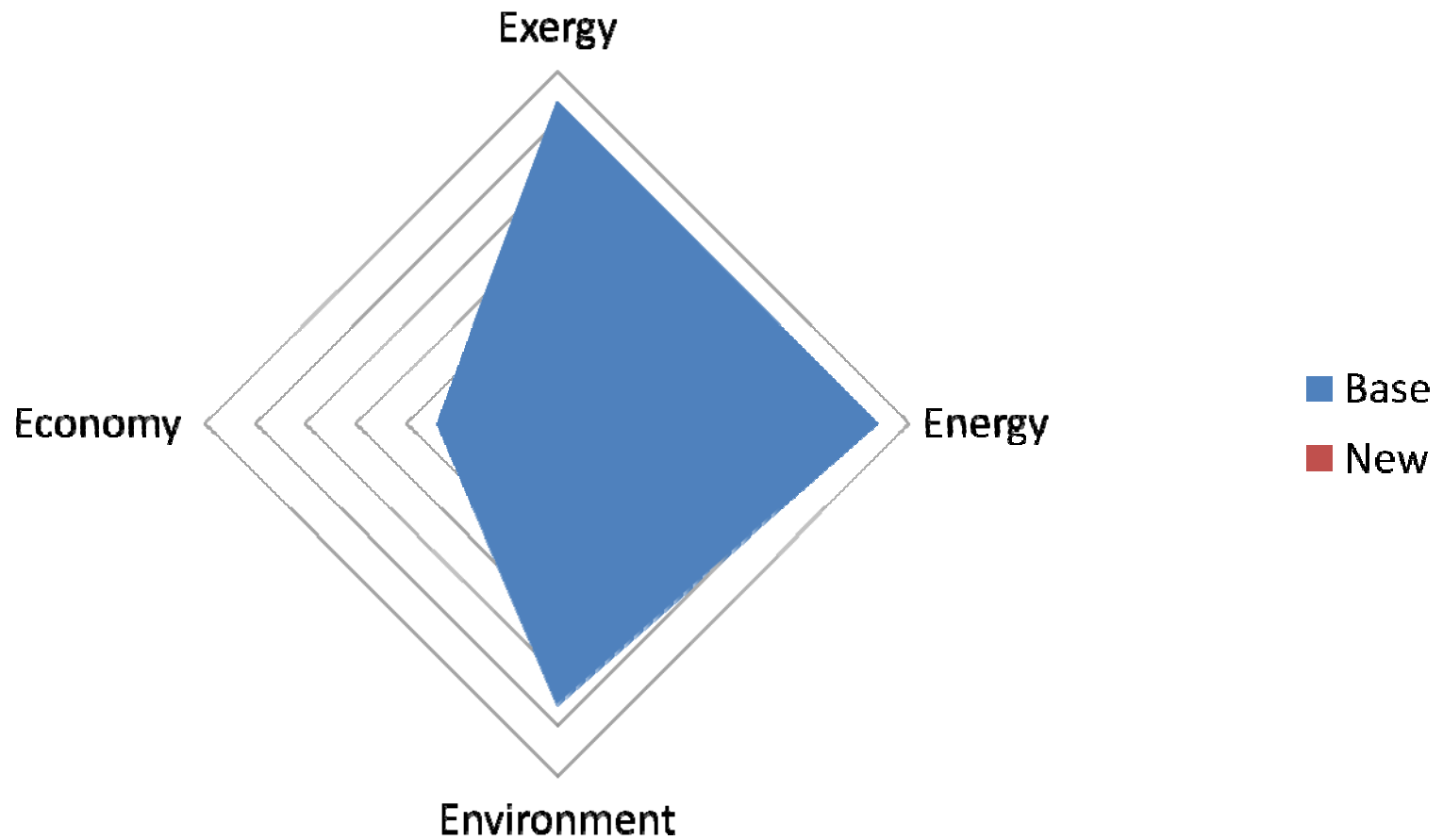
E⁴ (Energy, Exergy, Environment, Economy)

Planning - Programming
Architectural design
Passive design
Active design
Procurement
Controls and operation

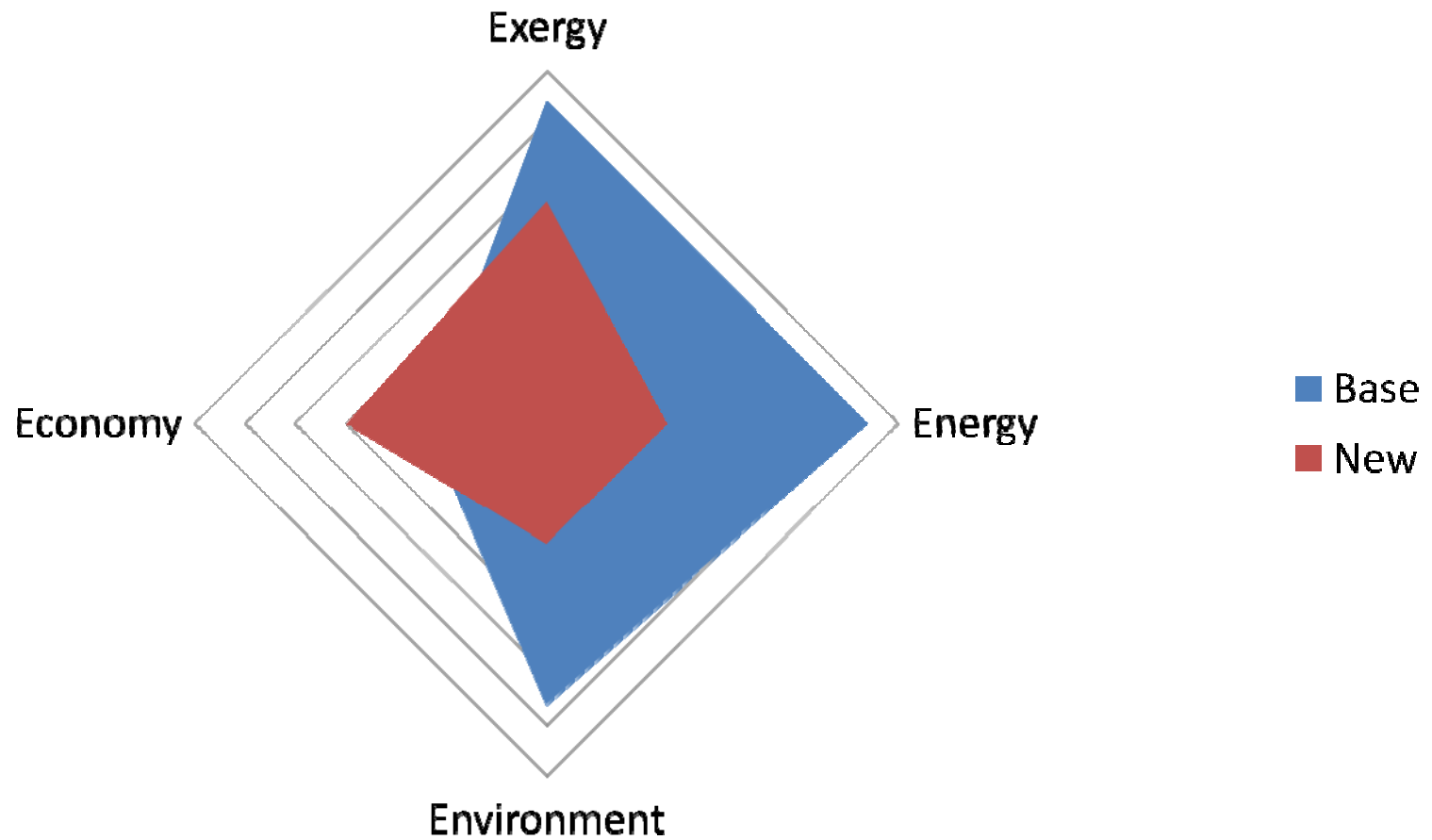
Economy
(investment)



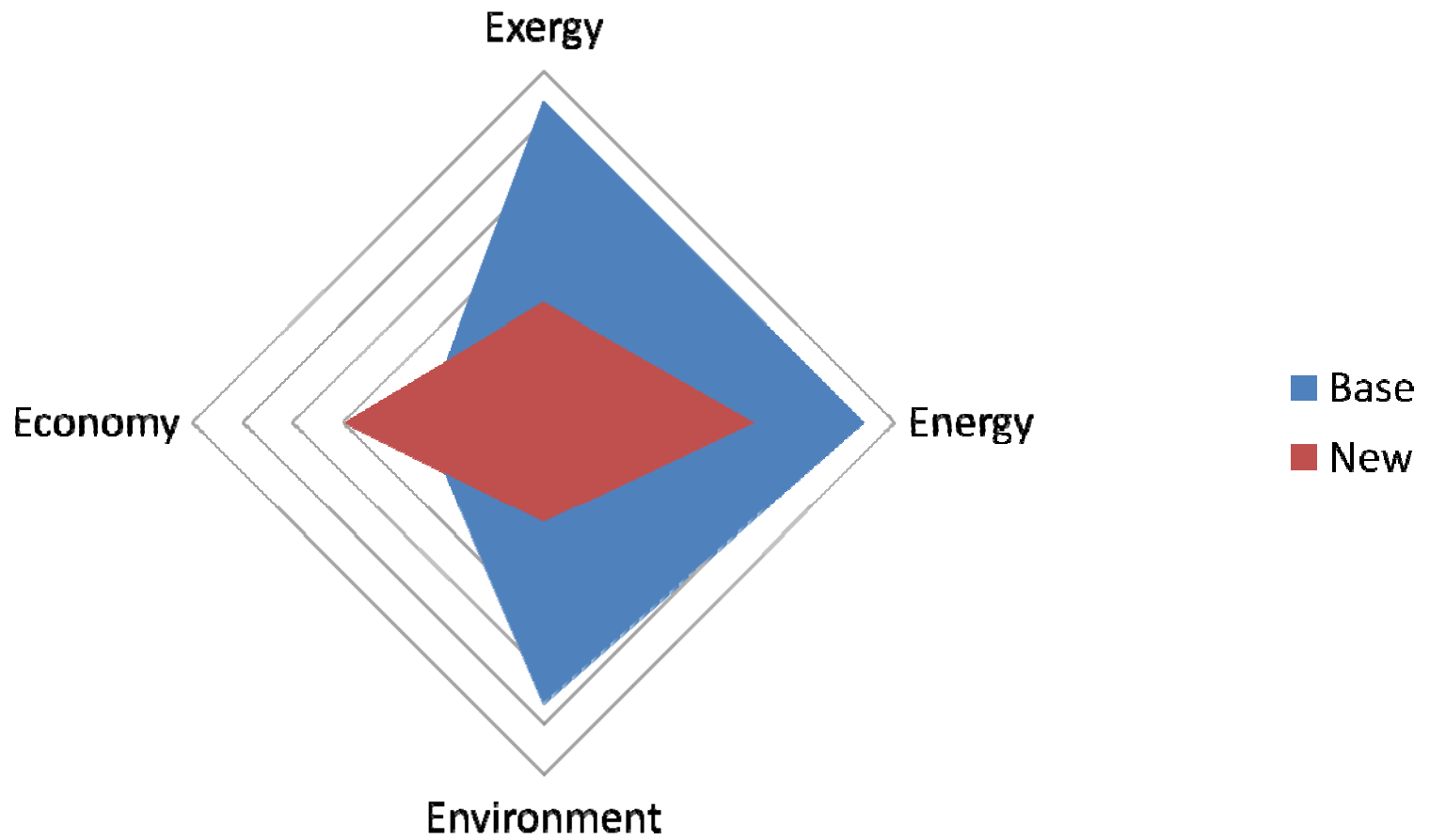
Base case 1970s building



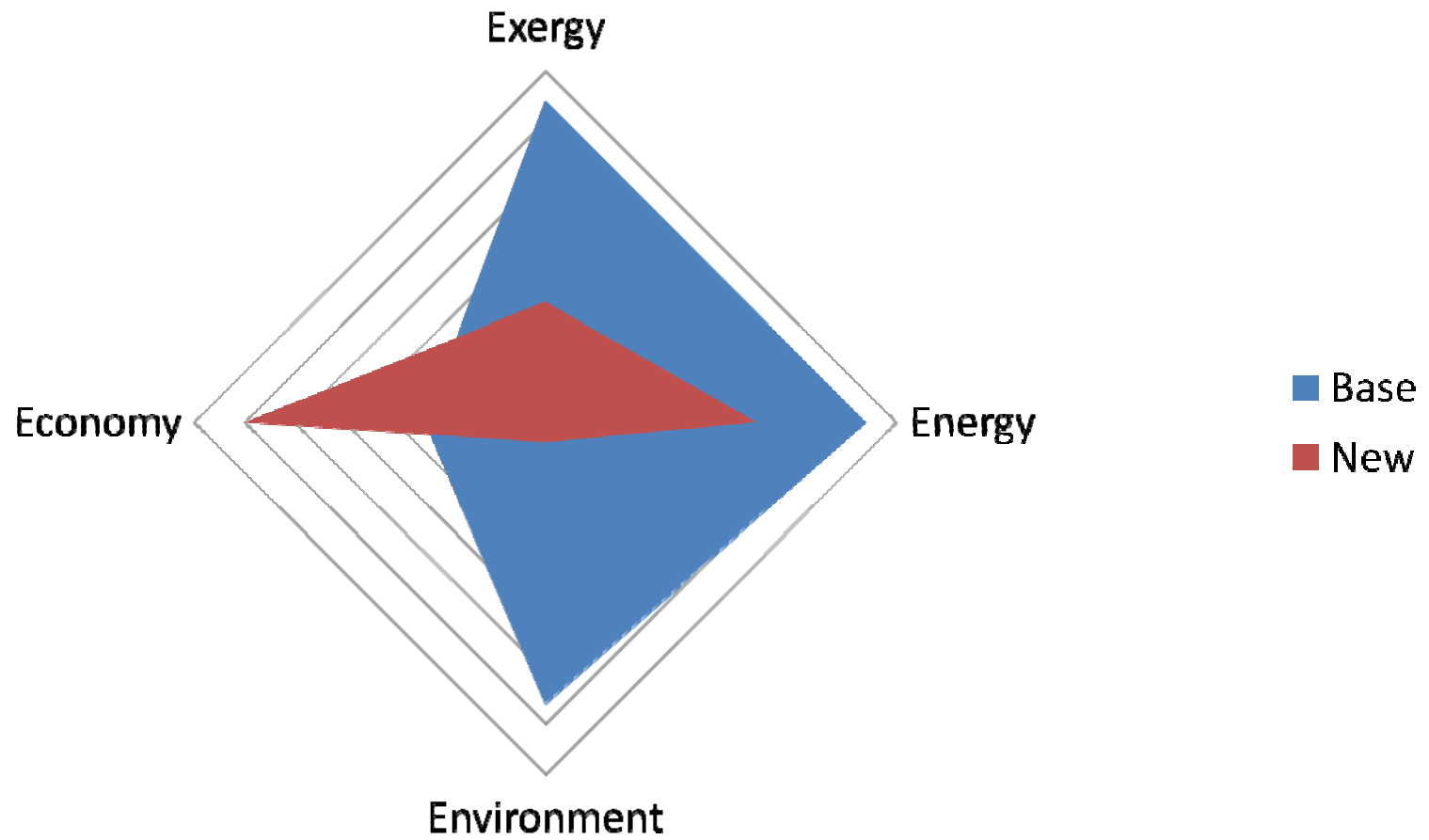
Passive house estimate



LowEx estimate



Zero emission estimate



Some Conclusions

- Integrated design is important
 - Holistic!!
- Exergy provides additional *insight*
- Active AND Passive iterative process
 - Visual tool provides *intuitive* feedback
- For further information about the software development and upcoming paper... contact...

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Fueled by...

