

Austin Resource Recovery - 2017 "Austin Sustainable Building Materials Forum" — towards a circular economy

Seven Material Systems that Might Save the World

Pliny Fisk III

Co-Director - Center for Maximum Potential Building Systems
Austin, Texas

Professor Emeritus Texas A & M University College Station, Texas



CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS

PRESENTATION OUTLINE–(the following will be presented in a non linear format)

- The Center for a Maximum Potential Building Systems –
- Material System ONE - BALANCE - a fundamental precept for a circular economy
- Material System TWO - Baselinegreen / GreenBalance - An IO/LCA/ GIS national material flow model specification tool and a means of planning the circular economy
- Materials protocols and techniques to watch and hopefully use in our quest for circularity

Material System THREE₂(LIF) Low impact foundations_–

Material System FOUR - Design based on reuse (DfRU),

Material System FIVE - silicated wood in a CLT future (lasting carbon sink)

Material System SIX – DfD – Design for Disassembly-,

Material system SEVEN₂ MgO –phosphate cement – a cement based on waste,

Material System EIGHT CDIR, (carbon dioxide Intensity) – anyone can do this

-

- Blockchain and bitcoin – a basis for a circular economy or better yet a flexible long lasting economy





BEST IN CLASS AND WORST IN CLASS WORKING TOGETHER –



ADVANCED GREEN BUILDING
AUSTIN, TEXAS



NOLAND RESIDENCE
LONE PINE, CALIFORNIA



SCHOOL FOR FIELD STUDIES
MAGADALENA BAY
BAJA DEL SUR, MEXICO



LAREDO DEMONSTRATION FARM
LAREDO, TEXAS



INGRAM CALICHE SCHOOL
INGRAM, TEXAS

ARCHITECTURE - RESIDENTIAL, FARMS & SCHOOLS

CMPBS Prototypes

Water harvesting /saline water use, Flower based w.water treatment ,Flexible building Systems, Caliche vs adobe, alternative cements.



SCHOOL FOR FIELD STUDIES
BAJA DEL SUR, MEXICO



ARMAND BAYOU NATURE
CENTER



LONGJU SUSTAINABLE
VILLAGE, CHINA



VAL VERDE VILLAGE
MASTER PLAN, MEXICO



photo credits: Blake Gordon

DEMONSTRATION
HOME STATE OF
TEXAS(1998)



photo credit: Blake Gordon

STUDIO – MEETING SPACE
ADVANCED GREEN BUILDER DEMONSTRATION HOME, AUSTIN



DEMONSTRATION
FARM
STATE OF
TEXAS(1998)

© R. Greg Hursley



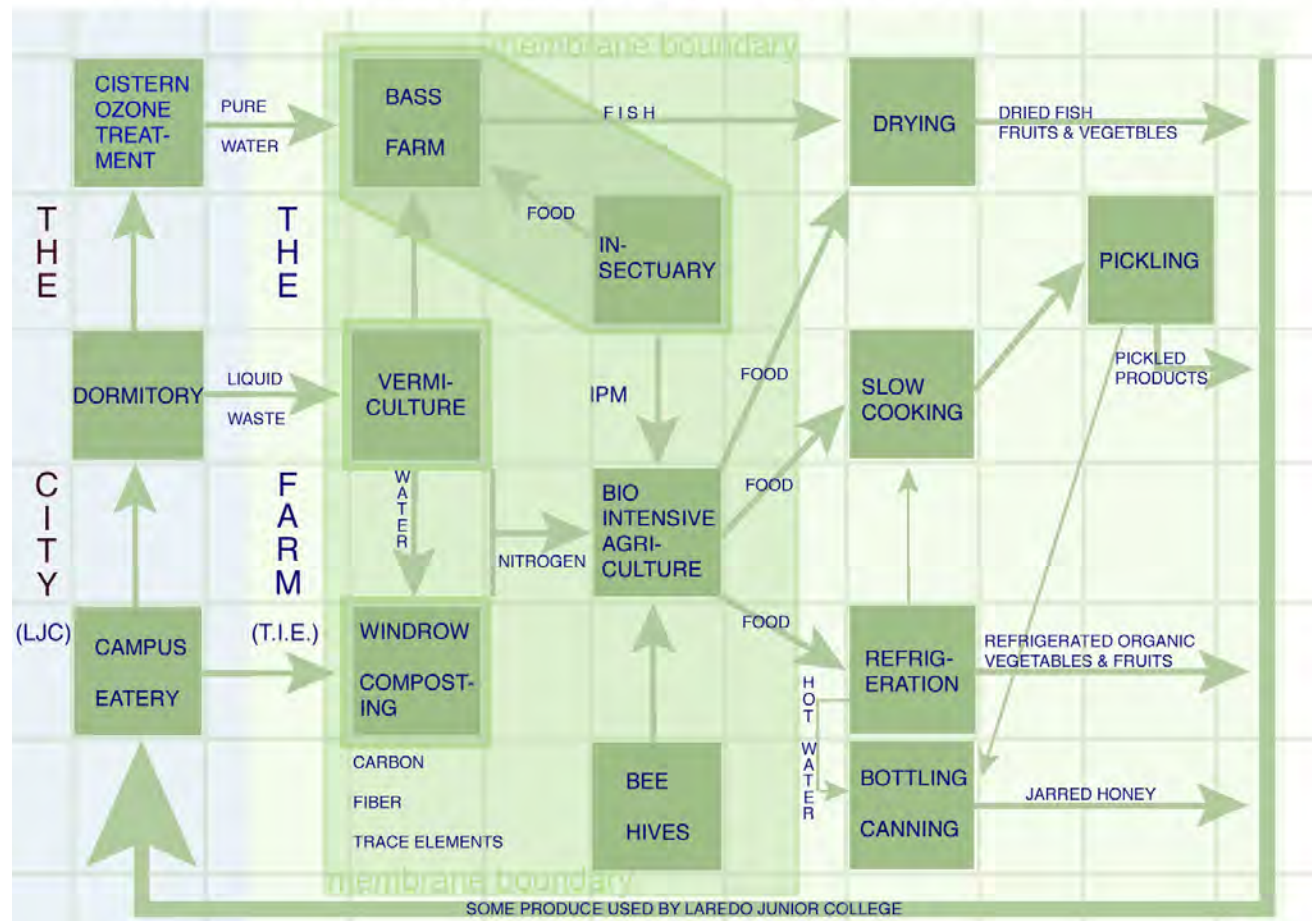
LAREDO PROTOTYPE FARM FOR THE STATE OF TEXAS (1988) integrated water systems within construction

PROTOTYPE TO APPLICATION



SHADE SYSTEM
THROUGHOUT SOUTHWEST

INTEGRATED METABOLIC UNITS ON DEMONSTRATION FARM



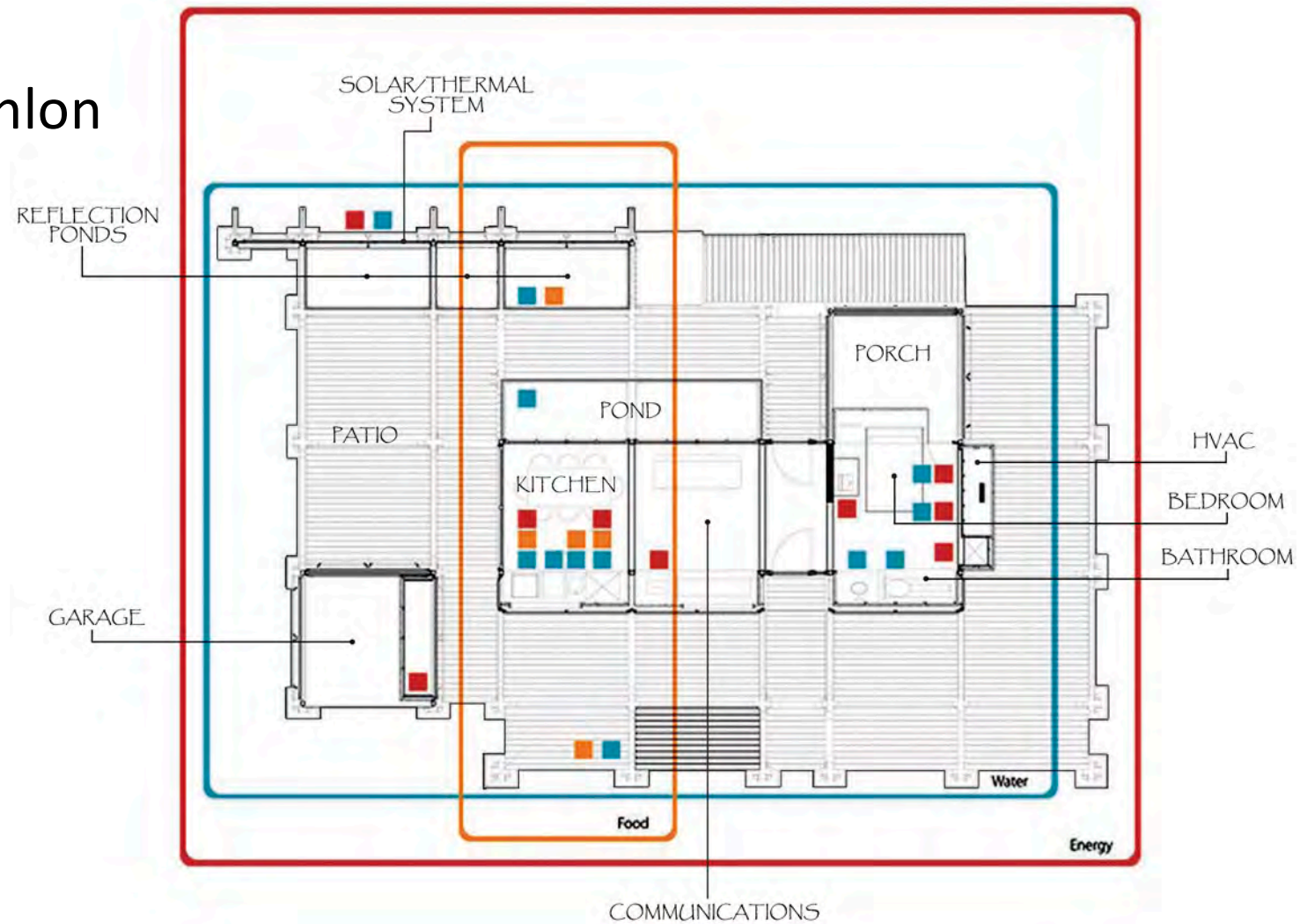


SOLAR DECATHLON,
TEXAS A&M
Washington DC Mall
2007

photo credit: Prakesh Patel

The cycles of life

TAMU solar decathlon



■ Visualization

the Processes

Food



Water



Energy



the Life Cycle

Source



Process



Use

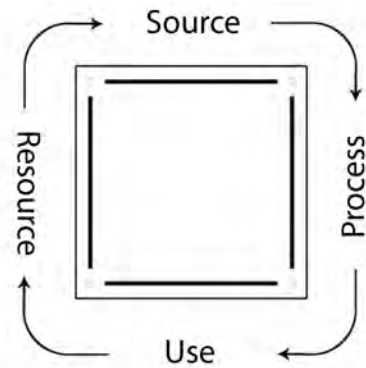


Resource

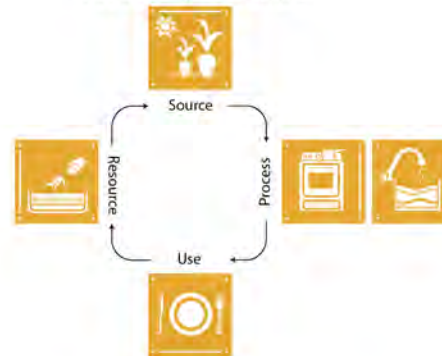


The cycles of life RFID connected Icons TAMU solar decathlon

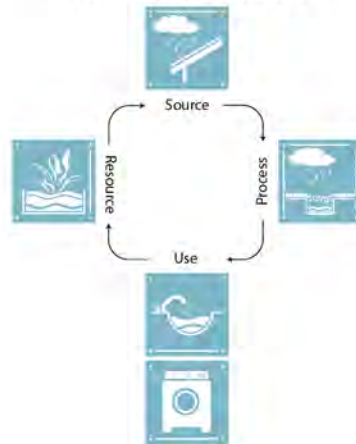
■ Visualization



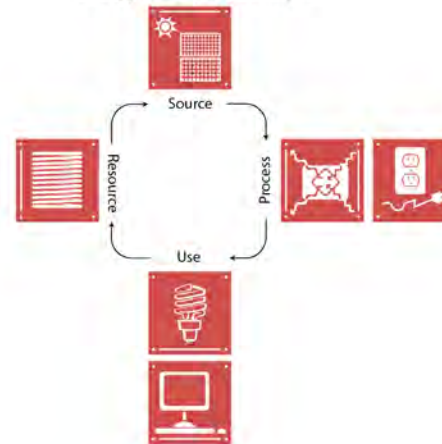
Food Life Cycle Example



Water Life Cycle Example

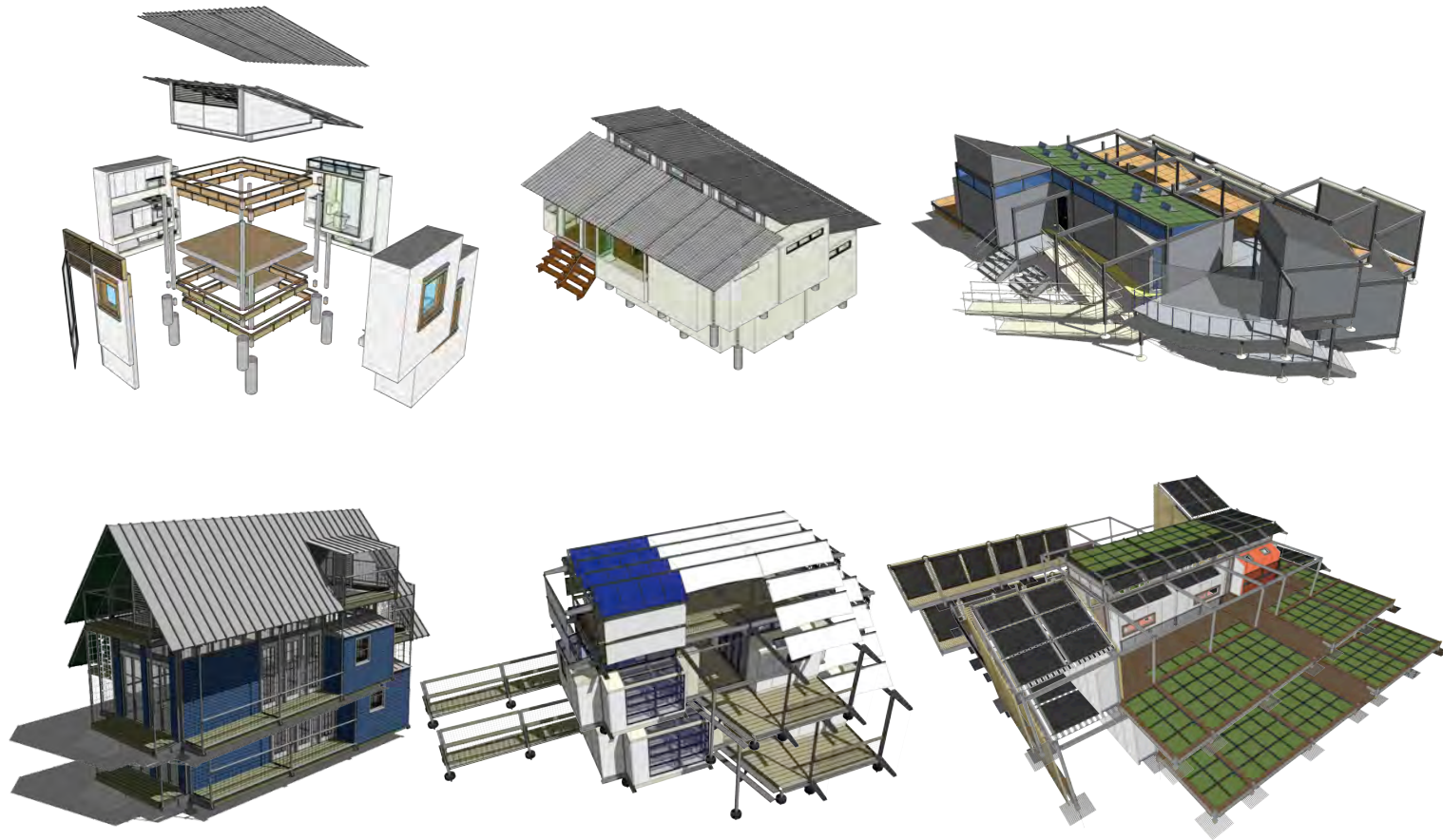


Energy Life Cycle Example

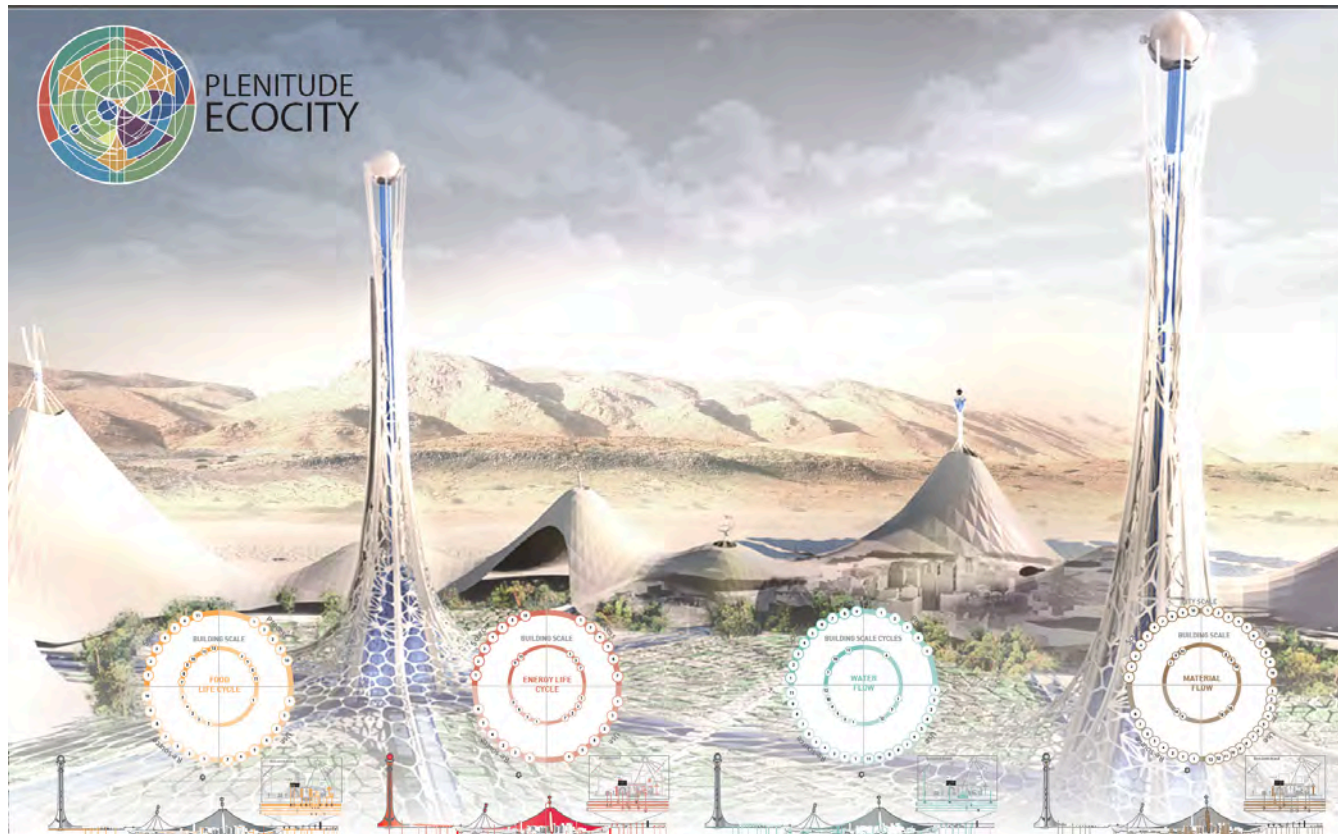




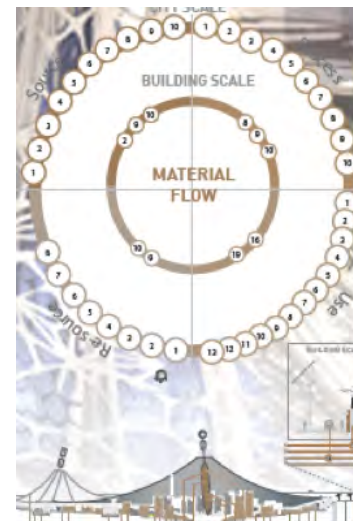
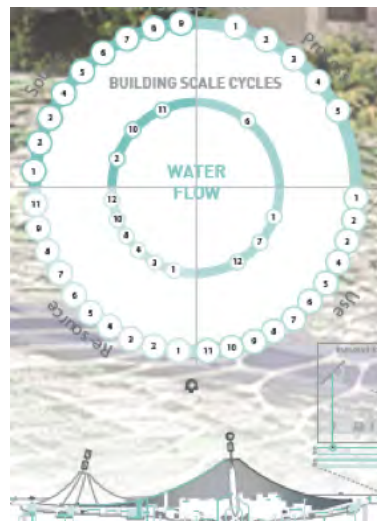
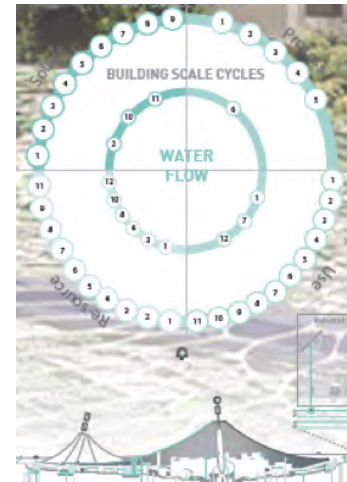
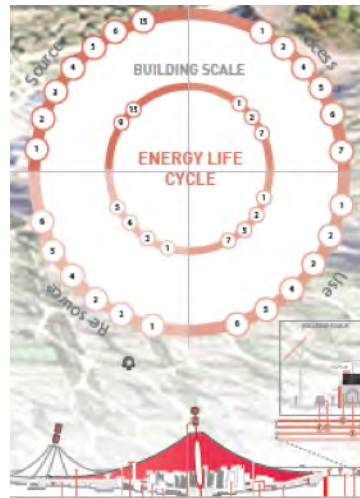
SOLAR DECATHLON,
UNIVERSITY OF TEXAS
Washington DC Mall
2002



Design for Disassembly (DfD) - Design for Open Building (DfOB) – Design for Reuse (DfRU)



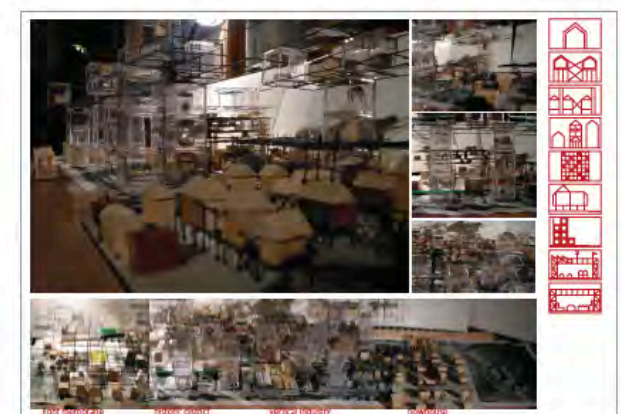
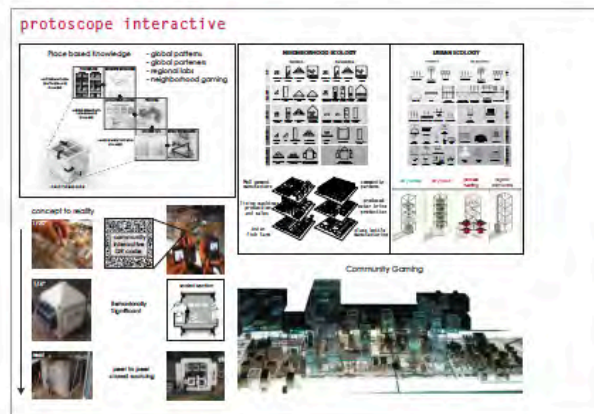
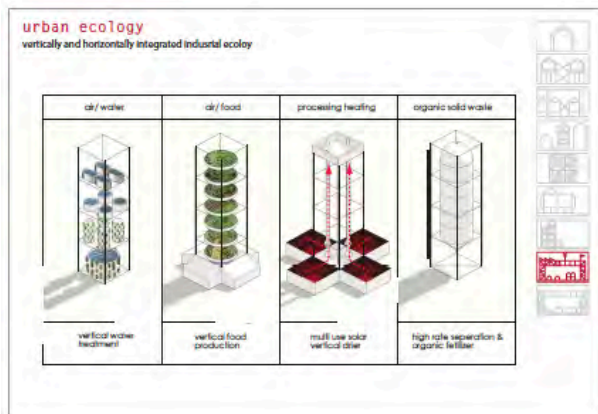
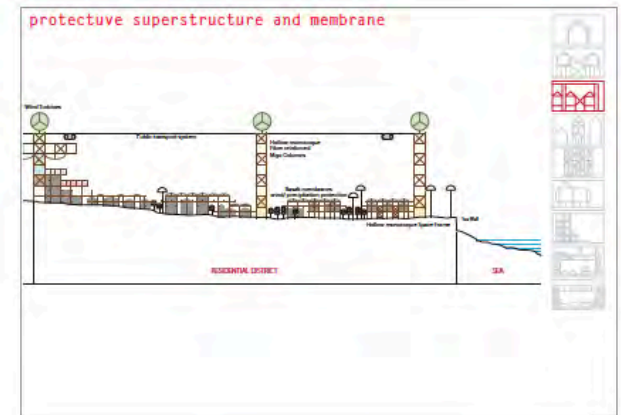
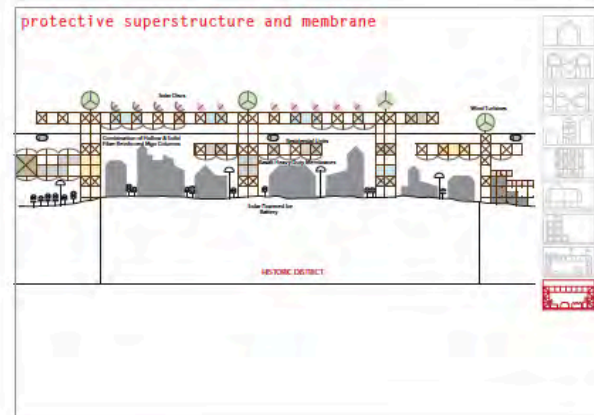
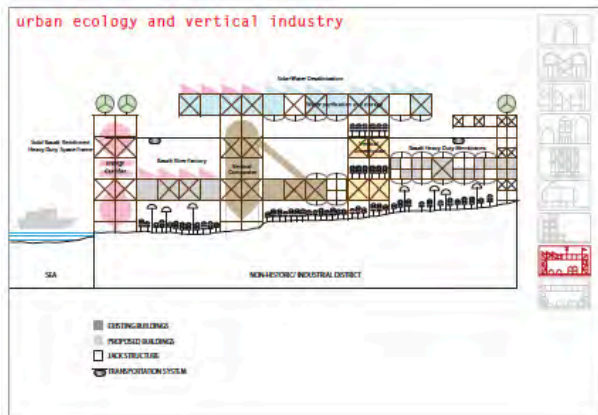
WORK ON INTERNATIONAL COMPETITIONS – A SUSTAINABLE RESOURCE BALANCED CITY FOR MOROCCO



RESOURCE BALANCING IN THE CITY OF PLENITUDE



A CITY OVER AN UNDERWATER RESTORED CITY OF GALAVASTON



- SECTION OF A CITY OVER A CITY - GALAVASTON

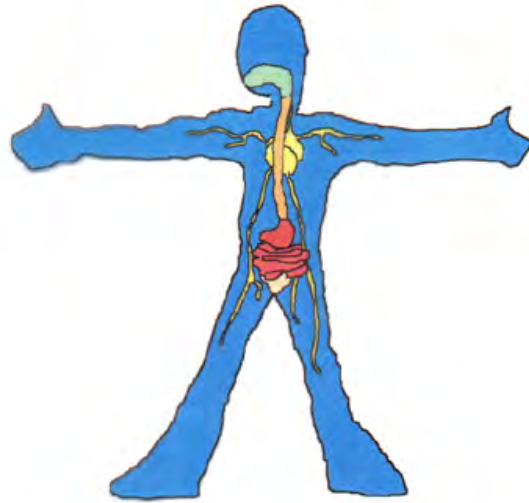
MATERIAL SYSTEM ONE – ECOBALANCE

BALANCE PERMEATES OUR DESIGN PROCESS (AIR, WATER, FOOD, ENERGY AND MATERIALS)
AND WE CONSIDER IT A FIRST STEP TOWARDS A CIRCULAR ECONOMY

Ecobalance –is the basic tenant behind the Austin Green Awards

ALLIED PROFESSIONALS	POTENTIAL OR EXISTING BALANCE CONDITIONS
Accountant	Balances Credit and Debit
Mathematician	Balances Algebraic Equations
Chemical Engineer	Balances Chemical Equations
Mechanical Engineer	Balances Heat Gain to Heat Loss
Civil Engineer	Balances Retention to Release of Stormwater
Structural Engineer	Balances Gravitational Force to Structural Capacity
Ecologist	Balances Producers and Consumers
Climatologist	Balances Carbon Release to Carbon Sink
Hydrologist	Balances Water Quality to Water Availability
Life Cycle Analyst	Analyzes Data for Upstream and Downstream
Industrial Ecologist	Balances Inputs & Outputs in Industrial Ecosystems
Urban Planner	Balances Public Sector to Private Sector Needs
Neurobiologist	Balances the Brain to Metabolic Functionality
Psychologist	Balances Society with the Individual

DISCIPLINES OF BALANCE



INGESTING

SWALLOWING

DIGESTING

CIRCULATING

EXERCISING

DEFICATING

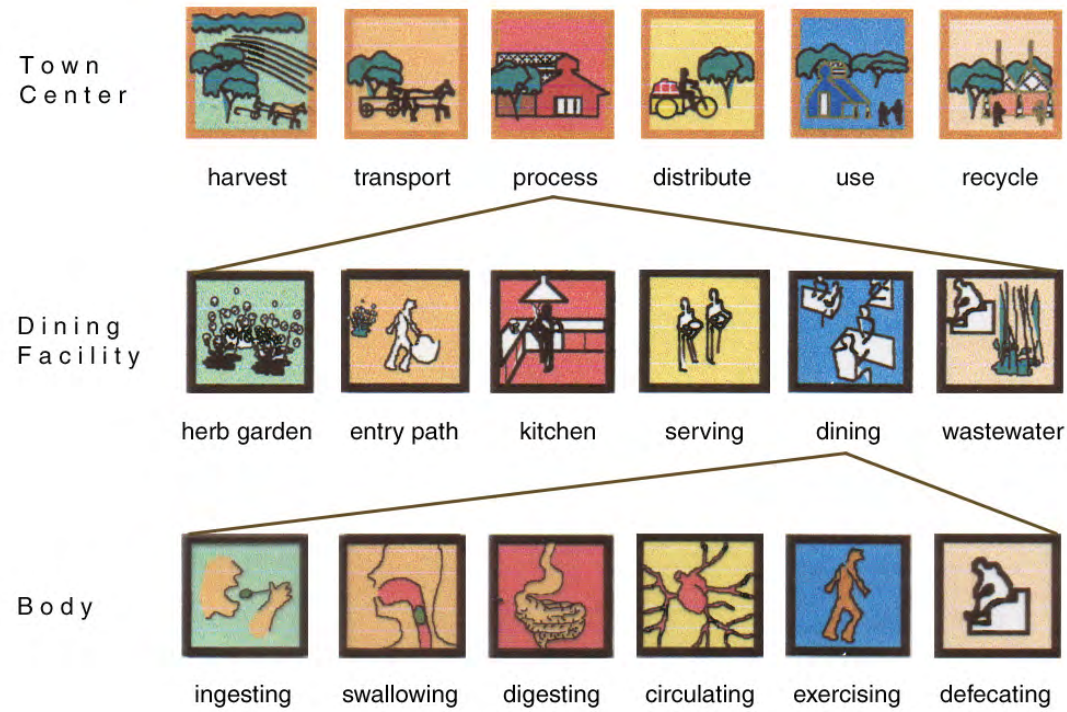


LIFE CYCLE FOOD



BODY

Food Life Cycle



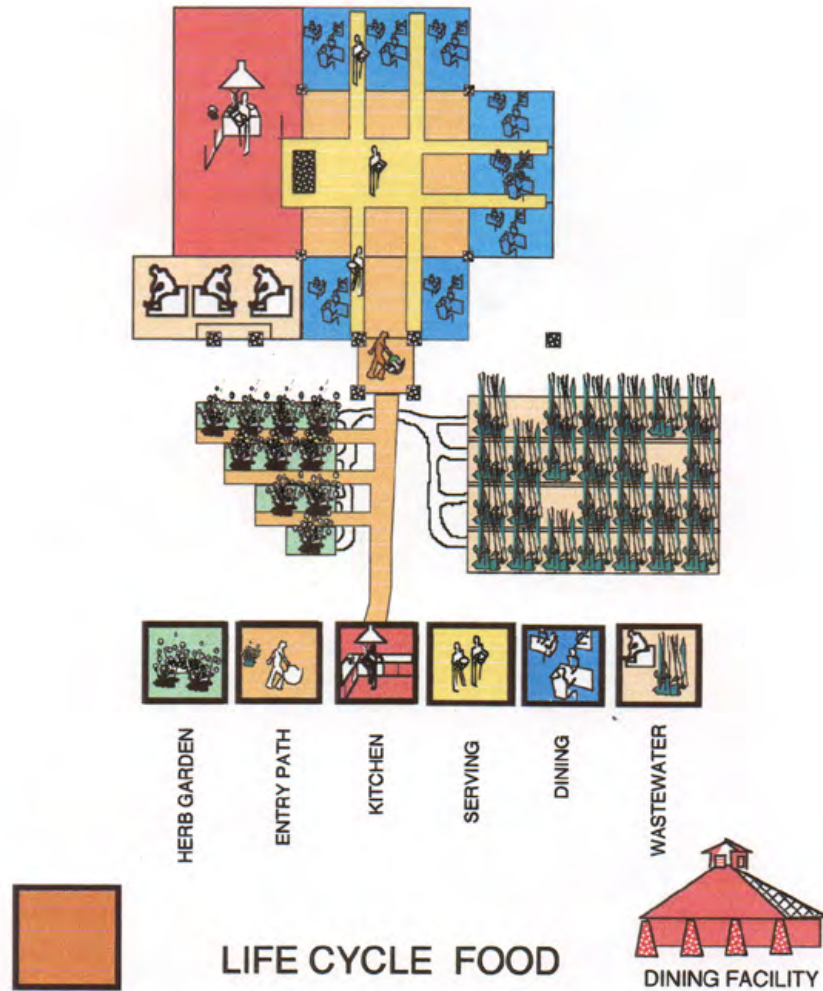


FOOD

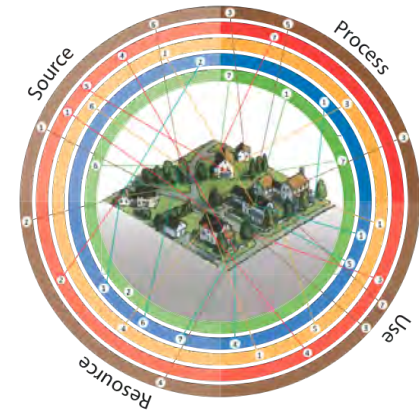
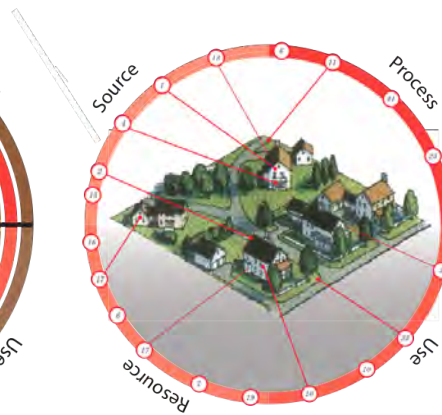
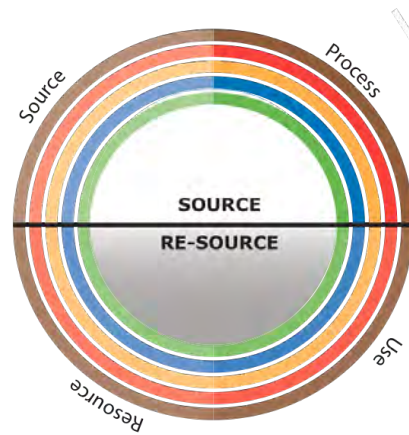
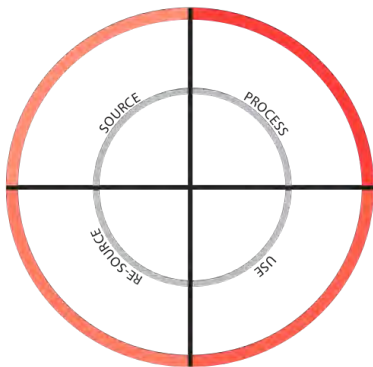
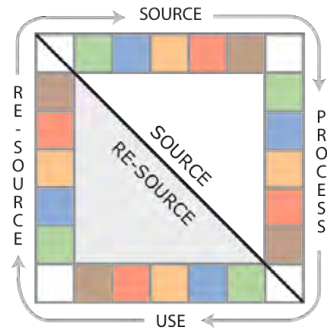
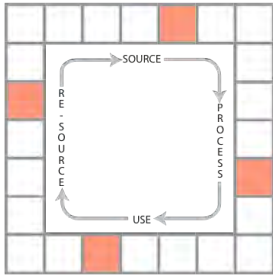


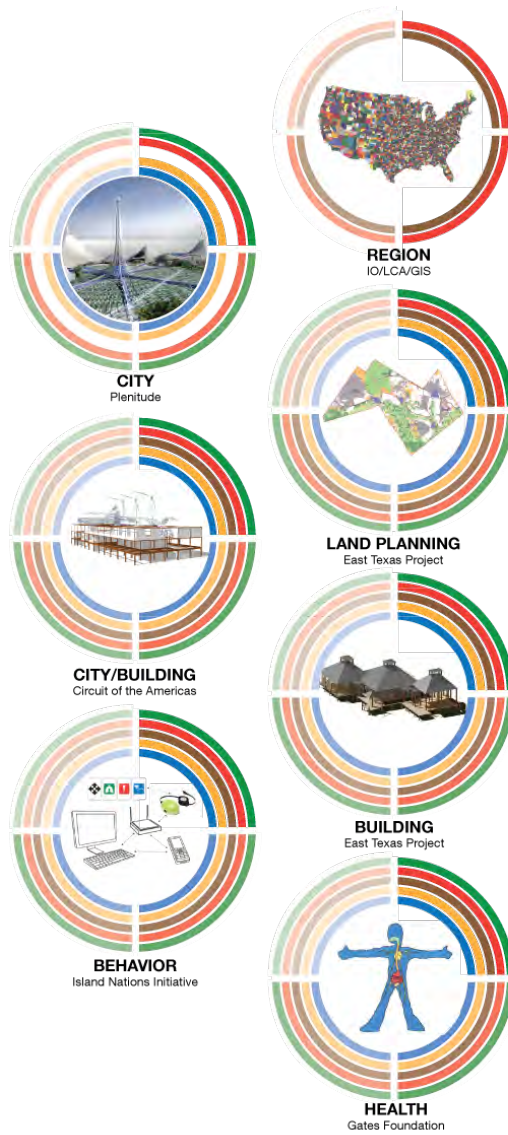
LIFE CYCLE FOOD

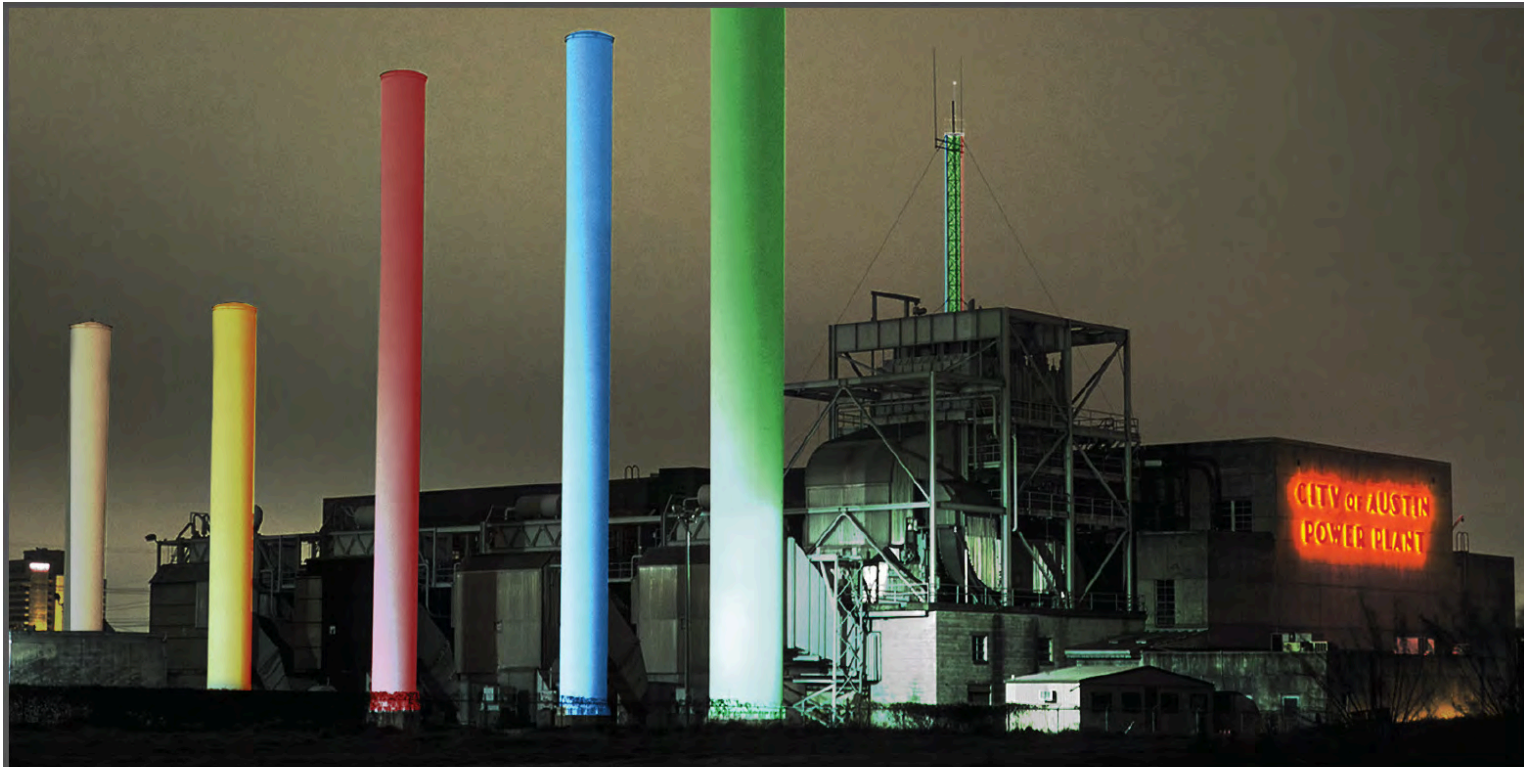
TOWN CENTER



LIFECYCLE ECOBALANCING



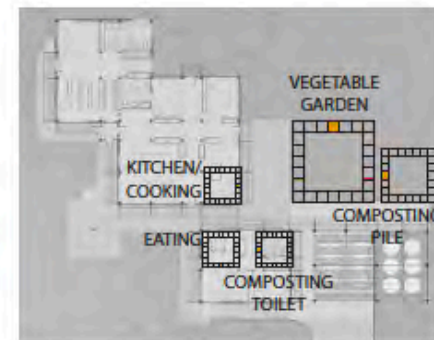
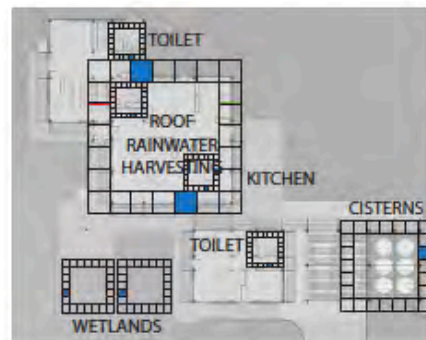
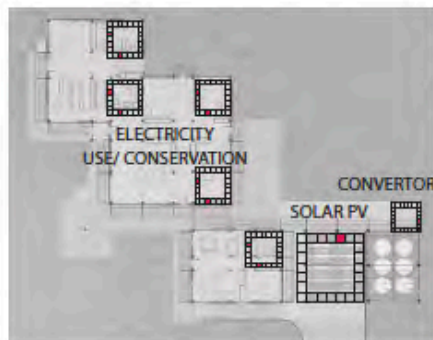




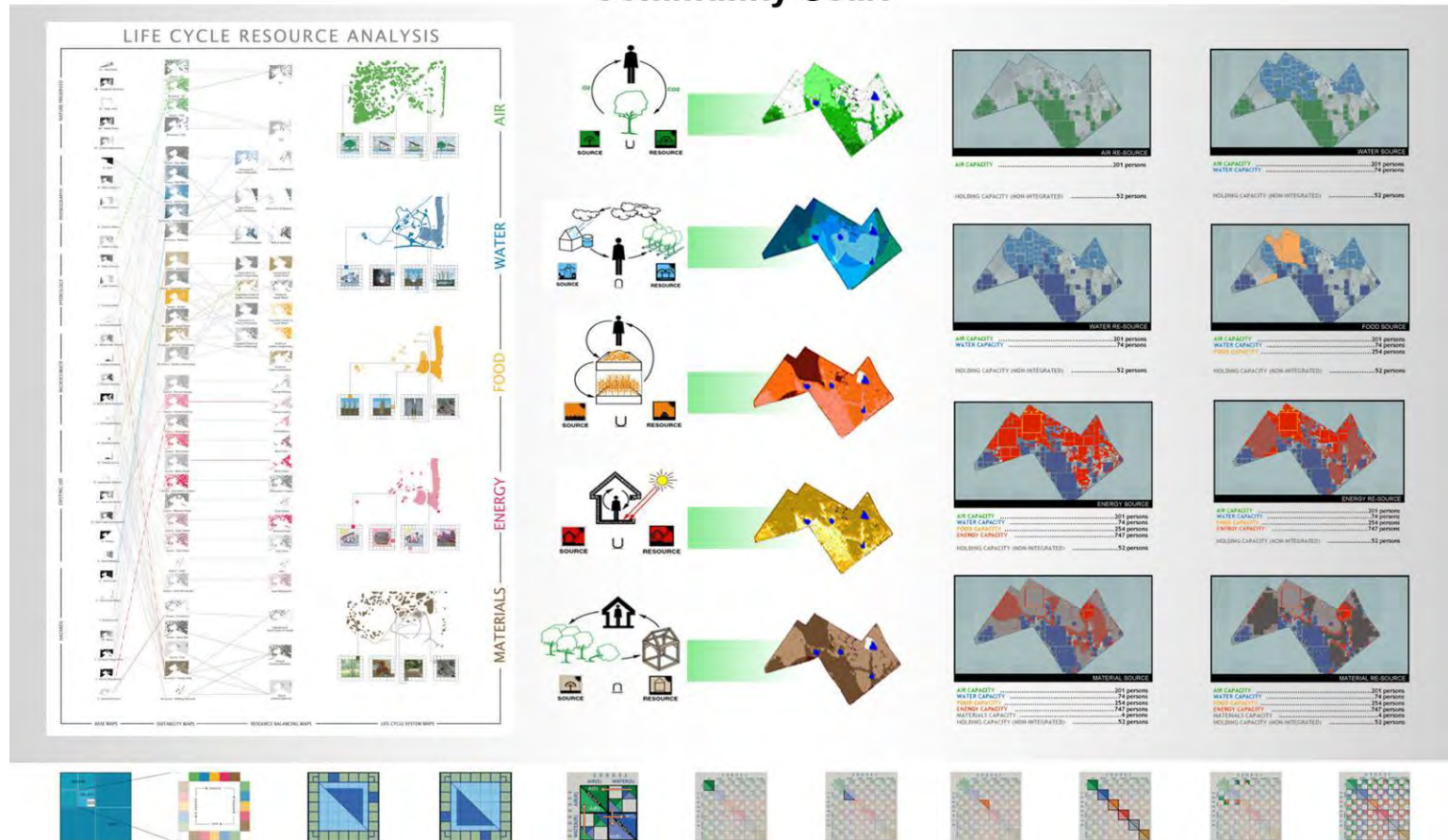
THE SEAHOLM STACKS

- INTERACTIVE ENVIRONMENTAL MEDIA PROJECT
- SEAHOLM ECODISTRICT
- AUSTIN, TEXAS

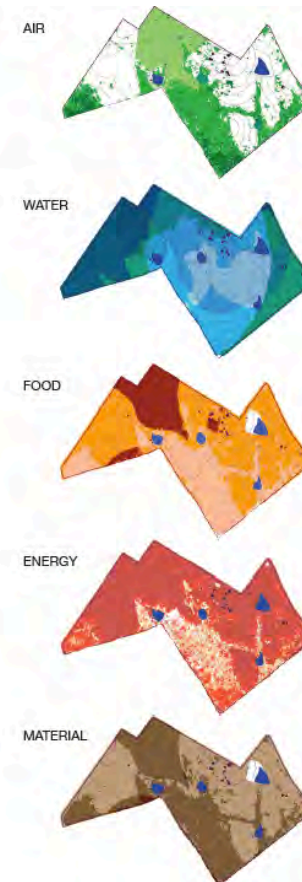
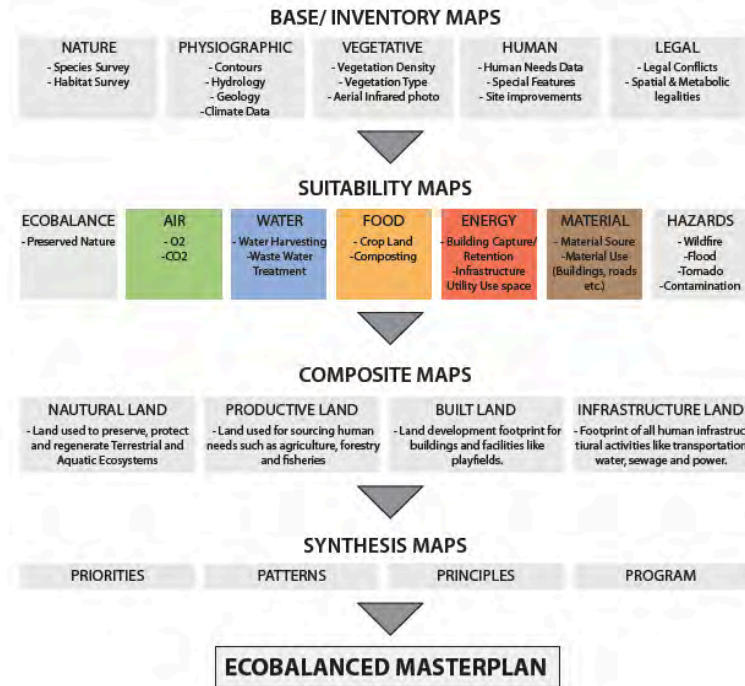
emplos

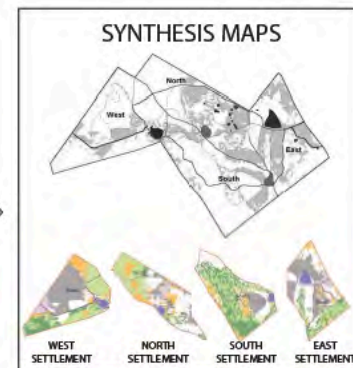
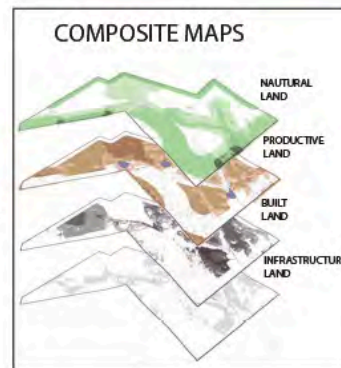
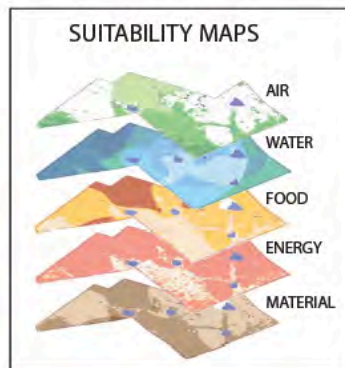
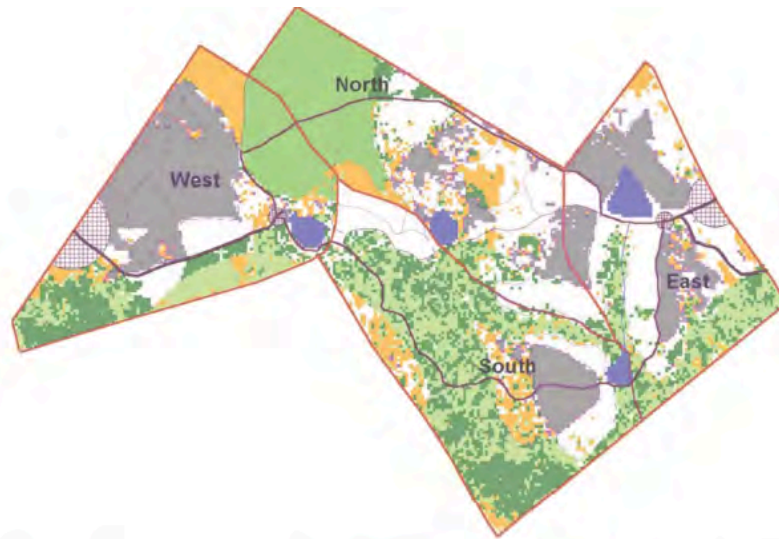


Community Scale

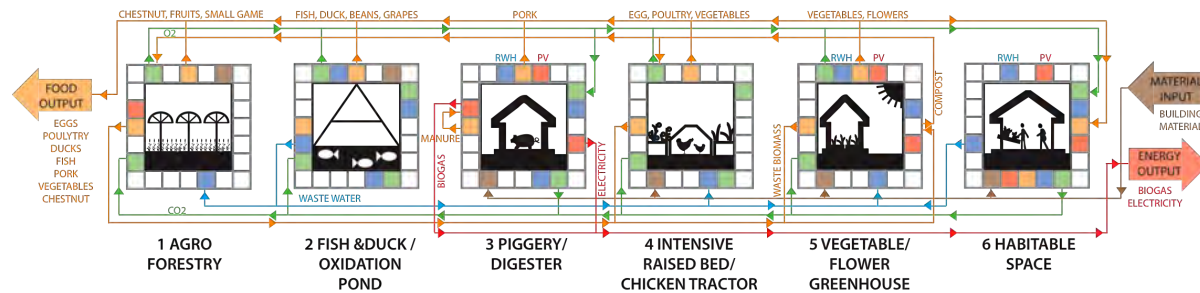
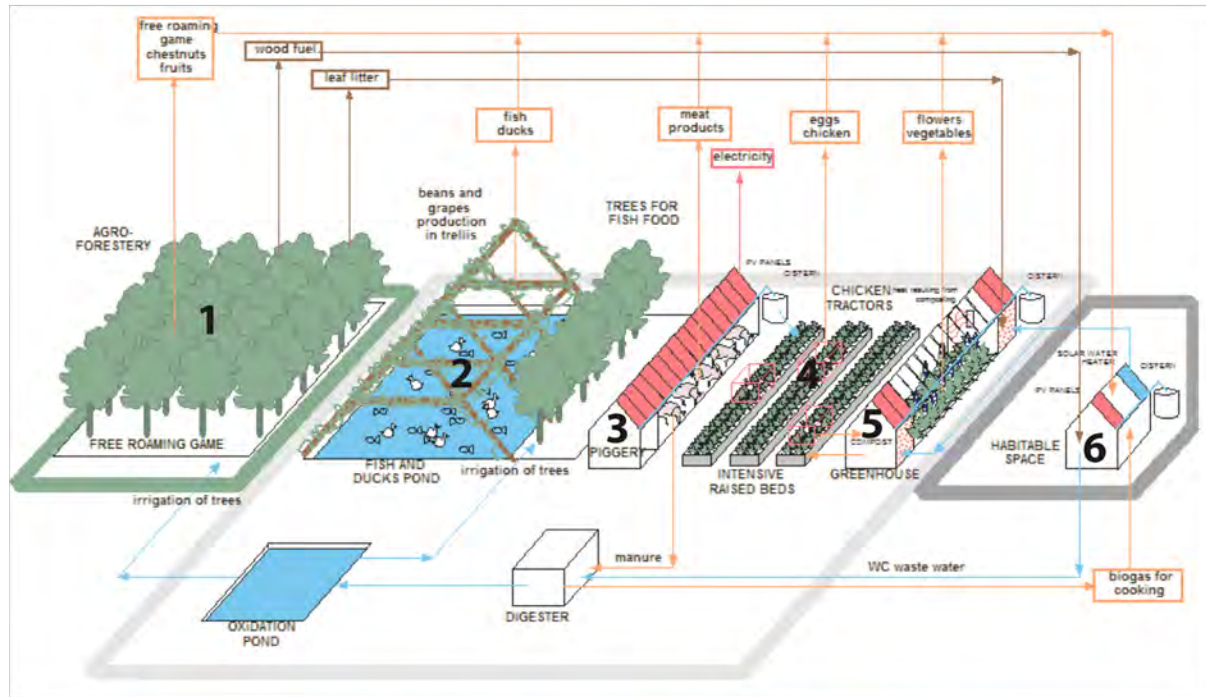


East Texas Project



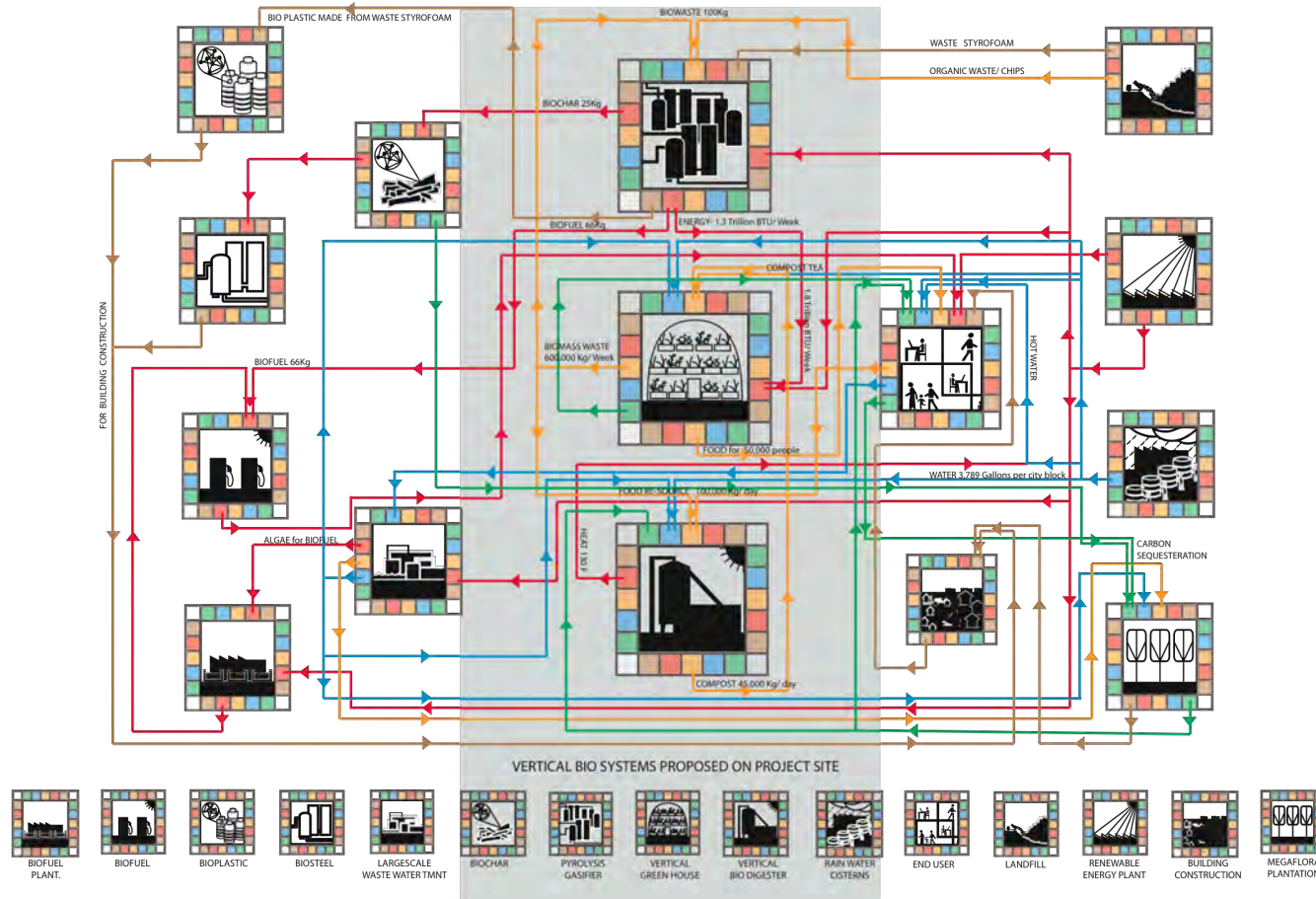


NORTH SETTLEMENT



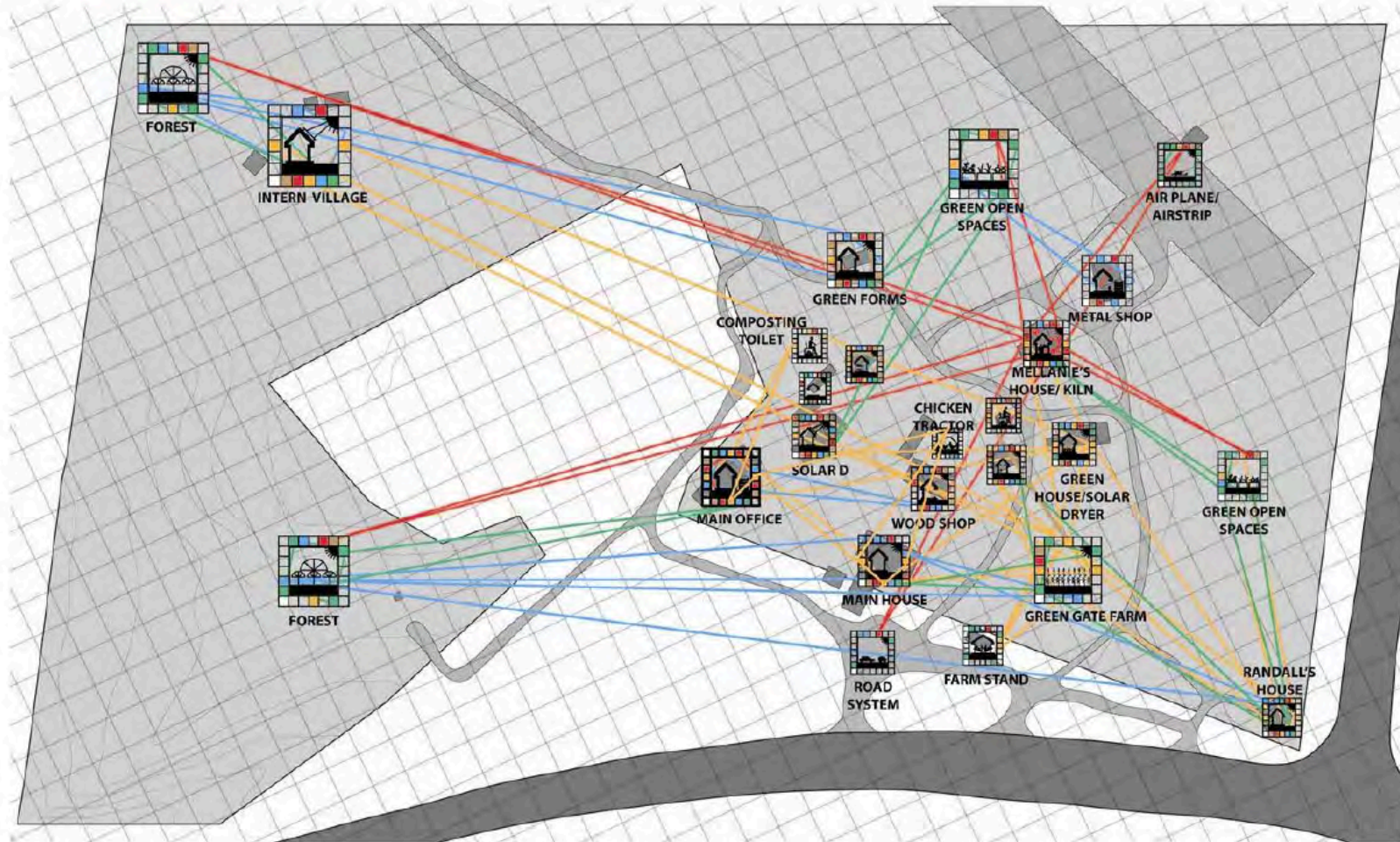
CIRCULAR ECONOMY PLANNING USING CMPBS AS TRIGGER TO INPUT/OUTPUT ACTIVITY

REGIONAL FLOW NETWORK



WORK ADVISED AND DIAGRAMMED WITH JASON AVENT, JOEP MEIJER, LOVLEEN GIL

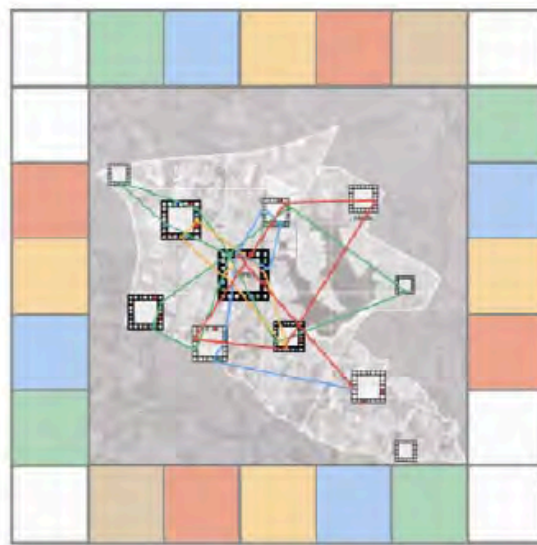
SITE LIFECYCLE NETWORKS



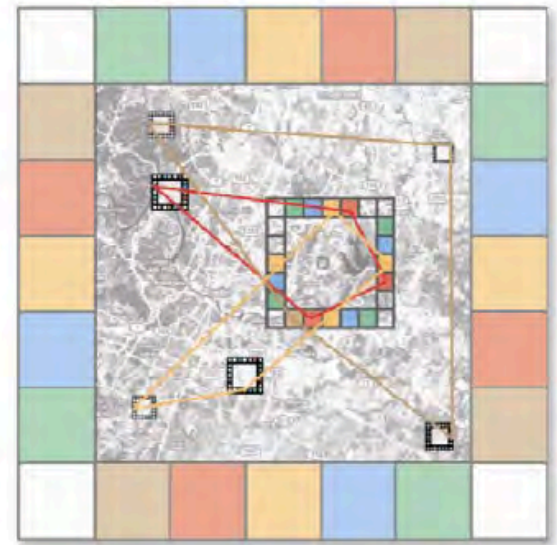
CIRCULAR ECONOMY PLANNING USING CMPBS AS TRIGGER TO INPUT/OUTPUT ACTIVITY



SITE



NEIGHBOURHOOD



REGION

MATERIAL SYSTEM - TWO

USING BIG DATA SETS TO MAKE RELEVANT DECISIONS



BASELINE-GREEN™

A BASELINING GUIDE FOR GREEN BUILDING

CMPBS®
AUSTIN, TEXAS
1998



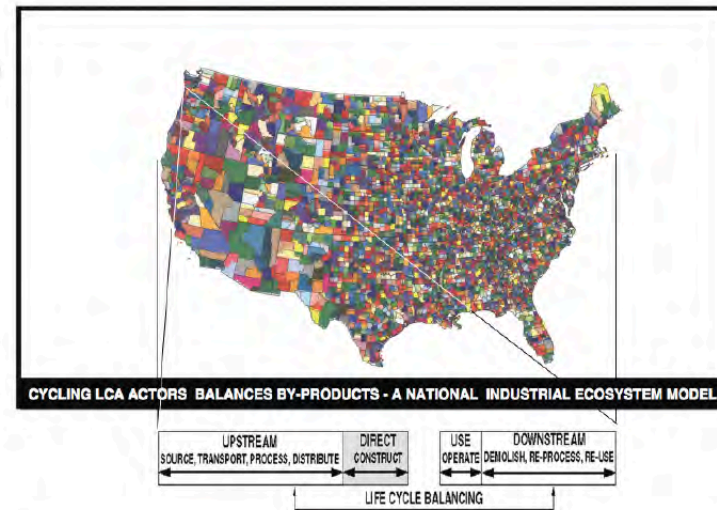


GREEN BALANCE™

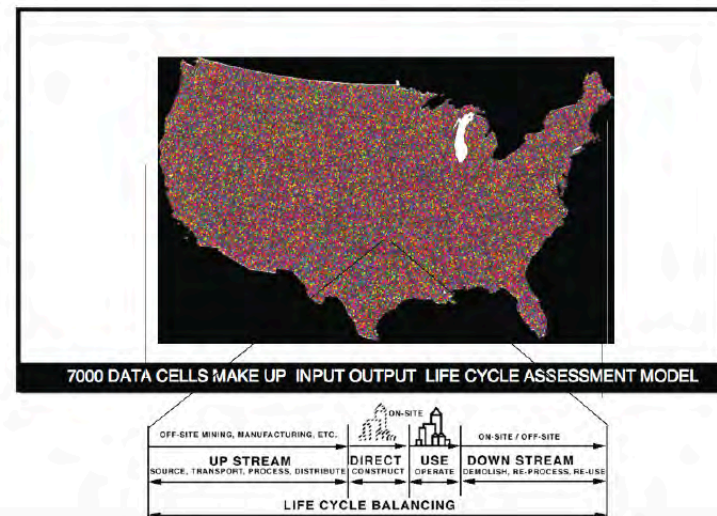
A POSSIBLE BASIS FOR A CIRCULAR ECONOMY

CMPBS ©
AUSTIN
TEXAS





National Ranking	Construction Sector Ranking	Specification Ranking	Component Ranking
Industry Name 1. New bldg. & m&r 2. Retail trade, except eating & drinking 3. Petroleum refining 4. Wholesale trade 5. Eating and drinking places 6. Motor vehicles & organic chemicals 7. Industrial inorganic & organic chemicals 8. Gas production and distribution (utilities) 9. Blast furnaces and steel mills 10. Miscellaneous plastics products	Sector New nonfarm 1 unit resd'l const. Nonresid'l m&r const. Resid'l m & r const. New nonfarm additions & alterations New hi-ways, bridges, etc. New office building const. Hi-ways & streets r&m const. New academic facilities const. New commercial structures New electric utility const. New industrial plants const. New hospital const. New res. Garden apts. Const New warehouses const. New water supply facilities const. Electric utilities r&m const. New telph & telgrph structures const. New sewer facilities const. New gas utility facilities const. Other new nonbuilding const.	Category Superstructure Foundations Interior Finishes Exterior Closure Electrical HVAC Interior Const. Plumbing	Component Ready Mix Concrete Reinforcing Bar Form Work Wire



National Ranking

Industry Name
1. New bldg. & m&r
2. Retail trade, except eating & drinking
3. Petroleum refining
4. Wholesale trade
5. Eating and drinking places
6. Motor vehicles & organic chemicals
7. Industrial inorganic & organic chemicals
8. Gas production and distribution (utilities)
9. Blast furnaces and steel mills
10. Miscellaneous plastics products

Construction Sector Ranking

Sector
New nonfarm 1 unit resd't'l const.
Nonresid't'l m&r const.
Resid't'l m & r const.
New nonfarm additions & alterations
New hi-ways, bridges, etc.
New office building const.
Hi-ways & streets r&m const.
New academic facilities const.
New commercial structures
New electric utility const.
New industrial plants const.
New hospital const.
New res. Garden apts. Const
New warehouses const.
New water supply facilities const.
Electric utilities r&m const.
New telph & telgrph structures const.
New sewer facilities const.
New gas utility facilities const.
Other new nonbuilding const.

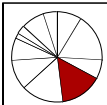
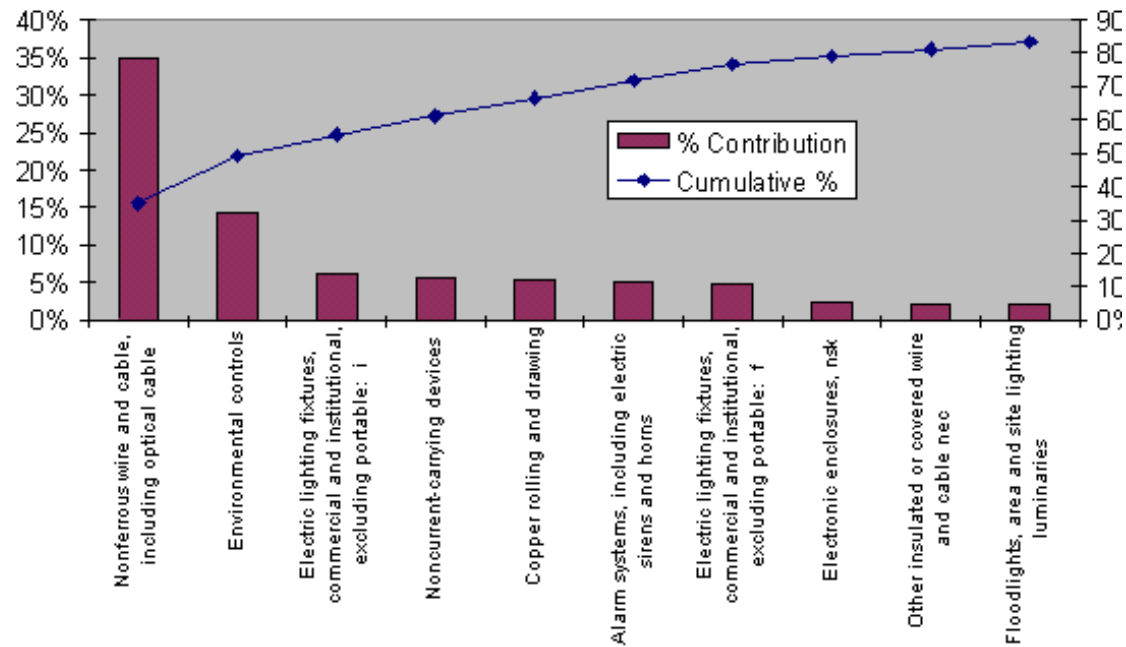
Specification Ranking

Category
Superstructure
Foundations
Interior Finishes
Exterior Closure
Electrical
HVAC
Interior Const.
Plumbing

Component Ranking

Component
Ready Mix Concrete
Reinforcing Bar
Form Work
Wire

Electrical: Top Ten Items, Individual and Cumulative Contributions



**ELECTRICAL
TOXIC RELEASE**

**TOP TEN ITEMS INDIVIDUAL AND
CUMULATIVE CONTRIBUTIONS**

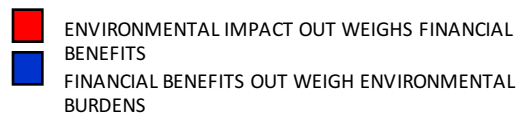
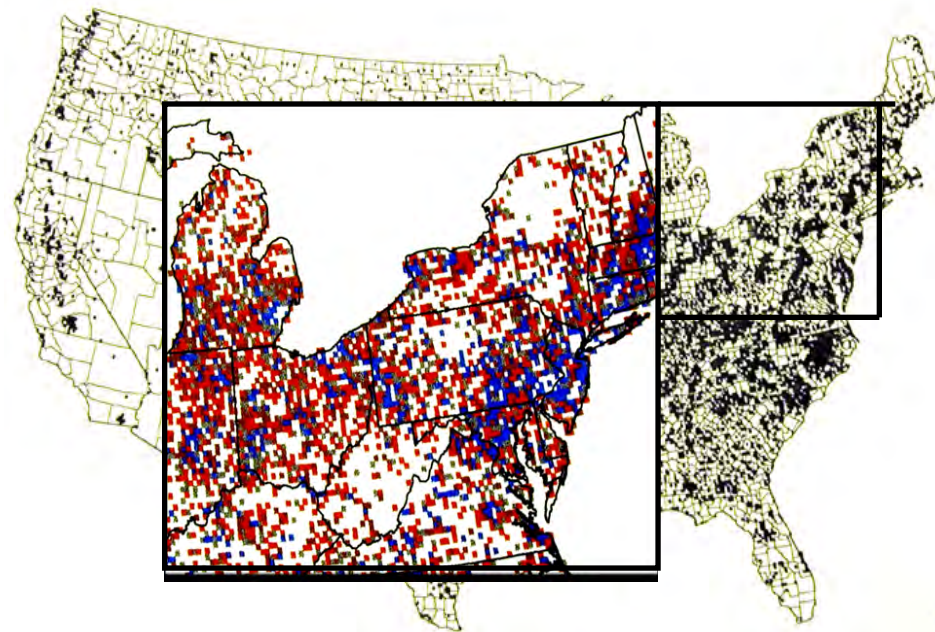
**BASELINE
GREEN™**





WIRE COVERINGS CAN BE HDPE OR PVC - THIS PARTICULAR PILE BEING READIED FOR RECYCLING IS HDPE



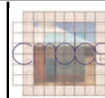


BASELINE GREEN: TALKING GRID
INTERCELLULAR LIFE CYCLE COMMUNICATION AGGREGATING ALL

	6. E X T. E N V . C O S T (M\$)	7. E M P'T (J O B S/ 10 ⁻³ \$)	FINAL RANK
RE A D Y M I X CO N C R E T E CO L U M N	34 .80	1.1	2
FA B R I C A T E D ST R U C T U R A L ST E E L C O L U M N	22 .30	1.3	1

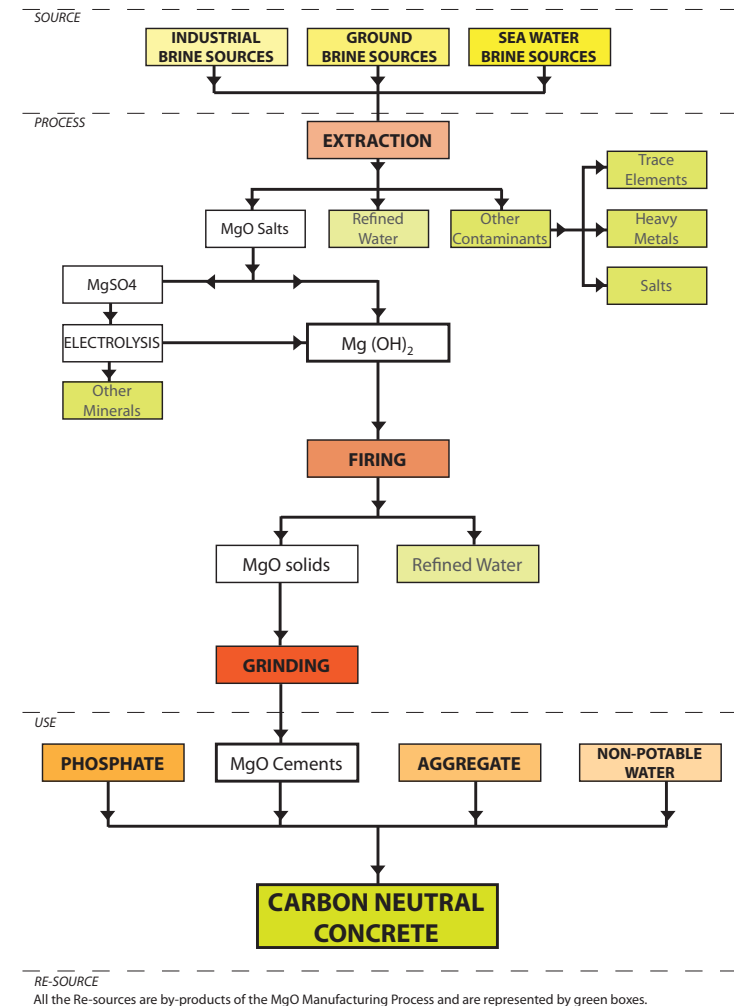
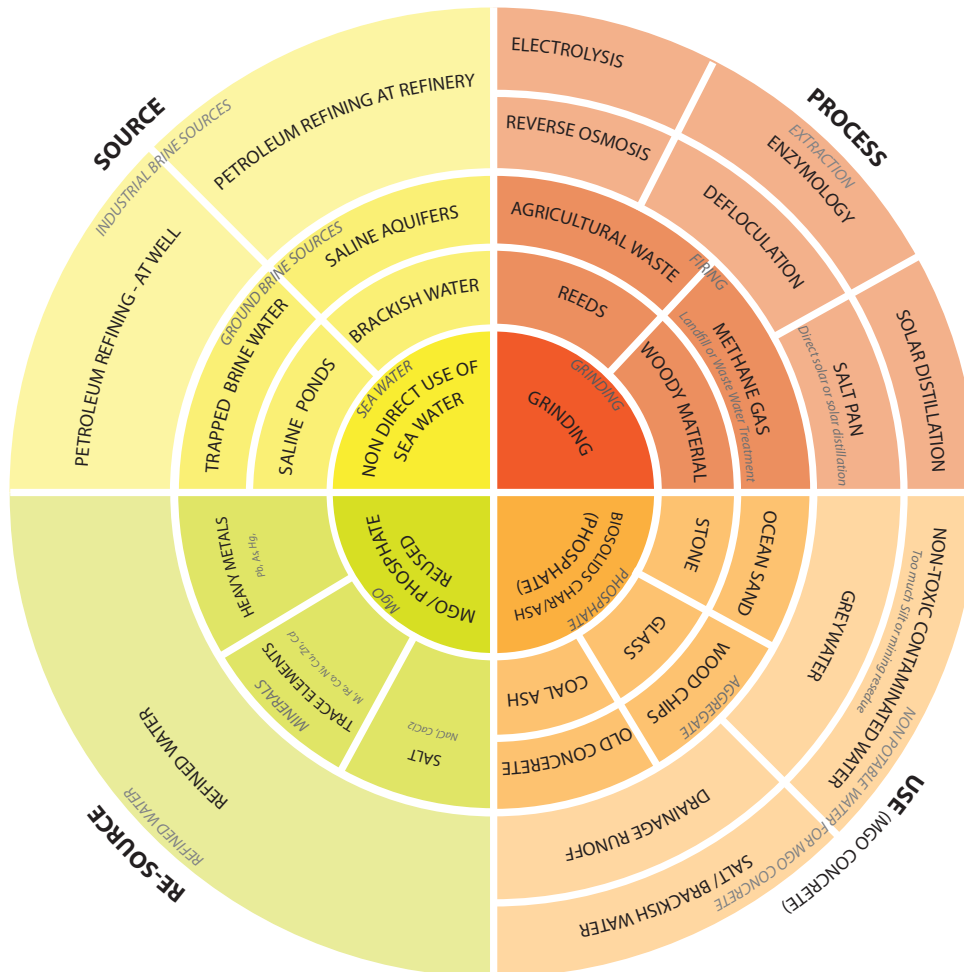
RANKING ENVIRONMENT & EMPLOYMENT

BASELINE
GREEN™



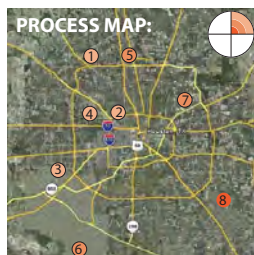
BUILDING SYSTM TWO (continued)
GREEN BALANCE
BUSINESSES ORGANIZED FOR CYCLICAL ECONOMY

Flexible Manufacturing Framework for Carbon Neutral Concrete Production

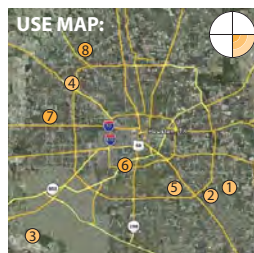




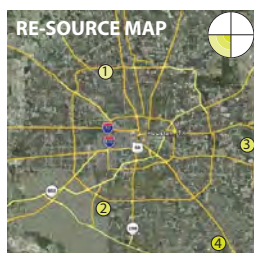
- INDUSTRIAL BRINE SOURCES:**
- 1 Valero Houston Refinery
 - 2 Oil Refinery, Houston Ship Channel
 - 3 Lyondell Citgo Houston Refinery
 - 4 Crown Central Petroleum Refinery
 - 5 Deer Park Refining LTD Refinery
 - 6 Exxonmobile baytown installation
- GROUND BRINE SOURCES:**
- 7 Jasper/ Chicot/ Evangeline Aquifers
- SEA WATER BRINE SOURCES:**
- 8 Specific Equipment Co.



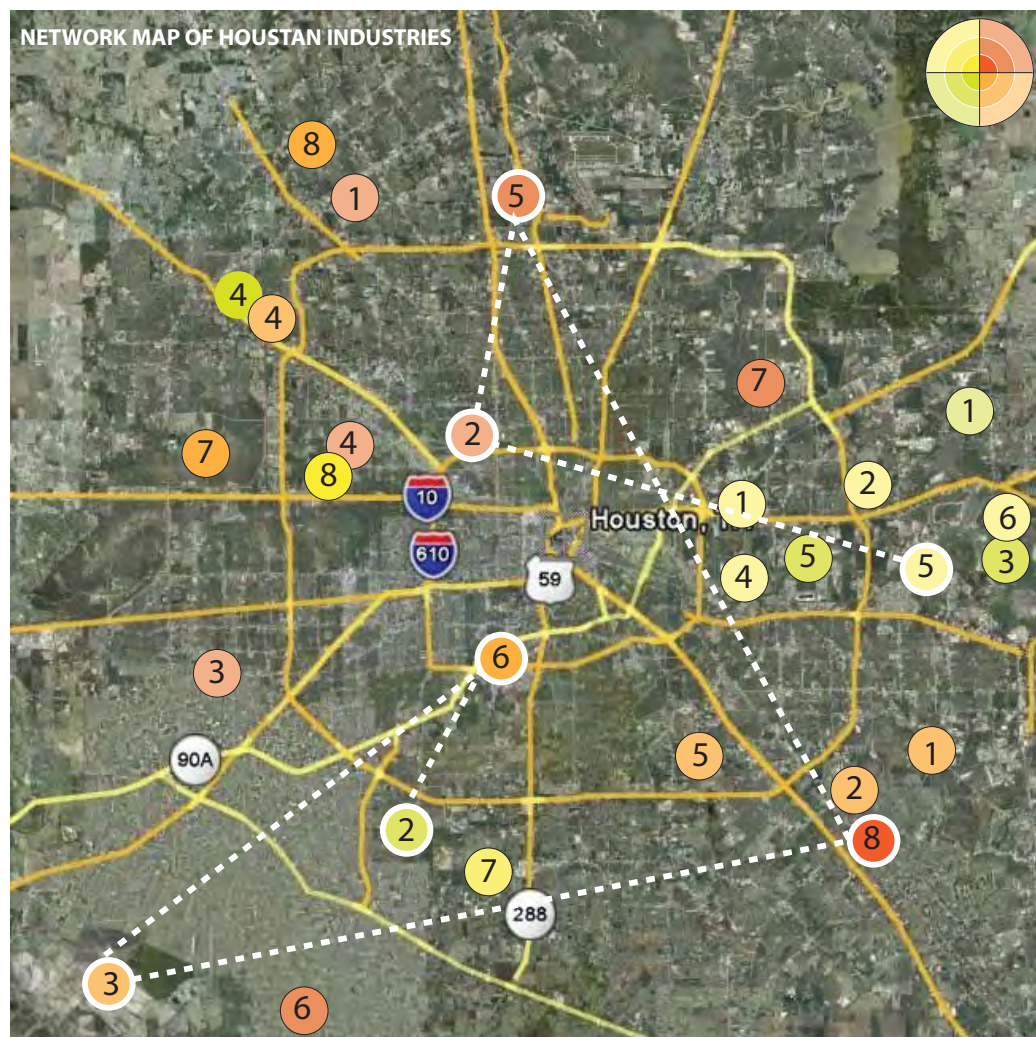
- EXTRACTION:**
- 1 Riley Equipment Co., Inc.
 - 2 Pure Water solutions Inc.
 - 3 Koch Membrane Systems, Inc.
 - 4 Specific Equipment Co.
- PIRING:**
- 5 Houston Cement Company
 - 6 Allen Butler Construction Cement Plant
 - 7 Bfi whispering Pines Landfill
- GRINDING:**
- 8 Texas Lehigh Cement Co.



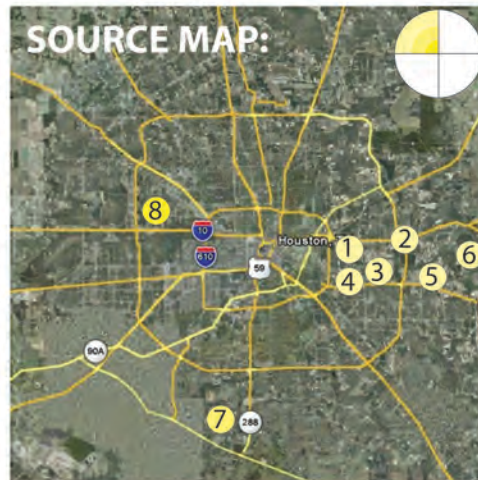
- NON POTABLE WATER:**
- AGGREGATE:**
- 1 Techmet LLP (recycled metal smelters)
 - 2 Platinum group metal recycling (smelters)
 - 3 Coal fired power plant
 - 4 Texas recycled concrete
 - 5 Coastal Crushed concrete
- PHOSPHATE:**
- 6 Houston Livestock Show and Rodeo
 - 7 Spring Creek Cattle Co.
 - 8 Biosolids Distribution Service



- REFINED WATER:**
- 1 Houston Water Purification
- MINERALS:**
- 2 United Salt Corporation, Blue Ridge Plant
 - 3 Texas Brine Co, Baytown LLC
- REUSED Mgo/ PHOSPHATE CONCRETE:**
- 4 Texas Recycled Concrete



Maps of Houston Industries for Flexible Manufacturing of Carbon Neutral Concrete



INDUSTRIAL BRINE SOURCES:

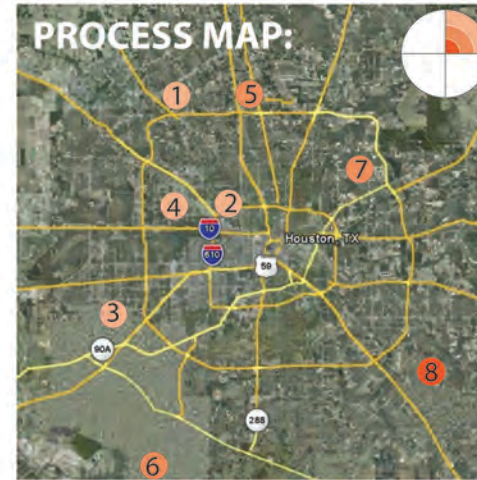
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- ④ Crown Central Petroleum Refinery
- ⑤ Deer Park Refining LTD Refinery
- ⑥ Exxonmobile baytown installation

GROUND BRINE SOURCES:

- ⑦ Jasper/ Chicot/ Eavngeline Aquifers

SEA WATER BRINE SOURCES:

- ⑧ Specific Equipment co.



EXTRACTION:

- ① Riley Equipment Co., Inc.
- ② Pure Water solutions Inc.
- ③ Koch Membrane Systems, Inc.
- ④ Specific Equipment Co.

FIRING:

- ⑤ Houston Cement Company
- ⑥ Allen Butler Construction Cement Plant
- ⑦ Bfi Whispering Pines Landfill (methane)

GRINDING:

- ⑧ Texas Lehigh Cement Co.



REFINED WATER:

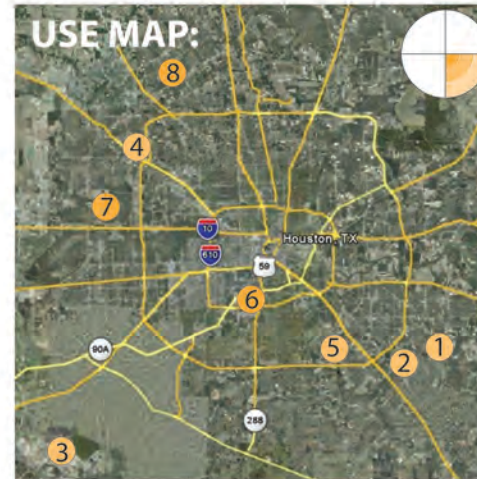
- ① Houston Water Purification

MINERALS:

- ② United Salt Corporation, Blue Ridge Plant
- ③ Texas Brine Co, Baytown LLC

REUSED Mgo/ PHOSPHATE CONCRETE:

- ④ Texas Recycled concrete



NON POTABLE WATER:

AGGREGATE:

- ① Techmet LLP (recycled metal smelters)
- ② Platinum group metal recycling (smelters)
- ③ Coal fired power plant
- ④ Texas recycled concrete
- ⑤ Coastal Crushed concrete

PHOSPHATE:

- ⑥ Houston Livestock Show and Rodeo
- ⑦ Spring Creek Cattle Co.
- ⑧ Biosolids Distribution Service

MATERIAL SYSTEM TWO— BASELINE GREEN / GREEN BALANCE

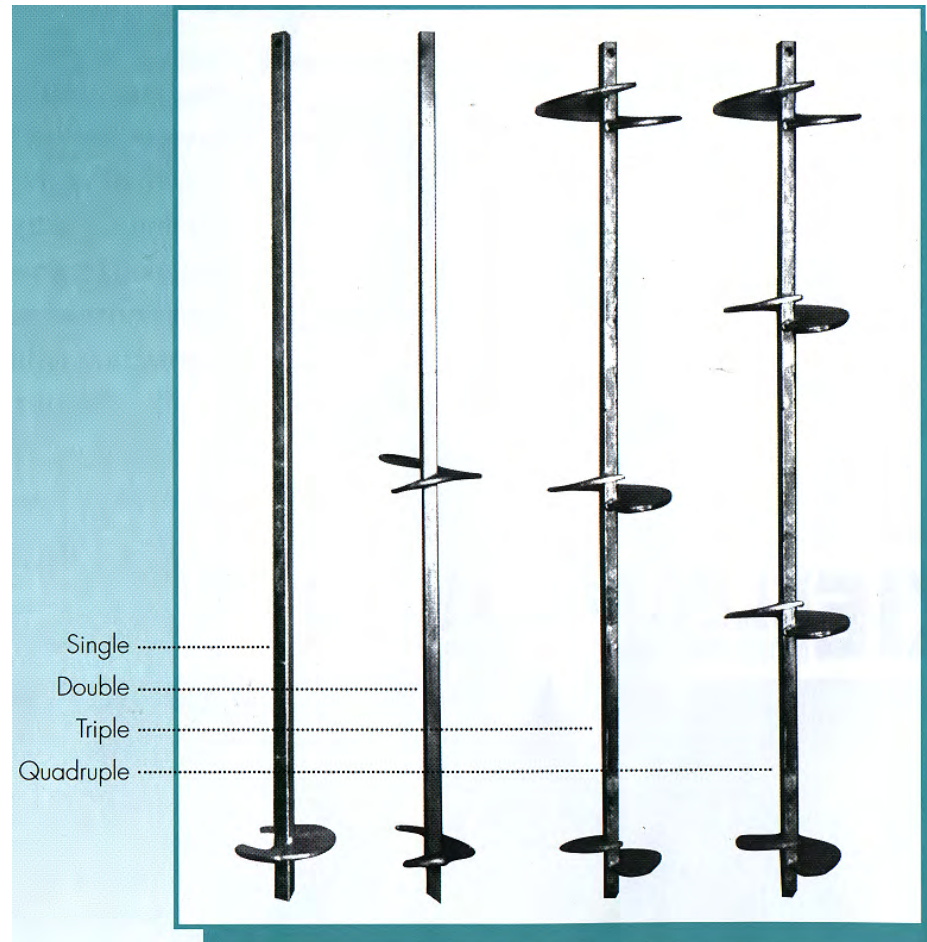
Lessons Learned

- The material make up of single family homes per million dollars of investment are the highest of any building type in the US for GHG, Criterial Air Pollutants and Toxic release
- Of all the individual specification areas of a typical home the most impactful are foundations
- Of all the materials used in the home Portland cement is the most impactful -

- Of all the activities in the whole life cycle of a home the impact of trips back and forth to the construction site justifies serious consideration of prepackaged building systems
- It seems that Concrete and Water are the two most used commodities by humans on the planet
- open, flexible reusable building components both adapt better to people and to new innovation but also reduce land fill
- materials can be specified together to be carbon balanced

MATERIAL SYSTEM THREE – L.I FOUNDATIONS

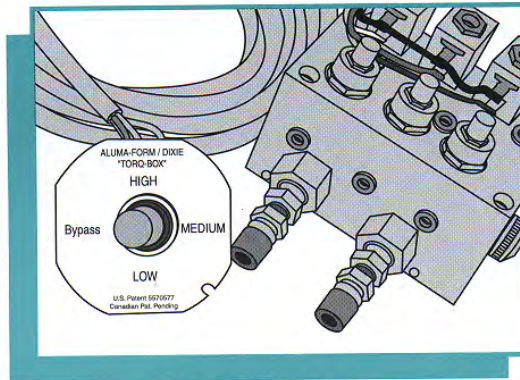
- FOUNDATIONS ARE HEAVY
- SITE EQUIPMENT IS EXTREMELY INVASIVE
- THE PROCESS IS TIME CONSUMING



**FOUNDATION SUITABILITY WAS EXPANSIVE CLAYS - EXPENSIVE
AS CONCRETE - CHEAPER/EASIER/QUICKER WITH HELIX ANCHORS
WITH FAR LESS ENVIRONMENTAL IMPACT AND THEY ARE REMOVABLE**







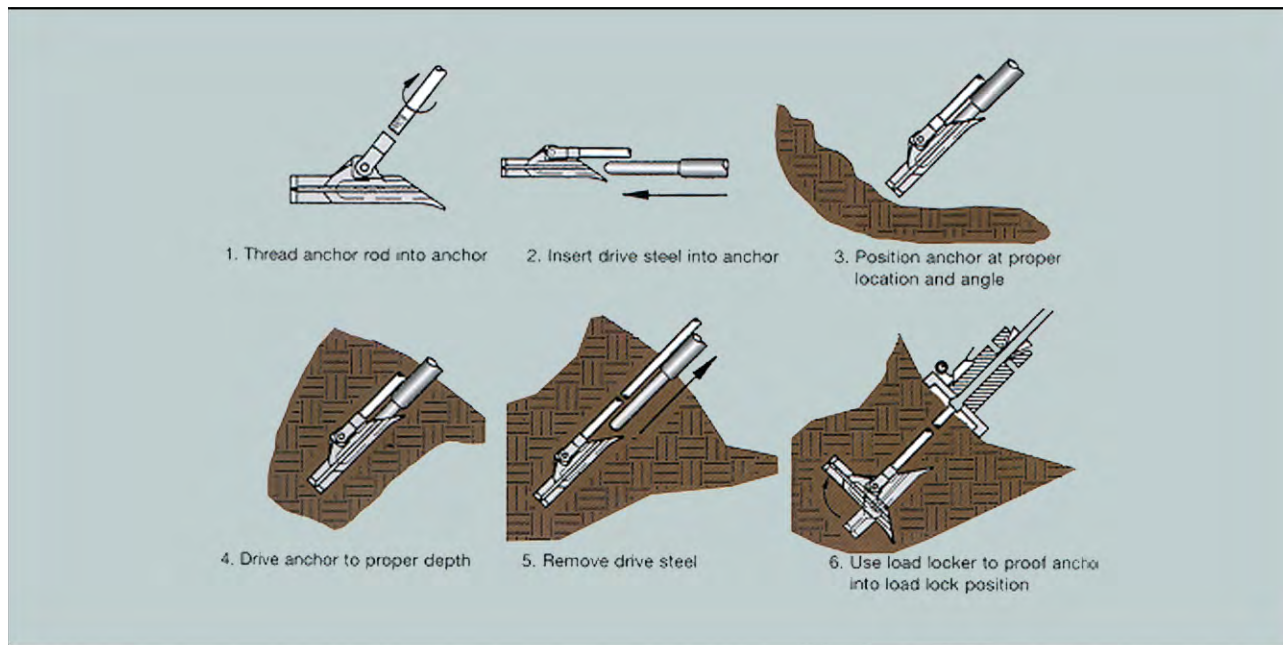
TORQ-BOX® Control Device



Digital TORQ-TRAK™

**TORQUE KIT AT END OF BOOM FOR DETERMINING HELIX
ANCHOR COMPRESSION CAPACITY**





FOUNDATION ANCHOR FOR SOLID SOILS

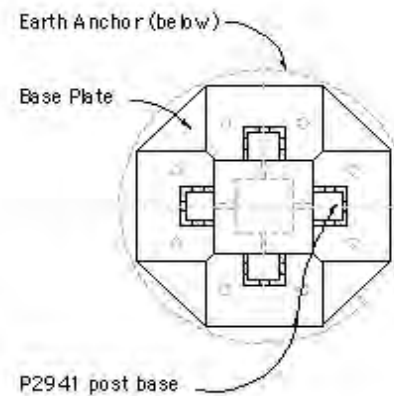


**SMALL LIGHT WEIGHT
EQUIPEMENT REDUCES
FOUNDATION IMPACT
ON SITE SIGNIFICANTLY**





**Center for Maximum
Potential Building Systems**
www.cmpbs.org



• Plan View of Column "A"

Qty:	Item Description:	Unit Cost:	Total:
1	Earth Anchor Assembly	125.00	\$125.00
1	Custom built Base Plate "A"	35.00	\$35.00
4	P2941 Post Bases	7.50	\$30.00
1	Misc. bolts and parts	Lump Sum	\$15.00

Total for this Assembly: **\$205.00**

Anchor Base Assembly



• 3D Perspective

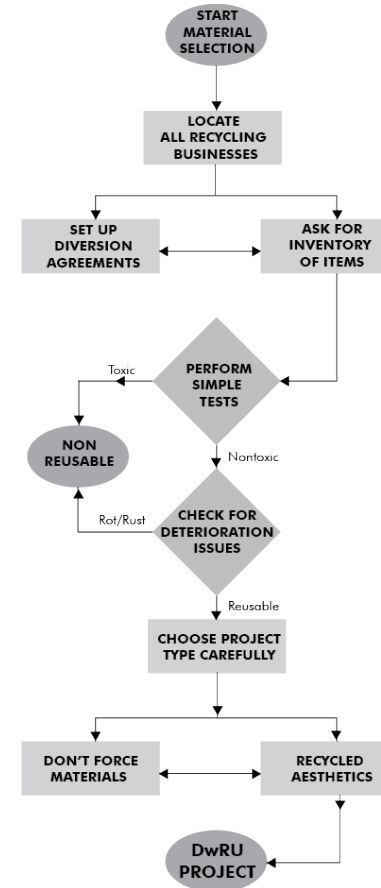
MATERIAL SYSTEM FOUR - DfRU
DESIGN BASED ON REUSE



design with reuse

PROCESS STAGES

- 1) **Locate all recycling business** - public and private including: metal (auto, farm, scrap), glass, paper, construction (windows, masonry, wood), organics (home, yard and county), tanks (drums, containers, culverts), Industrial – (oil fields, scrap) and look for sequestering invasive species.
- 2) **Set up Diversion Agreements** with collectors and pickup times.
- 3) **Ask for inventory of items** – start working photo inventory; start working atlas and/or web site called JUNC – (Join Us In Converting)
- 4) **Perform Simple Tests** (chemical and structural) and be cautious concerning potential toxicity.
- 5) Look for obvious and not so obvious **Deterioration Issues** like rust and rot.
- 6) **Choose project type and design elements carefully** using DwRU that promises long lasting success and ability to be reproduced. (examples: graded crushed concrete aggregate)
- 7) **Don't force materials together** with thermal, physical or chemical incompatibility.
- 8) **Design with recycled aesthetics** – don't fight it!



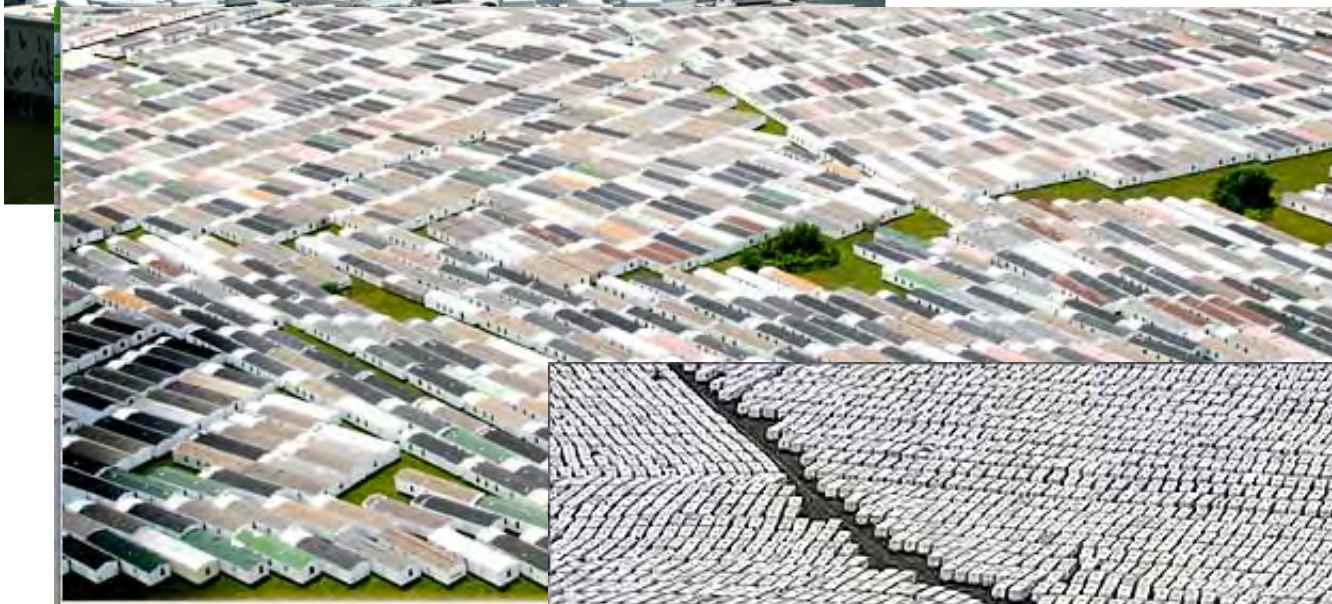
**PROCESS
DESIGN WITH REUSE**

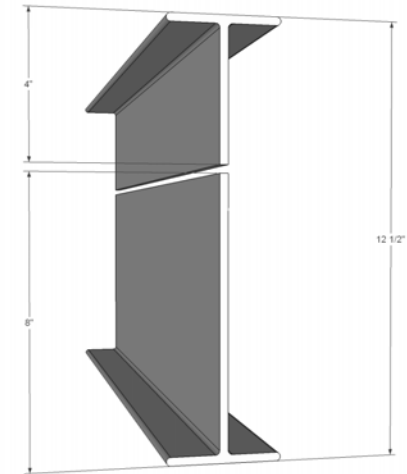


photo credit: NASA | MODIS Rapid Response Team | Marine
Photobank

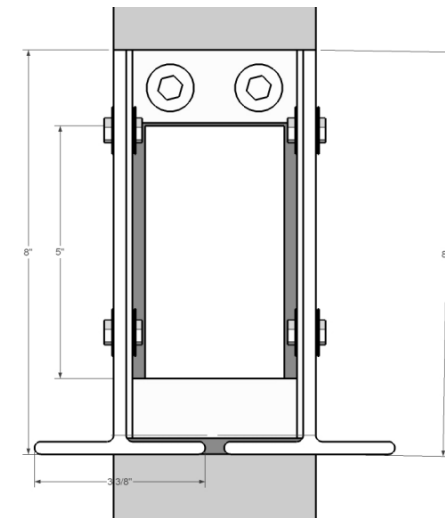
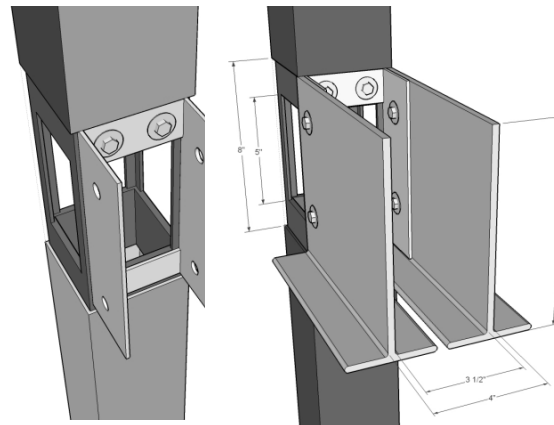
2005: HURRICANES KATRINA & RITA







BEAM SIZE TOLERANCES	NOMINAL DIMENSIONS
BEAM : B12-1/2 x 12.4	3.750
NOMINAL WL./FL. : 12.4# ± 0.31# (±2.5%)	2/8"
FLANGE WIDTH : ± .156"	300
DEPTH : +0.125" ± 0.093"	163
SQUARENESS: T+T = .032 (TOL. PER INCH OF FLANGE)	12.534
NOMINAL AREA : 3.66 in ²	
STRAIGHTNESS:	
CAMBER- 1/8" PER 5' OF LENGTH	
SWEEP- SUBJECT TO NEGOTIATION	
LENGTH: +2' : -0'	





1 MOTHBALLED FEMA TRAILER

reuse hardware
recycle materials
remediate toxins



2 ISOLATE CHASSIS

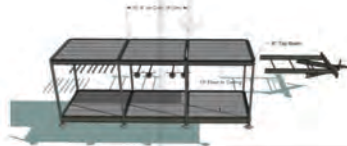


3 DISASSEMBLE CHASSIS



4 ASSEMBLE PRIMARY CHASSIS
FLOOR STRUCTURE

introduce 2nd chassis



5 CONNECT SECOND CHASSIS
ROOF STRUCTURE

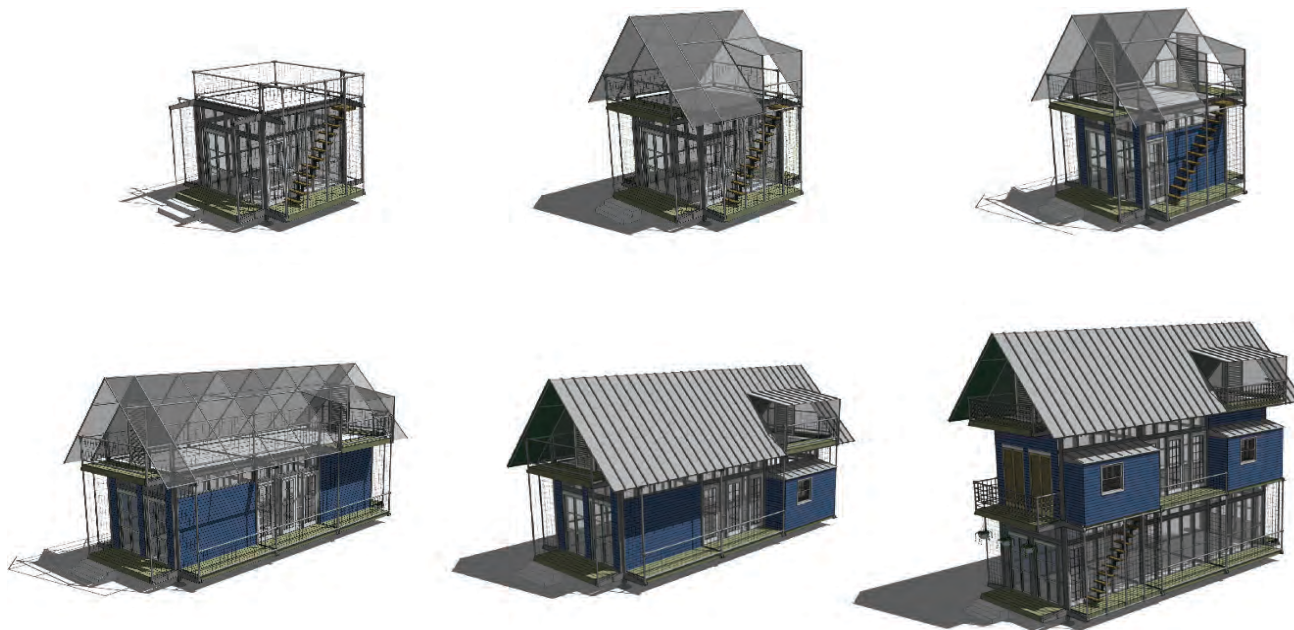
introduce prefabricated
building elements



6 LATERAL BRACING & ENCLOSURE

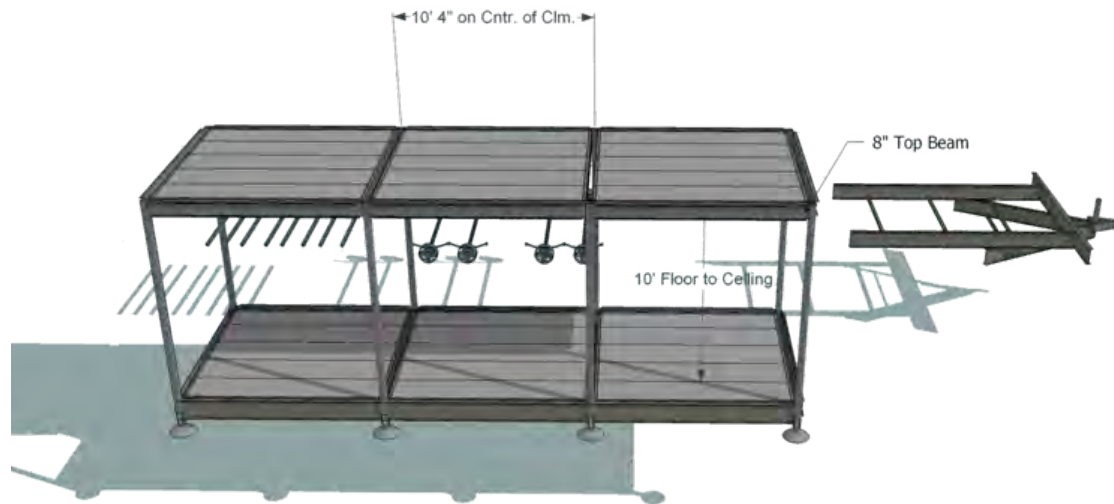
New Orleans Vernacular Home base on - FEMA Trailer





1 GROWTH CONFIGURATIONS

New Orleans Vernacular HomWorks™ - HomCore™

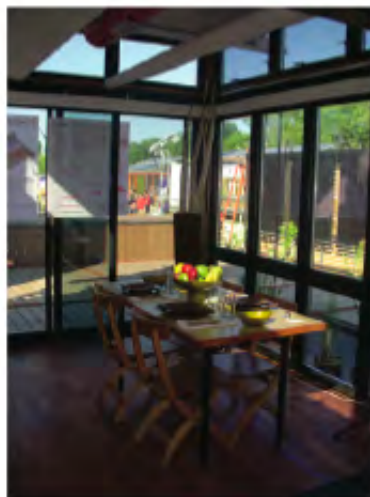




SOLAR DECATHLON: TEXAS A&M UNIVERSITY







MATERIAL SYSTEM FIVE – SILICATED WOOD & CLT

**Silicated
Fire Resistant- Rot proof – 100 year
wood**

T2EARTH



www.timbersilwood.com

T2EARTH – 2.5 times the strength



Properties	TimberSIL [®] Glass Wood Fusion	Beech	Oak	Douglas Fir	Radiata Pine	SPF (stud)
Strength (rupture) MOR (psi)	16,000	14,900	14,300	11,900	11,700	10,200
F _b (psi) (Grade 1, 2x4)	2,700	1,810	1,425	1,600	1480	690
Strength (elasticity) MOE (psi)	1,900,000	1,720,000	1,820,000	1,490,000	1,480,000	1,000,000
Compression parallel to grain (psi)	7,100	7,300	6,090	6,230	6,080	5,600
Compression perpendicular to grain (psi)	2,124	1,000	870	740	610	580
Tension parallel to grain (psi)	15,000	9,529	8,700	11,000	11,000	4,600
Shear parallel to grain (psi)	1,600	2,000	1,390	1,510	1,600	1,150
Hardness (lb)	1,012	500	1,060	510	750	510

www.timbersilwood.com



Graphite Apartments
London, 2008

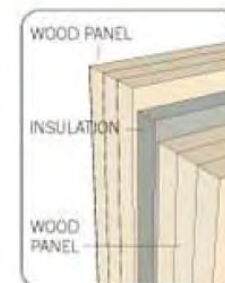
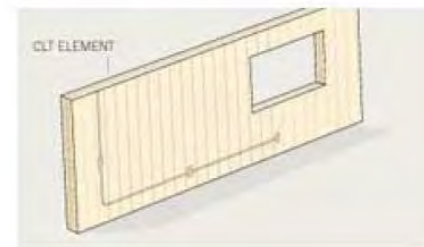
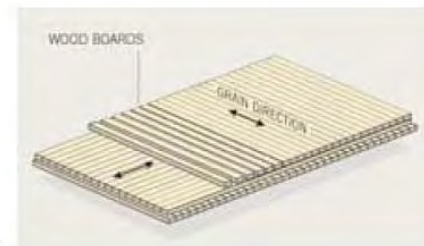
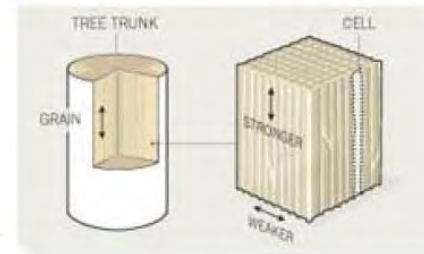
Waugh-Thistleton Architects

Cross-Laminated Timber (CLT)

Result of desire to reduce carbon emissions not only of finished building but of entire process.

Wood stores carbon as it grows.

186 tonnes carbon stored in the CLT of this building







Exposed solid wood structure



Conventional drywall cladding



Forte Apartments in Melbourne, by Lend Lease
Commenced 2012. Will be world's tallest wood frame building.

Reduces CO₂ equivalent emissions by 1,400 tonnes compared to same size concrete & steel structure.

Material system six DfD – Design for Assembly? or Disassembly?

OFF SITE BUILDING SYSTEM FABRICATION

- **IS FASTER AND MORE PROFITABLE**
- **REDUCES MATERIAL WASTE**
- **LOWERS ON SITE CONSTRUCTION COSTS**
- **LOWERS SITE IMPACTS**
- **LOWER URBAN AND NEIGHBORHOOD CONGESTION**



photo credit: Josh Canez

PORCH HOUSE: MILLER HOME



photo credit: Josh Canez

PORCH HOUSE: MILLER HOME





SOLAR DECATHLON: TEXAS A&M UNIVERSITY



photo credit: Lake|Flato Architects

PORCH HOUSE: MILLER HOME



photo credit: Lake|Flato Architects

PORCH HOUSE: MILLER HOME

THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS

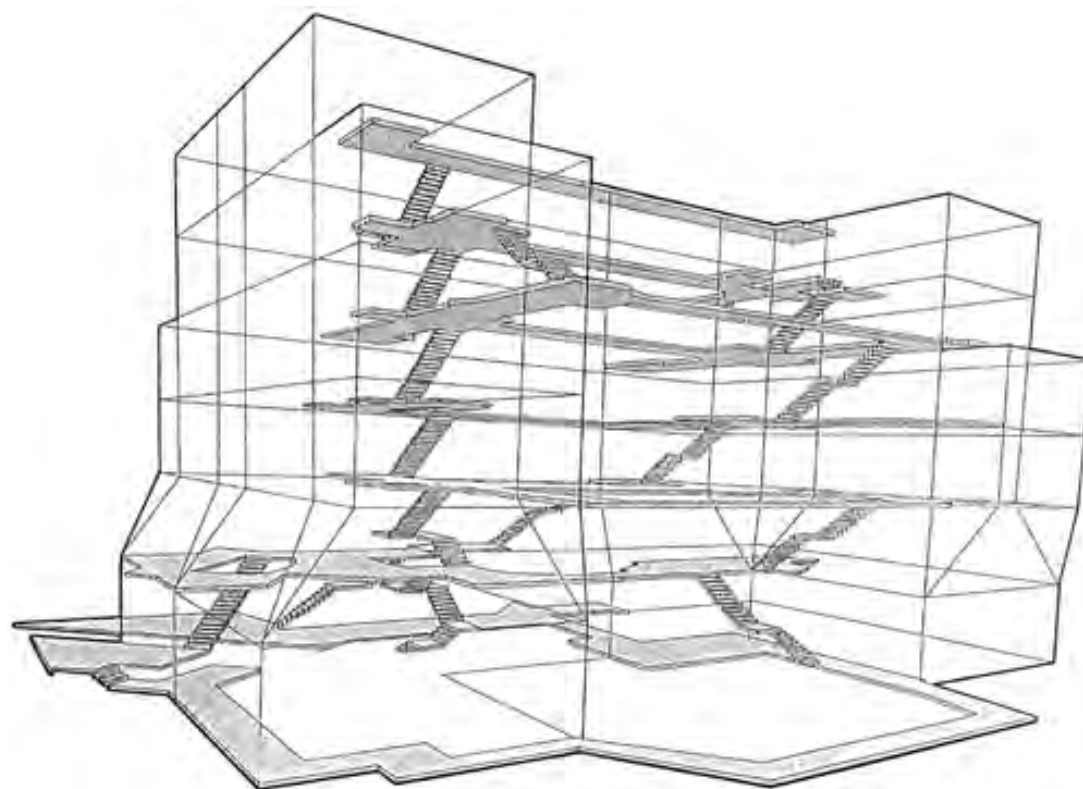


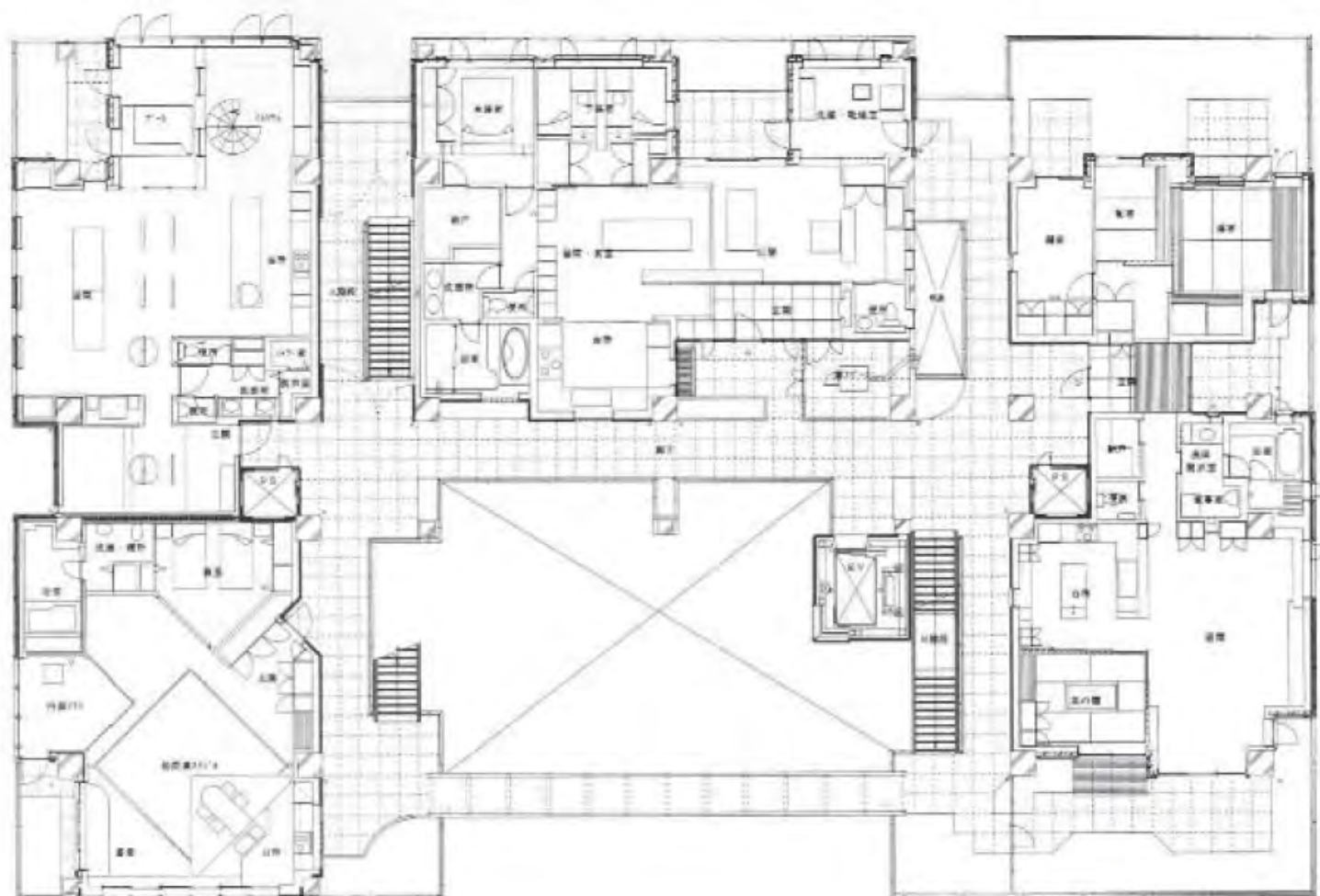
OSAKA GAS EXPERIMENTAL HOUSING
6-16 SHIMIZUDANI,
TENNOJI-KU
OSAKA CITY
JAPAN

NEXT21

Osaka Gas Experimental Housing







Community Systems

Three-Dimensional Street

- mixing an ecological garden with common space
- revive traditional urban areas without standardized approaches and pathways



High-storey Height Housing

- allow for more freedom and flexibility in design
- flexibility in utility systems
- increased storage capacity



Information System

- information networks will always improve and change, the building is designed around this reality
- cooking menu database
- remote control system for kitchen appliances
- security and emergency system

Greenery and Ecology

- spread out vertically as well as horizontally
- gardens not only for humans to enjoy, but to coexist with plants and animals
- life thriving on floors, walls, roofs to create a city/forest

Ecological Garden

- Rooftop environmental greenbelt – “Garden of Light”
 - breeding environment for butterflies
 - resting for wild birds
 - solar panels
- Green terraces, floors 2-6 – “Corridors of Flowers”
 - flowering trees that help guide butterflies emerging from roof garden
 - greater diversity of insects
- 1st floor environmental greenbelt – “Garden of Water”
 - small ponds that follow south slope
 - attract dragonflies and other insects
 - aquatic plants
 - easily accessible

Thermal Effect of Greenery

- shut out solar radiation
- eliminate latent heat caused by evaporation

Nature Information Center

- view the regeneration of nature into the city
- conduct research and exchange information
- managed by the Wild Bird Society of Japan





CONX[®] SYSTEM CONX[®] SYSTEM





FLEXIBLE PLUG AND PLAY HIGH RISE ERECTORE SET



Building System Seven –

A carbon, water, health, Balanced Cement

“Cement production is growing by 2.5% annually, and is expected to rise from 2.55 billion tons in 2006 to 3.7-4.4 billion tons by 2050”

“A single industry accounts for around 5% of global carbon dioxide (CO₂) emissions. Concrete is the second most consumed substance on Earth after water.”

- Rubenstein, Madeleine. “Emissions from the Cement Industry”
State of the Planet, Columbia University. 2012



CEMENT|GALVESTON

TEXAS IS #1 IN DISASTER & CEMENT PRODUCTION

DISASTER

By State:

	STATE	NUMBER OF DISASTER DECLARED
1.	Texas	86
2.	California	78
3.	Oklahoma	70
4.	New York	65
5.	Florida	63
6.	Louisiana	58
7.	Kentucky	55
8.	Alabama	55
9.	Missouri	53
10.	Arkansas	53

CEMENT PRODUCTION

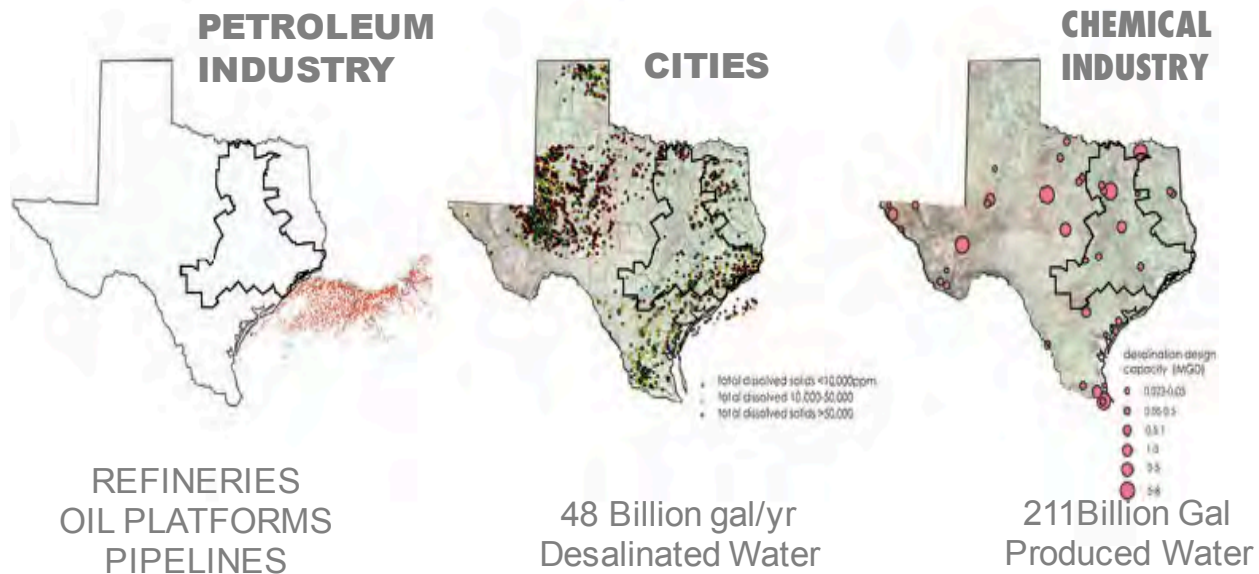
1. Texas

2. California
3. Missouri
4. Florida
5. Pennsylvania
6. Michigan
7. Alabama



CEMENT|GALVESTON

Saline Water Resources in Texas



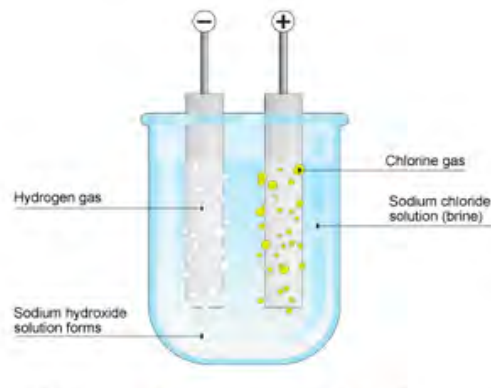
TEXAS possesses **110% MgO cement** compared to portland cement

CEMENT | GALVESTON

Methods of Desalination & MgO Procurement

100 million GPD sea water Desalination plant:

80 MGD Fresh Water
3000 TPD brine for NaOH,
HCL & Chlorine
108 TPD Cement
10 MWH Green Power



Salt Pond



Waste Heat



Electrolysis

Solar Stills



High Temp
Solar



Membrane



MANUFACTURERS

Dastech International, Inc. [NY]
 Noah Technologies Corporation [TX]
 Allan Chemical Corporation [NJ]
 Continental Chemical USA [FL]
 Lintech International, LLC [GA]
 Prinova Group [IL]
 Martin Marietta Magnesia Specialities [MD]
 Magnesium Products Inc. [OK]
 Alcan International Network USA, Inc. [CT]
 American Borate Company [VA]
 Brand-Nu Laboratories, Inc. [CT]
 Canton Chem, Inc. [MD]
 Cater Chemicals Corp. [IL]
 Chemical Lime Co. [TX]
 George S. Coyne Chemical Co., Inc. [PA]
 GFS Chemicals Inc. [OH]
 H.B. Chemical, Inc. [OH]
 Premier Magnesia, LLC [PA]
 R.E. Carrol, Inc. [NJ]
 Seacole-Plymoth [MN]
 Skyhawk [TX]
 SolvChem, Inc. [TX]
 Thatcher Chemical [NY]
 The HallStar Company [IL]
 Vignesh Life Science Pvt. Ltd. [IL]
US Gypsum [PA]



PRODUCTS

GranCrete
 Ceramcrete
 AirKrete
 Magnum Board
 CeraTech
 Bindan Company



RESEARCH

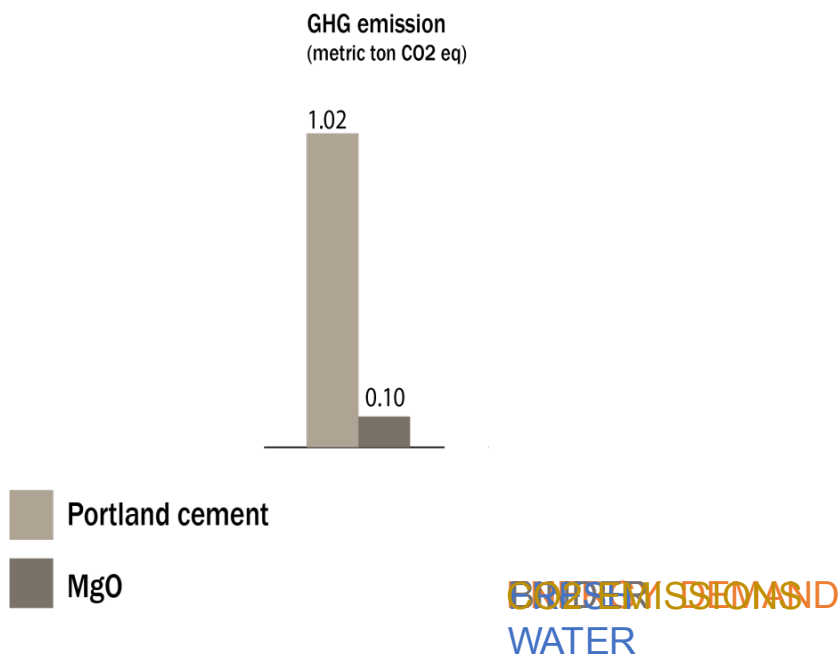
Sandia National Laboratories
 Los Alamos National Laboratory
 Argonne National Laboratory
 Ceralith
 Russian Federal Nuclear Center (VNIIEF)
 Mayak
 USDA Forest Service/Products Laboratory
 Natural Resources Research Institute
 (University of Minnesota-Duluth)
 Energy Center of Wisconsin

The same amount of
 carbon dioxide released
 in the production of
 MgO is **sequestered**
 in the curing process.



CEMENT | GALVESTON

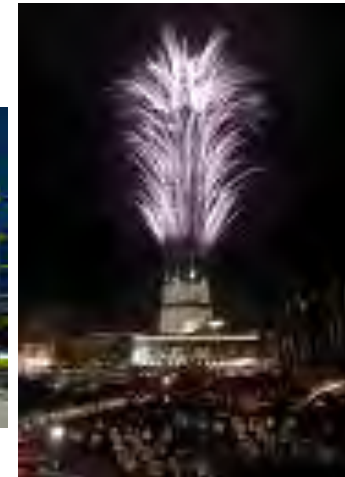
Portland Cement vs. MgO Cement





Taipei 101, Currently the tallest building in the world. All 101 stories use MgO sheeting on the inside and outside of all the walls, fireproofing beams and as the subfloor sheathing.

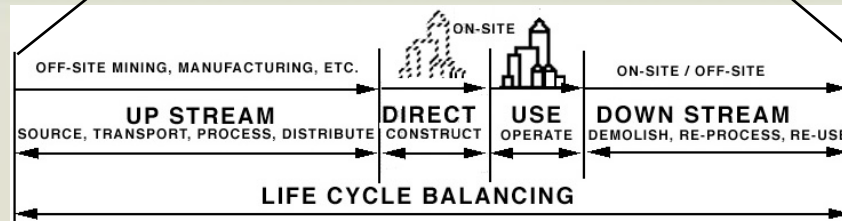
Source George Swansion



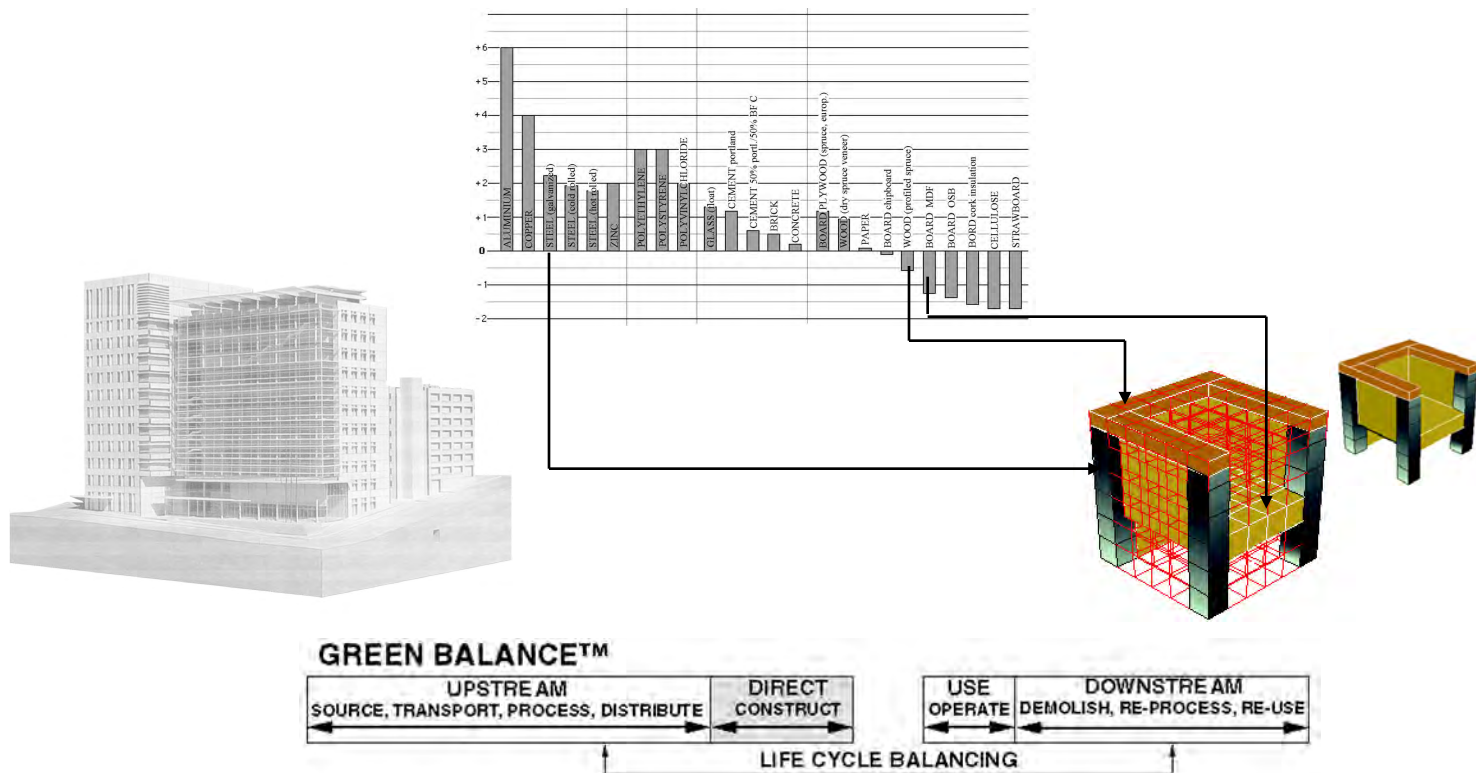
THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS



NATIONAL INPUT OUTPUT LIFE CYCLE ASSESSMENT MODEL



Building System Eight – CDIR
A net carbon neutral approach
to design that can set the



Life cycle CO₂ may be easier to attain at smaller scales.
 The carbon sink capacity of the biomass materials negates the upstream CO₂ emissions impact of all the materials used in the furnishing example illustrated above. A 50-100 year product lifetime is assumed.

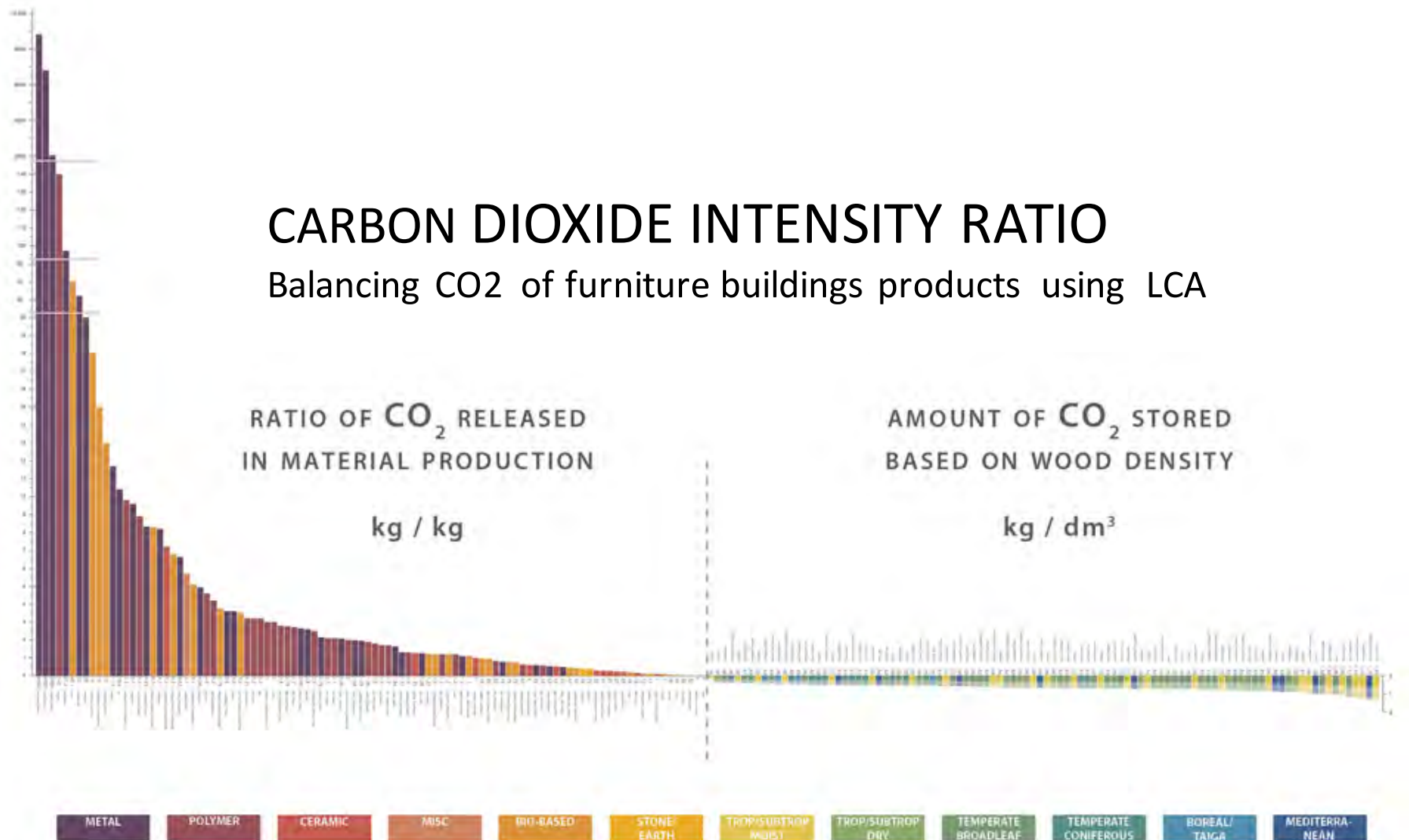
INTERIOR FURNISHINGS LIFE CYCLE BALANCING

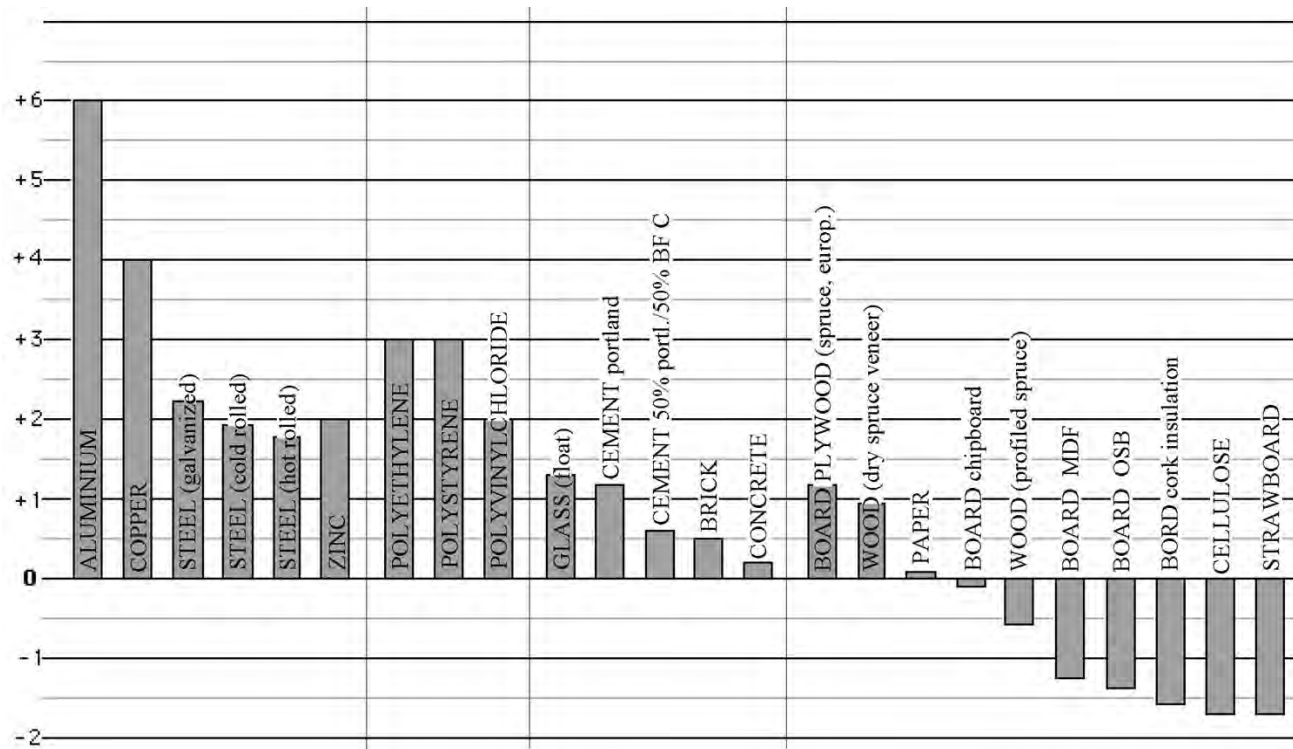
**GREEN
BALANCE™**



CARBON DIOXIDE INTENSITY RATIO

Balancing CO₂ of furniture buildings products using LCA





$$\text{CDIR} = (\text{CO}_{2e} - \text{CO}_{2s}) / \text{weight of material}$$

Where CO_{2e} = weight of upstream CO₂ emissions

and CO_{2s} = equivalent weight of CO₂ stored as carbon in the material

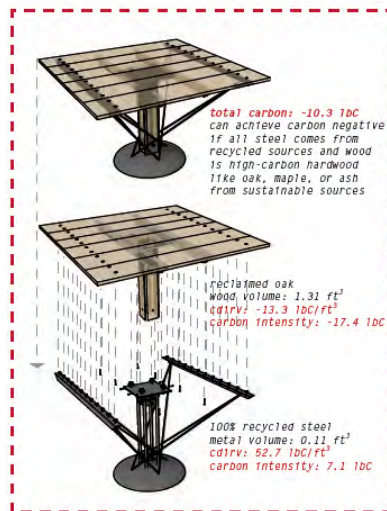
Positive ratios indicate net carbon dioxide sources; negative ratios indicate net carbon dioxide sinks.

CARBON DIOXIDE INTENSITY RATIO (CDIR) OF LONG-LASTING BUILDING MATERIALS

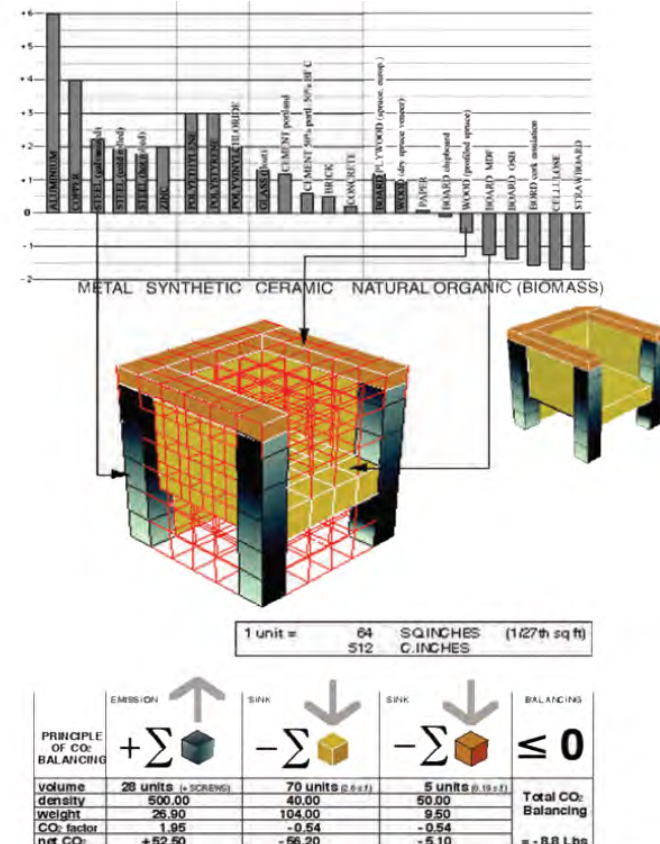
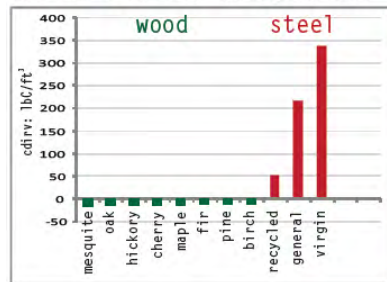
**GREEN
BALANCE™**







carbon balanced table
made from reclaimed oak and recycled steel





Credit: UT Health School of Nursing



Credit: © H-E-B