

## Lessons Learned - What I would do differently

- Humidity control in the basement during construction to prevent mold
- Make cistern room mold safe
- Have old house "ready for sale" before breaking ground on new house
- Use a plumber for solar hot water.
- Get a 12-month construction loan
- Better Cost Management (especially in the last quarter of construction)
- Include trim and doors in estimate...
- Use timer switches that positively use no electrical energy.
- Start excavation in or before August (if you only have a 3-person team)

## Serendipitous Success - What I would do the same

<b>Construction</b>	<ul style="list-style-type: none"> <li>▪ Solicit Input from friends, colleagues, builders, &amp; the community.</li> <li>▪ Take 2 years for planning and use the Internet for research.</li> <li>▪ Establish design goals &amp; values: What's important to you? (e.g., sustainable living, renewable energy, comfort, maintenance free)</li> <li>▪ Be the general contractor and have a time &amp; material contract</li> <li>▪ Hire Lyndon Clark Construction out of Plainview, MN: <ul style="list-style-type: none"> <li>▪ high quality, fair cost (\$25-\$35/hour)</li> <li>▪ highly versatile (driveway, excavation, footings, cement flatwork, ICF blocks, framing, siding, roofing, plumbing, ventilation, tiling, drywall, painting, flooring, trim work, etc.)</li> </ul> </li> <li>▪ Long-term perspective: Live in it "until we die"; do the right thing now.</li> <li>▪ Finish everything it now - then enjoy it &amp; save money in the long run.</li> <li>▪ Build in: Fillmore County, Lanesboro; Secluded building spot.</li> </ul>
<b>Design</b>	<ul style="list-style-type: none"> <li>▪ Design it myself: Use 3D Home Design Planning Software</li> <li>▪ Passive Solar Design</li> <li>▪ Garage: attached, two-car, back-to-back on North side</li> <li>▪ Basement: full basement, 8-foot ceilings</li> <li>▪ Deck: wrap-around, 9 feet wide with, with "balconies"</li> <li>▪ Handicap-accessible: main floor living, future laundry hook-up, large-enough bathroom, 3-foot wide doors</li> <li>▪ Compact design: 1,440 sq. ft. for 3 Bedroom, 3 Bath, Kitchen, Living, Dining, Laundry, Pantry, Wardrobe</li> <li>▪ Optimized for our use: "How will we use it?" scenarios</li> </ul>
<b>Materials</b>	<ul style="list-style-type: none"> <li>▪ Renewable Materials; Local, Regional, or Domestic Materials;</li> <li>▪ Health-Friendly Materials: Low VOCs/Offgasing (No: particle board, MDF, Formaldehyde)</li> <li>▪ Milk Paint, Clay Paint; Cellulose Insulation; Domestic Red Slate;</li> <li>▪ Domestic Stone for Masonry Stove, 100% Plastic Decking from Wisconsin</li> <li>▪ ICF blocks, Icynene, Certified Lumber</li> </ul>

## Three (or more) Things You Can Do In Your Existing Home Today!

<b>1 Electrical</b>	<ol style="list-style-type: none"> <li>1. Monitor your monthly/weekly/daily electrical usage [ \$0 ] <ul style="list-style-type: none"> <li>▪ Measure your electrical loads with a Kill-A-Watt Meter [ \$35 ]</li> </ul> </li> <li>2. Compact-Fluorescent (CF) Light Bulbs: [ \$3-\$15 ] <ul style="list-style-type: none"> <li>▪ 25%-30% energy of Incandescent</li> <li>▪ colors (warm, full-spectrum); "bulb" shaped; dimmable</li> </ul> </li> <li>3. Eliminate Phantom Loads <ul style="list-style-type: none"> <li>▪ Hunt for Phantom Loads with a Kill-A-Watt Meter [ \$35 ]</li> <li>▪ Switched Power Strip [ \$10-\$30 ]</li> <li>▪ Switched Outlet [ \$100s ]</li> <li>▪ Remote-controlled outlet [ \$30-\$50 ]</li> <li>▪ Timed Outlet (programmable) [ \$20 ]</li> </ul> </li> </ol>
<b>2 Heating</b>	<ol style="list-style-type: none"> <li>1. Solar Hot Water [ \$2,000-\$5,000 ] <ul style="list-style-type: none"> <li>▪ \$2,000 Tax Credit in 2006 &amp; 2007</li> <li>▪ 5-8 years payback period</li> </ul> </li> <li>2. On-Demand/Tankless Water Heater [ \$700+install ] <ul style="list-style-type: none"> <li>▪ Takagi TK-2 (Propane, Natural)</li> <li>▪ Fuels: Propane, Natural Gas, Electric</li> </ul> </li> <li>3. Triple-Honeycomb Shades (up to R20!) [ \$100-\$300 ]</li> <li>4. A 7-day Programmable Thermostat [ \$50 ] <ul style="list-style-type: none"> <li>▪ Turn down if out of the house for more than 4 hours</li> </ul> </li> </ol>
<b>3 Water</b>	<ol style="list-style-type: none"> <li>1. Monitor your monthly/weekly/daily water usage [ \$0 ]</li> <li>2. Have Your Well Water Tested (County/Extension Service) [ \$0? ]</li> <li>3. Low-Flow Showerheads (bricor.com) [ \$40-\$80 ]</li> <li>4. Low-Flush, Dual-Flush Toilets (caravelle.com) [ \$300+install ]</li> <li>5. Collect Rainwater for the Garden [ \$50-\$2,000 ]</li> </ol>



## Staying Protected & Healthy: Shelter/Building Materials

- Insulated Concrete Forms (ICF) from the footings to the gable
- Certified Lumber for interior stud walls (only 5% more)
- Fiber Cement Board Siding (25-year paint warranty)
- Decking is 100% recycled plastic & maintenance free
- Aluminum Railing is maintenance free
- Paint: Milk Paint & Clay Paint. No VOC primer.
- Lacquer: water-based (for trim & doors & cabinets)
- Tiles: some from local/regional tile artists
- Countertops: MN Granite, MN Limestone, VT Slate
- Flooring: Bamboo, Cork, Domestic Red Slate, Tiles
- Cabinet Panels: Sunflower Shells, Millet in Acrylic

## Staying Warm: Heating

Systems	1: Passive Solar	2: Masonry Stove	3: Radiant In-Floor
Sources	sun	wood	sun & wood
Collection	fiberglass windows		solar water panels
Control: On	sunny day	one burn a day	thermostats in
Off	overhang/shades	no fire	12 zones
Storage	concrete floor, thermal mass	4-5,000 pound mass of stone & firebrick	260 gallons water, concrete floor
Distribution	radiation from thermal mass, convection with open floor plan		PEX tubing in floor, DC pumps
Insulation	<ul style="list-style-type: none"> <li>11" ICF (comparable to R-40 12" stud wall)</li> <li>8-12" Icynene (comparable to R70+ fiberglass)</li> <li>2 &amp; 3-pane fiberglass-frame windows (U&lt;0.32)</li> </ul>		
Passive Solar Design	<ul style="list-style-type: none"> <li>True south orientation</li> <li>Windows with high heat gain coefficient (&gt;0.60)</li> <li>thermal mass for storage</li> <li>engineered overhang (shades sun out in summer)</li> </ul>		
Masonry Stove	<ul style="list-style-type: none"> <li>convoluted flue system with high thermal mass</li> <li>fire once a day - burn for only two hours</li> </ul>		
Radiant In-Floor	<ul style="list-style-type: none"> <li>hot water in tubes embedded in floor</li> <li>nice even heat - warmer at feet than at head</li> <li>12 zones with programmable thermostats</li> <li>heated by solar hot water panels &amp; masonry stove</li> </ul>		
Backup	Throw a log on the fire		

## Staying Clean: Water

System	<ul style="list-style-type: none"> <li>Rainwater collection with standard septic</li> <li>No drinking water</li> </ul>
Collection	<ul style="list-style-type: none"> <li>Standing-seam steel roof (30¢/ft<sup>2</sup>)</li> <li>Gutters with leaf protection (\$40/foot)</li> <li>Downspouts (4" PVC pipe)</li> <li>"roof washers" - first flush diverter</li> </ul>
Storage	<ul style="list-style-type: none"> <li>Three 2,500 gal cisterns &amp; 300 gal settling tank</li> <li>1,500 gal tank for garden</li> </ul>
Conservation	<ul style="list-style-type: none"> <li>low-flush, dual-flush toilets, low-flow shower</li> <li>water-efficient laundry, dishwasher</li> <li>elbow-operable faucets</li> </ul>
Filtration	none to date (5-6 gal/week bought at store)
Backup	water from dairy/fire truck

## Sources & Resources

Accessibility Advice	Andy Bunge, Lanesboro, MN
Bamboo	Teragren
Battery	Hup Solar One (thesolar.biz)
Certified Lumber:	CertifiedWoodProducts.net, Dan Haugen, Minnetonka, MN
Cistern Tanks	Norwesco, MN (thesolar.biz)
Construction	Lyndon Clark, Plainview
Cork Flooring	Expanko
Countertops	AFM Countertops, Rochester
DC Fans	Fanworks.com (thesolar.biz)
DC Pressure Pump	Dankoff Flowlight
Deck Railing	Crystalite, WA
Decking	RenewPlastics.com, WI
Dishwasher	Asko
Education	Midwest Renewable Energy Fair, WI; Libraries
Electrician Advice	Dan Anderson, Lanesboro
Financing:	F&M, Mary Schwarz, Chatfield
Fridge	Kenmore (370 kWh/year)
Gas stove	Premier Peerless
Gutter	Leafguard, Byron, MN
HRV	Recoupaerator
ICF Distributor:	tristateicf.com, Lyndon Lee, Mabel
Inverter	Outback (thesolar.biz)
Kitchen Cabinets	Andy Bunge/Jordan Kiel, Lanesboro
Laquer, waterbased	AFM Safecoat
Manifold	Jürgen Lüderitz, Germany
Masonry Stove:	Gimme Shelter, Mark Klein, WI
Materials	Kreofsky Supplies, Plainview
Medaillon/Compass	mtiledesign.com
Millwork	Region Millworks, Matt Sveen, Elgin
MN Tile Festival	handmadetileassociation.org
Paints	BioshieldPaint.com
Primer (low VOC)	AFM Safecoat
Septic	Daren Hofschulte, Eyota
Siding:	Weatherboard or Hardiplank
Slate	SheldonSlate.com
Spend big money at	Menards, Rochester
Stove Facing	Ted Wilson et al., Decorah
Sunflower Boards	Environ (Dakota Burl), Mankato
Switch Covers	switchhits.com ("funky ceramics", MN)
Tank-less heater	Takagi TK-2
Tiling	Dave Jorde, Eyota
Toilets	Caroma Caravelle, Australia/USA
Wind Meter	winddatalogger.com, James Jarvis, Winona
Wind Generator	Bergey XL.1
Windows	Thermotech Windows
Winona Limestone	Biesanz, Winona

## Staying Comfortable: Electricity

Systems	Small Wind Mill	Solar (PV) Panels	LP Generator
Sources	Wind	Sun	Propane
Storage	24 DC lead-acid, deep-cycle battery, 33 kWh		
Distribution	Inverter/Charge Controller, standard 120 VAC wiring		
Conservation	<ul style="list-style-type: none"> <li>energy-efficient fridge, gas stove, washing machine, dishwasher, air-to-air exchanger; central vacuum</li> <li>compact-fluorescent, fluorescent or halogen lights</li> <li>LED light rope for indirect ambient lighting</li> <li>motion detectors</li> <li>timed, switched &amp; remote-controlled outlets to eliminate phantom loads</li> <li>home automation (planned)</li> </ul>		
Backup	Propane Back-up Generator		

## Staying cool: Cooling

Passive	Active
<ul style="list-style-type: none"> <li>south-side overhang</li> <li>thermal mass</li> <li>low heat-gain windows on west side</li> <li>window shades</li> <li>awning on west-side</li> </ul>	<ul style="list-style-type: none"> <li>Six DC ceiling fans</li> <li>windows placed for cross-ventilation</li> <li>special air-to-air exchanger mode: exhausts warm air at night</li> </ul>

## Paying for it all: Financing, Finances & Numbers

Construction Loan	<ul style="list-style-type: none"> <li>Gathered detailed estimates, prepared "exposé"</li> <li>Ongoing communication via eMail</li> </ul>
What did the unusual stuff cost?	<ul style="list-style-type: none"> <li>Off-Grid Electric: \$18k to date, about ~\$25k total (versus \$12k for Tri County to hook us up)</li> <li>Rainwater Collection: \$7k (versus \$22k+ for well)</li> <li>Solar &amp; Tankless Hot Water: \$3-5k</li> <li>Passive Solar: Slab +\$5k, Windows +\$5k</li> <li>Masonry Stove: \$25k (starting at ~\$10k)</li> <li>Cellulose: \$2,300, Icynene: \$3,600</li> <li>ICF: \$36,000 from footings to gables</li> <li>Certified Lumber: 5% more (\$400)</li> <li>Bamboo &amp; Cork: \$6.50/\$7.50 per sq. ft.</li> <li>Milk/Clay Paint: \$40/gal.</li> <li>Tiles, Slate, &amp; Labor: \$25k</li> <li>Custom Kitchen: \$20k</li> <li>Custom trim work, doors: \$30k</li> <li>Custom stairs: \$8k</li> <li>900 sq.ft. Deck: \$18k</li> <li>100' x 10' Winona Limestone Retaining Wall: \$12k</li> <li>2,000 foot Driveway: \$30k</li> </ul>
Size	<ul style="list-style-type: none"> <li>4 bedrooms, 4 baths</li> <li>22 finished rooms, 4 closets, 2-car garage &amp; cistern</li> <li>~1,440 sq. ft. of living space above ground</li> <li>~1,000 sq. ft. of living space in lower level</li> <li>~3,650 sq. ft. of total (&amp; finished) space</li> <li>about \$115/sq.ft.</li> </ul>