

# Massive Passive: The Challenge of Incorporating Passive Energy Strategies in Developer Single-Family Suburban Housing

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Measurable success of sustainable energy systems in construction will require application on a sizable scale. However, wind and solar are still a very small percentage of building energy systems that rely heavily on fossil fuels. Single-family housing accounts for a huge amount of residential construction (the US Census Bureau reports levels of over one million single family home starts per year) yet passive houses make up only a tiny percentage of overall housing construction. With housing development companies producing the vast majority of new house construction, this segment of the market is prime for applying passive strategies that can affect major change in energy conservation. Yet developers typically design entire subdivisions with no regard to orientation to sun, wind and thermal efficiency. Why have developers stayed out of the passive energy housing market and what would it take to convince them of the feasibility of sustainable single-family housing? And why aren't architects more involved in suburban housing? Plenty of well-trained professionals who could lend their expertise have washed their hands of developer housing.

Research reveals surprisingly few passive single-family housing communities, and none on a vast scale. Passive houses have been around for decades so why haven't they made the leap in scale? This research/design project considers the biggest obstacles to

passive developer housing then tests these ideas through potential design solutions of a prototypical house (based on the Charleston typology) and a neighborhood master plan. This objective, to reveal the major challenges and the potential for bringing passive energy to the massive scale of developer housing, produced two main questions; how do we apply passive energy strategies to the pre-manufactured suburban house and how do we make passive houses marketable in a well-established industry?

The Challenge to Making Developer Houses Passive - Current developer housing is designed with little to no relation to the direct sun, wind movement, daylight or thermal efficiency. Houses in a typical subdivision are oriented towards the street regardless of cardinal direction. How can we adapt these non-directional houses to maximize natural environmental benefits such as:

- Orienting Towards the Sun
- Increasing Natural Ventilation
- Bringing Daylight to the Core
- Creating a Super-Insulated and Sealed Envelope

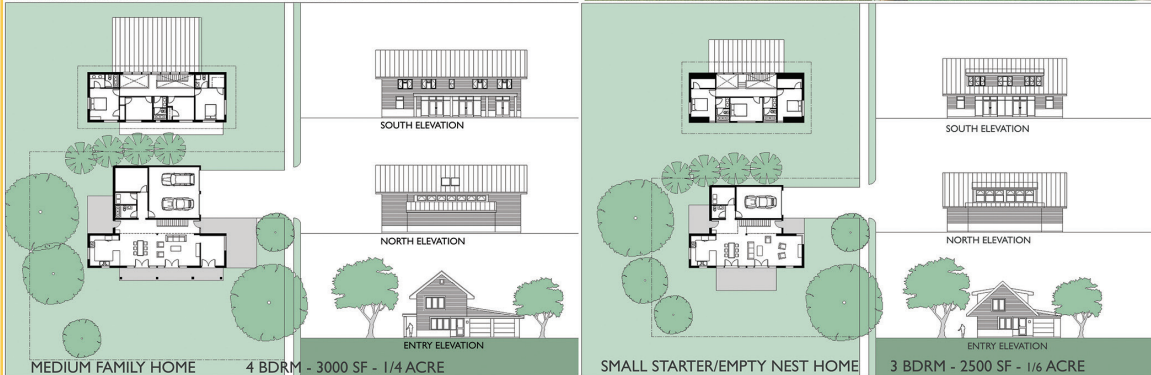
The Challenge of Making Passive Houses Developable - None of the changes above will matter if the houses won't sell. The typical developer house is primarily concerned with presenting a nostalgic image of house as "home" because that is what their clients

want, but most architects are not interested in reproducing repetitive, historical kitsch. So any design for passive suburban developments must be financially feasible and marketable and address the following issues:

- Conveying an Authentic Image of "Home"
- Making Passive Construction Cost Effective
- Avoiding Repetitive Communities and Houses

# MASSIVE PASSIVE APPLYING PASSIVE ENERGY STRATEGIES TO DEVELOPER SUBURBAN HOUSING

SUCCESSFUL SUSTAINABLE ENERGY REQUIRES IMPLEMENTATION ON THE MASS SCALE. SUBURBAN DEVELOPMENTS COMPRISE THE VAST MAJORITY OF HOUSING CONSTRUCTION YET HOUSES ARE DESIGNED WITH NO CONSIDERATION TO THE SUN AND WIND. THIS PROJECT APPLIES PASSIVE SOLAR HEATING, COOLING AND DAYLIGHTING TO AN ENTIRE SUBURBAN SUBDIVISION.

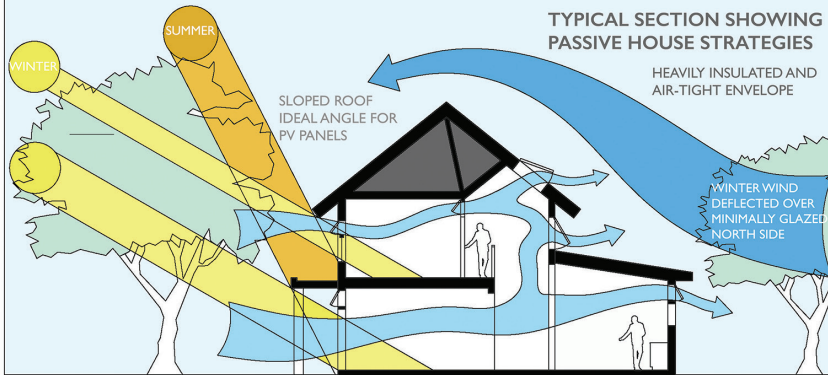


## MARKETING "HOME"

SUBURBAN SINGLE-FAMILY HOME BUYERS STILL DEMAND HOUSES THAT CONVEY THE IMAGE OF "HOME" AS SYMBOLIZED BY THE GABLE ROOF. THE NEW MODEL INCORPORATES THIS PRACTICAL ROOF TYPE BUT IN A NON-HISTORICAL, FUNCTIONAL AND MODERNIZED INTERPRETATION.

## ORIENTATION

ALL MAJOR ROOMS ALIGN TOWARDS THE SOUTH ALONG THE EAST-WEST AXIS WITH PROTECTIVE UTILITY SPACES ON NORTH. THE RESULT IS A SIDE-YARD FOCUSED DESIGN WITH ARCADE SIMILAR TO THE "CHARLESTON" HOUSE TYPOLOGY.



## TYPICAL SECTION SHOWING PASSIVE HOUSE STRATEGIES

HEAVILY INSULATED AND AIR-TIGHT ENVELOPE

SLOPED ROOF IDEAL ANGLE FOR PV PANELS

WINTER WIND DEFLECTED OVER MINIMALLY GLAZED NORTH SIDE

PASSIVE SOLAR - DEEP EAVES AND ARCADE SHADE HEAVILY GLAZED SOUTH FACADE IN SUMMER

MULTIPLE TRANSOMS PROTECTED FROM RAIN ALLOW CONTINUOUS VENTILATION

DOUBLE STORY CIRCULATION CORE PULLS HOT AIR UP AND OUT WHILE ALSO DAYLIGHTING INTERIOR CORE



## AVOIDING REPETITION

TO RELIEVE AN UNRELENTING GRID CAUSED WHEN ALL HOUSES FACE ONE DIRECTION, NEIGHBORHOODS ARE DEFINED BY HOUSES OF DIFFERING SCALE, GENTLY CURVED AND ANGLED STREETS (WITHIN 20 DEGREES OF SOUTH), POCKET PARKS AND TREE-LINED MEDIANS. USING AN EXISTING DEVELOPMENT SITE PLAN AS A BASE, MORE EFFICIENT PLANNING INCREASED THE TOTAL LOTS FROM 45 TO 86 TO SAVE LAND.

