

# Pricing the Factory-Built House

**The design of a prefabricated house is not too difficult. Production is relatively simple. But to select and train a vast number of dealers who can go and sell houses day in and day out, and make a living at it, is the major problem.**

—Foster Gunnison

Dwarfed by massive images of automobiles plastered over a neoclassical frieze, a man studies an intricate, sectioned motor of a modern automobile. Far above his head an image of two searching auto headlights, pronounces: “Ford ... Ford.” This vivid scene, with its bold juxtapositions, stands above the laconic title of Le Corbusier’s visionary essay: *Maisons en Série* (Mass-Production Houses). It recounts a dream—as yet unfulfilled in 1923—to conceive, develop, produce, and live in factory-built houses. “A great epoch has begun,” Le Corbusier declared, “Industry ... has furnished us with new tools adapted to this new epoch.”<sup>1</sup> Although it seemed that the technical challenges of producing houses in factories had been nearly resolved, the huge effort of convincing people to step into this new epoch had barely begun. “*The right state of mind does not exist,*” Le Corbusier announced; Architecture must bring about “revision of values,” a “mass-production spirit” consistent with “economic law.”<sup>2</sup>

Nearly a century later, echoing Le Corbusier, Stephen Kieran and James Timberlake lamented, “the architect awakes from an 80-year dream to find that ... all appears different yet is in fact the same.”<sup>3</sup> Their book, *Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction*, evokes the same immanent but unfulfilled dream, and its assessment of efforts toward achieving it: “A Century of Failure.”<sup>4</sup> They attributed this in part to architects and policymakers who failed to recognize that in “Western democracies, the market... is the only reliable long-term agent of change.”<sup>5</sup> Despite this, they, like Le Corbusier, had almost nothing to say about how to address the market for factory-produced houses.

“Mass-Production Houses” and *Refabricating Architecture* bracket a long and disappointing trend of failure that has been partly the fault of the visionaries themselves. Instead of considering how architects collaborating with industry can convince people to buy and enjoy living in factory-built houses, they repeatedly ask: why can’t the house be produced with the same efficiency, speed, economy, and quality as an automobile? It turns out that this is the easy question. As Foster Gunnison, whose company was capable of producing a house every 25 minutes,<sup>6</sup> told a group of MIT students in 1953, “the design of a prefabricated house is not too difficult. Production is relatively simple. But to select and train a vast number of dealers

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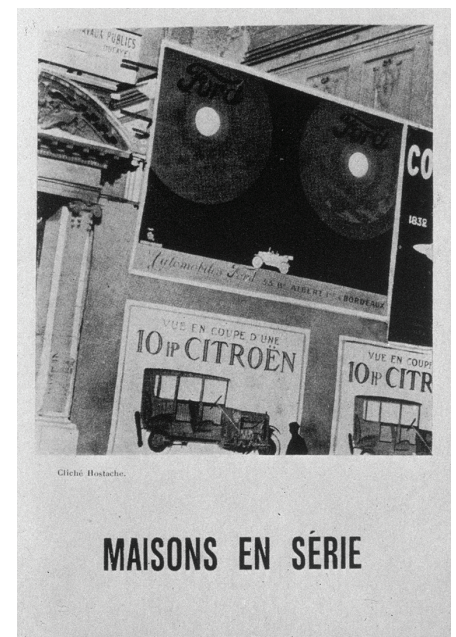


Figure 1: Le Corbusier, *Towards a New Architecture*, “Mass-Production Houses,” 1923

who can go and sell houses day in and day out, and make a living at it, is the major problem.”<sup>7</sup> That same year, the Cornell University Housing Research Center’s *Marketing Handbook for the Prefabricated Housing Industry* advised that “neither manufacturers of prefabricated housing nor dealers were employing recognized procedures of effective marketing.”<sup>8</sup> Kieran and Timberlake themselves pointed out that the architecturally-significant factory-built house is readily achievable, a fact exhibited repeatedly over the last ‘century of failure’ in prototypes received enthusiastically by the public but purchased by almost no one.

Meanwhile, the manufactured/mobile home industry has produced, sold, and placed millions of inexpensive, but architecturally uninspiring factory-built houses throughout the United States.<sup>9</sup> Architects find these circumstances especially disheartening because apparently good designs have failed to sell while indifferent designs have proliferated. It is easy to dismiss this as merely “automating mediocrity,” as Kieran and Timberlake did; however, the reality is that consumer choices are almost always strongly constrained by cost.<sup>10</sup> Low price is, naturally, an important aspect of almost any factory-produced house scheme.

A crucial challenge, then, is to sell the well-designed factory-built house in a price-driven market. Looking past the disappointment of our ‘century of failure’ brings to light many fascinating, if unsuccessful, efforts in this direction. This essay seeks to learn from five mass-production house schemes that expressed the value of low cost in very different ways: the Aladdin Read-Cut House, Buckminster Fuller’s Dymaxion House, the Lustron Home, Operation Breakthrough houses at Lendemain in Kirkland, Washington, and Michelle Kaufmann’s Glidehouse.

The narrative of low cost in the marketing of these mass-production houses shifted over the last century as cultural values evolved. Within those general trends, companies have, of course, tried to gain advantage for their particular products. The earliest pre-cut, package houses advertised low cost primarily as a reward for homeowner labor.<sup>11</sup> After World War II, when middle-class demand for houses was exceptionally high, factory-built house schemes capitalized on American pride in its rapidly modernizing infrastructure and the country’s huge post-war manufacturing capacity. They did this by advertising technical or abstract price benefits accrued through savings of weight and time. Perhaps the most significant shift in the promotion of low cost for factory-built houses occurred in the 1970s, when manufacturers and government sponsors directed the emphasis of low cost specifically toward low income buyers. Firms marketing to middle class consumers, who were anxious to avoid association with “cheap” manufactured houses, deemphasized low cost as a primary feature of their products. Until the early 2000s, house manufacturers focused increasingly on “affordable housing,” and virtually abandoned other segments of the market. Over the last decade, a resurgence in the modernist dream of the factory-built house has attracted wealthier clients not because of low purchase price, but because sustainable manufacturing techniques appear to support a lifestyle that reduces building and planetary life-cycle costs.

#### **WORK = VALUE**

One of the most popular types of mass production for houses during the first half of the twentieth century was pre-cutting, in which all pieces were prepared at the factory and shipped to the consumer for on-site assembly. Advertisements for these products emphasized a range of benefits, including the integrity and service-orientation of the producer, quality of the product, speed of construction, and—most consistently—cost savings. As the industry matured, however, the story behind these cost savings evolved.

The North American Construction Company of Bay City, Michigan provides a vivid illustration of this trend. The company published its first catalog of Aladdin “Knocked-Down Houses” in 1908. It claims huge savings for clients, asserting that the six-room Dwelling House priced

## Put up an “Aladdin” Yourself

Don’t hesitate to send for an “Aladdin” house because you fear it is difficult to put up. There is no back-breaking, muscle racking, sawing, measuring, figuring or fitting to do. We do all that in our mill. Your “work” is driving nails.



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Figure 2: Aladdin catalog frontispiece, 1908

This is the new Lustron Home  
...the house America has  
been waiting for....



Here is America's new standard for living. It is the Lustron Home, produced in a factory to bring you the cost-saving benefits of volume production, unit assembly, precision engineering, and mass purchasing. It is a better house than many people ever expected to be able to buy—yet well within the means of anyone who can afford \$35 to \$50 a month for a home of his own. It offers cheerful convenience, room for living, the strength and permanence of modern steel construction—without the penalty of price.

Read some of the basic facts about the new Lustron Home here.

LUSTRON CORPORATION  
Box 2023 N. Columbus St. Siles



3

Figure 3: Lustron *Life* ad, 7/12/48

**ENDNOTES**

1. Le Corbusier, *Towards a New Architecture*, trans. Frederick Etchells (New York: Dover Publications, Inc., 1986) 225.
2. Le Corbusier, 227-229.
3. Stephen Kieran and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction* (New York: McGraw Hill, 2004) xi.
4. Kieran and Timberlake 105.
5. Kieran and Timberlake 105.
6. "Housing: Factory Built Solution?" *Time*, February 11, 1946, web <<http://www.time.com/time/magazine/article/0,9171,854164,00.html>>.
7. Phyllis M. Kelly and Richard W. Hamilton, eds., *Housing Mass Produced* (Cambridge, Massachusetts: Albert Farwell Bemis Foundation, Massachusetts Institute of Technology, 1952) 23.
8. Glenn H. Beyer and James W. Partner, *Marketing Handbook for the Prefabricated Housing Industry* (Ithaca, NY: Cornell University Housing Research Center, 1953) 5.
9. For example, the industry placed about 1.5 million such units from 2000 through 2014 (about 10% of all houses built during the period), and there are just under 7 million occupied manufactured/mobile homes in the United States today. Department of Housing and Urban Development, "American Housing Survey," Table C-01-AH, 2013, web <[http://www2.census.gov/programs-surveys/ahs/2013/AHS\\_2013\\_National\\_Tables\\_v1.2.xls](http://www2.census.gov/programs-surveys/ahs/2013/AHS_2013_National_Tables_v1.2.xls)>.
10. Kieran and Timberlake complain that for all its success, the industry has succeeded primarily in "automating mediocrity." Kieran and Timberlake 112.

at \$592<sup>12</sup> would otherwise be worth \$1200, and "is as good a building in every sense of the word for its size as money can buy."<sup>13</sup> It explains that cost savings derive almost entirely from the purchaser's labor, which requires "no experience or mechanical skill ... and no tool but a hammer."<sup>14</sup> Elsewhere, the catalog suggests other reasons Aladdin can "sell the best article of its kind at a price lower than any other," including the company's access to abundant, cheap lumber near its headquarters in Michigan and the large production volume of its mill.<sup>15</sup>

The cover of the 1909 catalog declares, "Manufacturers add value ... middlemen add cost."<sup>16</sup> Here the emphasis shifts, making less of the buyer's labor and drawing attention to savings generated from a direct company-client relationship that bypasses middlemen such as the timber cutter, mill owner, wholesaler, and local lumber yard.<sup>17</sup> Two slogans—both new in 1909—"Built in a day," and "Direct from the forest to the home," proclaim big time and cost savings for the client.

During the next decade, as the firm reached its peak productivity of about 1800 houses per month, the company replaced the unfortunate "Knocked-Down" house name with the "Readi-Cut" brand and oriented its marketing toward the more intellectually discerning, but manually capable consumer.<sup>18</sup> Its 1917 catalog, for example, proclaims leadership in "all things pertaining to Scientific Home Building" while emphasizing client relationships where "integrity prevailed."<sup>19</sup> An impressive-sounding "Board of Seven,"<sup>20</sup> guarantees these claims and upholds the highest design, detailing, and manufacturing standards. The customer, a "friend" credited for understanding the company's scientific claims and sharing its values, keeps "four or five hundred dollars" that middlemen would otherwise take as profit.<sup>21</sup> And of course he continues to save by "doing all the work," assisted in the cutting and fitting of parts by Aladdin's "modern power-driven machines [that] can do BETTER work at a lower cost than hand labor."<sup>22</sup>

**LIGHTNESS = VALUE**

After the war, with a huge housing demand and at least temporary scarcity of resources, Buckminster Fuller proposed that the biggest limitation for any industrialized housing scheme would be weight. He explained, furthermore, that inefficient use of heavy compressive materials, inattention to lateral loads, and spatially wasteful rectangular shapes had limited the progress of house design. Even a very modest traditionally built house of 650 square feet, he argued, required material exceeding 45 tons; plumbing and foundations increased that to 150 tons. Assuming annual demand of a million new houses, material expenditure at this level would far exceed the nation's shipping capacity, outstripping the movement of material even at the height of wartime productivity. Because shipping and material costs so strongly affect the price of factory-produced housing, Fuller suggested that manufacturers should limit the weight of the house as much as possible. This would save material costs for the homeowner and conserve the nation's construction resources.

Fuller's solution to these challenges was the aluminum-skinned Dymaxion House, to be produced in the repurposed Beech Aircraft factory in Wichita, Kansas.<sup>23</sup> While it differed radically in form from other mass-production house schemes, it departed even more so in terms of how it proposed to economize. Fuller aimed to reduce the weight of the house to about 3 tons through careful choice of materials and assembly techniques. By the beginning of 1946 Fuller had solved most of the technical and logistical issues, exhibiting the 1,075-square-foot prototype in Wichita. Despite its strange appearance, the resultant house—with its flattened dome shape and prominent wind scoop, its central mast, tensioned aluminum skin and immense plastic windows—generated huge interest. *Fortune* and *Life* magazines both published enthusiastic feature articles but wondered "Would people buy such a strange house?"<sup>24</sup> Apparently, many would: 30,000 people expressed interest in purchasing the \$6,500 unit soon after it went on display.<sup>25</sup>

It never went into production, though, so one can only speculate on how Fuller might have developed a marketing strategy for it. However, it is clear that Fuller's arguments concerning weight economy caught on. William H. Harman, for example, also began promoting his factory-built steel house in terms of weight, a point emphasized in a 1947 *Kiplinger* article that proclaimed, "a Harmon home weighs only about 22,000 pounds as compared with 92,000 pounds for a conventional home of comparable size."<sup>26</sup>

#### TIME = VALUE

From a sales standpoint, a far more successful, though ultimately failed,<sup>27</sup> mass-production housing venture of the 1940s was the Lustron Home, a small, "modified ranch style" house sheathed in porcelain enameled steel.<sup>28</sup> In terms of design, it was far more conservative than Fuller's scheme. It never demanded 'a new state of mind' in home buyers; rather, it promised to deliver traditional values of comfort and family pride at a higher standard.<sup>29</sup> One of its most important selling points, however, was pace: quick construction, easy monthly financing, long-term durability.

As with Fuller's house, the Lustron home—"the house America has been waiting for"—generated plenty of enthusiasm before production began. In early 1948, pre-production models exhibited in New York, Washington, Chicago, Detroit, Milwaukee, St. Louis, Des Moines, Indianapolis "and many other communities" drew huge crowds. National advertisements for the Lustron Home in *Life* magazine promising a "new standard of living" elicited more than 300,000 inquiries.<sup>30</sup> As production began ramping up later that year, the company claimed with pride its distinction as the first to produce houses, "after years of effort," entirely in the factory. "Somehow, some way," their advertisements proclaimed, "you knew that modern engineering 'know how' would go to work in home construction just as it has in automobiles. The Lustron Home is the answer..."<sup>31</sup>

Once the house went into production, Strandlund touted the speed with which the undertaking had gotten under way—less than a year from occupying an empty factory to the beginning of production, and he promising that "we will build, build, build as fast as human ingenuity, modern machinery, and the steel supply will permit" so that people could acquire a Lustron Home as soon as possible.<sup>32</sup> The price; however, presented a marketing challenge. As the early prototypes had gone up, Strandlund suggested that the Lustron Home would be quite inexpensive, "\$3000 to \$5000 less than cost of building conventional house of same size, but [with] features that cannot be obtained in any other house at any price."<sup>33</sup> Actual production costs proved to be significantly higher, so advertisements took a different approach to price.<sup>34</sup> Unlike most competitors, Lustron emphasized affordability relative to the homebuyer's income, rather than a total price: "And the beauty is, an average American family can afford it. If you make \$50 to \$60 a week, you can buy a Lustron Home."<sup>35</sup>

As production issues complicated delivery of the houses and gradually escalated its price well above that of comparable site-built houses, advertisements focused on other advantages besides price, one of which was the benefit of time. After a few Lustron Homes had been delivered, the company declared from experience that it could be "erected on site in three to four days from completion of the concrete foundation to putting key in front door."<sup>36</sup> Once people began moving in, advertisements exclaimed that housewives could keep it clean in "less than an hour a day."<sup>37</sup> And as more Lustron Homes occupied sites all over the U.S. the company re-emphasized that they were "precision engineered to last a lifetime."<sup>38</sup>

#### CONTEXT = VALUE

The Lustron Company was the most prominent of many failed industrial house prefabricators operating in the 1940s. In fact, of the 280 such companies recognized by the National Housing Agency in 1946, fewer than 100 were still in operation by the end of 1947.<sup>39</sup> This

11. As this market expanded to consumers with higher incomes, reduced labor costs had less direct value, and thus played a less important role in advertising copy.
12. Or \$492 as indicated in two other places in the catalog. North American Construction Company, *Aladdin Knocked-Down Houses* (Bay City Michigan, 1908) 9, 11.
13. Aladdin 1908 10.
14. Aladdin 1908 cover.
15. Aladdin 1908 4.
16. North American Construction Company, *Aladdin Knocked-Down Houses* (Bay City Michigan, 1909), cover, web <[http://clarke.cmich.edu/resource\\_tab/aladdin\\_company\\_of\\_bay\\_city/annual\\_sales\\_catalogs/pdfs/1909\\_fall\\_annual\\_sales\\_catalog.pdf](http://clarke.cmich.edu/resource_tab/aladdin_company_of_bay_city/annual_sales_catalogs/pdfs/1909_fall_annual_sales_catalog.pdf)>
17. The company's policy of cash-only sales also contributed savings by removing creditors.
18. Although sales declined steadily from this peak. Aladdin continued to produce Readi-Cut houses until 1982.
19. The Aladdin Company, *Aladdin "Built in a Day" House Catalog*, 1917, reprint (New York: Dover Publications, Inc. 1995) np.
20. Aladdin 1917 4.
21. This suggests a significant savings for buyers who can choose from among models costing between \$318.25 for the 320 sf. Selwyn and \$3420.00 for the 2704 sf. Villa (after a 5% cash discount).
22. Aladdin 1917 2, 3.
23. The brand name itself presented an unusual picture of what a modern home should become; combining the words "dynamic," "maximum," and "tension" it suggested a house driven by technology rather than a traditional image of home.
24. "Fuller's House," *Fortune*, April 1946, 166-72. "Fuller House," *Life*, April 1, 1946, 73-76.



25. By contrast, a typical, traditionally built home, produced under federal post-war housing programs cost approximately \$6,000, but was only 600 square feet. See Thomas T. Fetters and Vincent Kohler, *The Lustron Home: The History of a Postwar Prefabricated Housing Experiment* (Jefferson, North Carolina: McFarland & Company, Inc., Publishers, 2002) 4.
26. "Bill Harman Delivers His Factory House," *Kiplinger Magazine*, September 1947, 46. The Harman project won Rockefeller backing and a guaranteed U.S. Government purchasing contract of 4200 houses through 1947, although the company declared bankruptcy the following year because of "its inability to overcome the complexities of distribution and the difficulties of financing sales and erection. Production and consumer acceptance of our houses has never presented a serious problem." See, Burnham Kelly, *The Prefabrication of Houses* (Cambridge, Massachusetts: The Massachusetts Institute of Technology, 1951) 414.
27. In the end, the Lustron Home was a spectacular business failure despite tremendous government support and public interest. Virtually all start-up loans for Lustron, totaling more than \$37.5 million by mid 1950, came from the federal post-war housing programs. But the company was never able to deliver on its promise, or its loans. Excessive factory re-tooling costs, production missteps and delays, transportation cost overruns, relatively high unit costs, and increasingly negative press seriously hampered deliveries.

decline continued into the 1960s when, according to the U.S. Department of Housing and Urban Development (HUD) "studies found industrialized methods to be technically feasible, but ... social, economic, and political factors prevented their widespread use in the United States."<sup>40</sup> At the time, perennially acute housing shortages prompted HUD officials to suggest, nevertheless, that a "large-scale demonstration of industrialized housing construction methods could be a catalyst" to the industry, which could help satisfy the anticipated need for more than two million new houses per year in the early 1970s.<sup>41</sup>

In 1969 HUD therefor proposed the nation's largest ever effort to manufacture housing on a massive scale. Operation Breakthrough, "an action program to support the development of industrialized housing construction systems,"<sup>42</sup> resulted in the production of 2,794 factory-built prototype housing units on 9 test sites throughout the U.S., followed by an additional 20,000 or so production units manufactured by the participating firms. Despite these seemingly promising production numbers, they never approached the hundreds of thousands the endeavor was expected to produce. In their 1976 report to congress the directors of HUD declared this grand and expensive experiment a failure, inasmuch as "it did not create the large, continuous markets necessary for efficient industrialized housing construction."<sup>43</sup> The report cited many problems that contributed, such as conflicting building codes, labor opposition, and transportation costs. Marketing challenges were among the most intractable.

The Seattle area was the only Operation Breakthrough context that included both urban and suburban housing types in a single market. 236 prototype units took shape on two sites within 10 miles of downtown core—a multifamily urban site at 18th and Yesler with 58 units, and a suburban neighborhood in Kirkland with 178 single-family houses, townhouses, and condominiums. Program directors chose Boeing as the developer for both sites, not because it had any experience with housing, but because of its manufacturing expertise and extensive government and labor connections in the region. Its job was to keep things running smoothly for the participating housing manufacturers, which it generally managed to do.

Four manufacturers assembled the 178 units in the suburban site: Alcoa Construction Systems (86 units), Christiana Western Structures (54), Levitt Technology Corporation (28), and Material Systems Corporation (10). Each company employed a different system. Alcoa installed factory-built "wet cores" containing kitchens and bathrooms in site-built shells. Christiana used components prebuilt in the factory then assembled on site.<sup>44</sup> Levitt employed a system of room-sized boxes with pull-out bays and hinged roofs, which they shipped 2000 miles by train from their purpose-built factory in Battle Creek, Michigan. Material Systems used aerospace technology to produce fiberglass-reinforced panels, which they combined into modules to be assembled on site.

Marketing of these homes proved challenging because of their location in an already developed suburban area and because of a precarious local housing market in early 1972. Boeing hired a regional real estate group, Eastside Brokers Association (EBA), to coordinate sales. EBA, in turn formed a subgroup, Woodland Properties Inc. (WPI), with about 50 brokers who would sell the units. WPI proposed the site name, "Lendemain" and began selling the houses in July 1972. By the end of 1972, WPI had managed to sell only 10 units, so Boeing withdrew WPI's contract. An established local real estate office, MacPherson's Realty, took over and sold more than 100 houses in the first six months of 1973.

In strong contrast with marketing for earlier mass-production houses, the advertising for Lendemain by both WPI and MacPherson avoided the idea of factory production entirely. Instead, it emphasized the suburban context and numerous neighborhood amenities of the development: professionally landscaped yards, a clubhouse, pool, putting green, tot lots, rv parking, and eleven shared acres of wooded grounds with lighted trails. Although the development's name, "Lendemain" (French for the day after tomorrow), and slogan, "new

**Buy a new home in the woods with 11 acres of living room.**

Nearly a third of the land at Lendemain, new planned—environment community between Kirkland and Woodinville, is devoted to greenbelts, open space and recreation to enjoy with your new home. Ramblers, two-story, split-level homes and townhouses open today. There's a better home for your family in a better community now at Lendemain.

**\$28,800**  
An impressive entry with wrought-iron railing groats you when you step inside this 4+ bedroom, 2 1/2+ bath townhouse by LEVITT TECHNOLOGY. Built-ins include washer and dryer, oven-range, dishwasher and disposal. Full basement, professionally landscaped yard, many more features for family living.

**\$29,100**  
Long-lasting, easy to maintain aluminum siding is standard with this 4+ bedroom, 2+ bath two-story home by ALCOA. Also features shake roof, patio with private screen fencing, fireplace and professional landscaping. Convenient kitchen with built-in oven-range, dishwasher and disposal.

**A VARIETY OF EXCELLENT FINANCING PLANS AVAILABLE**

- Big community clubhouse and swimming pool
- Kids' wading pool
- Tot lot play areas
- Lighted trails
- Each home completely landscaped
- Parking space for recreational vehicles
- Underground utilities
- Quiet loop-road and private cable-tv
- Close to freeways and major shopping

**FURNISHED MODELS OPEN 9 A.M. TO DUSK**

**Lendemain**  
New as tomorrow

Woodland Properties Association, Inc. (206) 827-8666

Figure 4: Lendemain *Seattle Times* ad, 9/24/72

as tomorrow,” alluded to the forward-looking nature of the undertaking, advertisements only vaguely mentioned “innovative features” of the houses. Toward the end of 1972, as WPI struggled to complete sales, they made their most forceful, but still oblique, reference to technical innovation touting the “newest and most imaginative concepts in homebuilding today.”<sup>45</sup>

Price arose as a significant selling point only toward the end of WPI’s tenure, but again in reference to site amenities rather than the houses or their innovative manufacturing: “The price is right, too; for anyone who has dreamed of owning his own home in the woods in a really pleasant community.”<sup>46</sup> In its advertisements MacPherson also downplayed construction innovations, placing emphasis instead on “luxury” and interior features, noting for example, “you’d expect to pay thousands more for the space, quality, and luxury” on offer.<sup>47</sup> In reality, factory production provided no price savings in these particular houses, because they were relatively costly prototypes. Their price (about 10% below comparable houses in neighboring subdivisions) was artificially produced, since program subsidies covered about 40% of gross costs. Even so, advertising copy suggests that the 1970s suburban market was hardly interested in industrialization of houses or even construction innovation, so it was not used to motivate sales.

### VALUES = VALUE

With the failure of the Operation Breakthrough experiment, interest in mass production of innovative houses waned, even as sales of very low cost mobile homes and manufactured houses continued to expand.<sup>48</sup> Efforts to produce architecturally significant factory-built houses did not gain momentum again until the early 2000s when *Dwell* magazine invited 16 architects to design a “modern prefab home for \$200,000.”

While this was far more costly than a typical manufactured house, organizers of the competition suggested that price was an important factor nevertheless. Given that a “shack” in San Francisco might sell for \$650 a square foot, even the relatively high \$175-250 per square foot costs of *Dwell* houses would make modern design accessible to a large group of well-off but still cost-conscious buyers.<sup>49</sup> Even so, the *Dwell* effort shaped a new vision for factory-produced houses that was less strictly dependent on price. Organizers summarized the result somewhat wistfully after completing the first prototype by Res4 Architects and Carolina Building Systems in April 2004: “It is true that much of the appeal of prefab for the public has been tied to cost savings. At the present time, those savings are not as significant as the consumer might hope. But one cannot underestimate the efficiency and precision of this type of construction, if done right, and the value of the time saved in the process.”<sup>50</sup> For this category of factory-built house, low cost would have to assume more subtle characteristics.

First, the cost of the completed house would need a different standard of comparability, since its clients were not interested in the bottom end of the market. Certainly, in terms of scope—total square feet, mechanical services, appliances—the *Dwell* house could not begin to compete with comparably sized site-built houses. However, as Allison Arieff, one of the organizers of the original competition noted in justification for this—using a variation on the standard analogy with automobile production—“To be sure there are poorly constructed factory-built homes, just as there are cheap cars. But luxury cars are also factory-built and, as we’ve shown, well-designed homes can be, too.”<sup>51</sup> Savings from this house would have to accrue from construction speed, from building quality and precision, and, most important, from efficiency and ecological effectiveness over the lifetime of the house.

One of the most important offshoots of the *Dwell* house effort was Michelle Kaufmann’s Glidehouse, a modular, factory-built house first displayed by *Sunset* magazine in May 2004. After its enthusiastic reception by 25,000 visitors in a single weekend, the Kauffmann

The factory never shipped more than 270 units in a single month, although it anticipated monthly delivery of 3,700 units. By the time Lustron went into receivership in 1950 it had installed a total of just 2680 houses. (See Fetters and Kohler, 150) Even so, the Lustron Home was one of the more successful twentieth-century factory-produced housing schemes in the United States, both in terms of popular appeal and units installed. See Douglas Knerr, *Suburban Steel: The Magnificent Failure of the Lustron Corporation, 1945-1951* (Columbus, Ohio: The Ohio State University, 2004).

28. This was a material used extensively for diners and gasoline stations, but until that time never on houses. Fetters and Kohler 69.
29. Fetters and Kohler 78.
30. Carl G. Strandlund, “The Lustron Home ... Now in Volume Production,” *Life*, November 15, 1948, 120. Fetters and Kohler 48.
31. *Life*, October 11, 1948, 93. *Life*, September 13, 1948, 157.
32. *Life*, November 15, 1948, 121.
33. *Life*, April 19, 1948, 12.
34. In the New York region the Lustron Home cost about \$9500, whereas site-built house in Levittown cost about \$8000. See *Suburban Steel*, 153. A *Kiplinger* article in 1946 compared the Lustron Home to nine other factory built houses, including Fuller’s. The Lustron price of \$7350 in that chart, put it right at the top of the list and \$850 more than the Dymaxion House. “Packaged Housing Up To Now...,” *Kiplinger Magazine*, March 1947, 13.

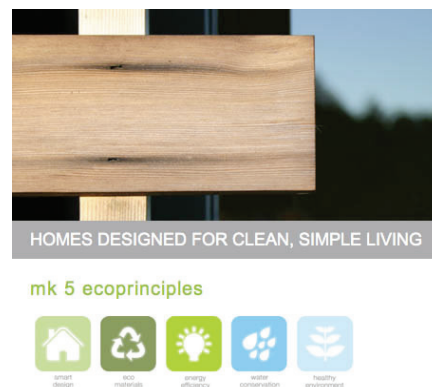


Figure 5: mkDesigns webpage advertisement, 2010

35. *Life*, October 11, 1948, 93. Another advertisement puts it in monthly terms. "It is a better home than many people ever expected to be able to buy—yet well within the means of anyone who can afford \$50 to \$60 a month for a home of his own." *Life*, July 12, 1948, 114.
36. *Life*, September 13, 1948, 157
37. *Life*, November 15, 1948, 120
38. *Life*, December 13, 1948, 118
39. Kelly 71
40. Elmer B. Staats, *Report to Congress, Operation Breakthrough: Lessons Learned about Demonstrating New Technology*, web <<http://www.gao.gov/assets/120/117465.pdf>> 4.
41. Staats 6
42. Staats 6
43. Staats 16
44. Christiania initially proposed a system of sprayed fiberglass wall panels. These proved impractical, so they ended up using more standard materials.
45. This advertisement was for the "New Idea Series" houses by Alcoa. *Seattle Times*, 10/29/72, 79
46. *Seattle Times*, 11/19/72, 42
47. *Seattle Times*, 11/18/73, 63
48. I.e. "single-wide" and "double-wide" units.
49. "Prefab Meets Style," *Business Week*, 11/24/05, web <[http://www.businessweek.com/print/magazine/content/05\\_46/b3959135.htm?chan=gl](http://www.businessweek.com/print/magazine/content/05_46/b3959135.htm?chan=gl)>.
50. Allison Arieff, "Prefab, Proven," *Dwell*, 12/04, web <<http://www.dwell.com/articles/prefab-proven.html>>.
51. Arieff 4
52. Michelle Kaufmann and Catharine Remick, *Prefab Green* (Layton, Utah: Gibbs Smith, 2009) 21.
53. Site work typically increased final costs to between \$700,000 and \$1,000,000. "Glidehouse Makes Its Second Debut," *Residential Architect*, September 1, 2010, web <[http://www.residentialarchitect.com/technology/glidehouse-makes-its-second-debut\\_o](http://www.residentialarchitect.com/technology/glidehouse-makes-its-second-debut_o)>.
54. mkDesigns, *Glidehouse* (brochure) 9, 14.
55. Michelle Kaufmann, "Living the Green Life: Five Eco Principles," 1/11/10, web <[http://www.kashi.com/articles/living\\_the\\_green\\_life\\_five\\_eco\\_principles](http://www.kashi.com/articles/living_the_green_life_five_eco_principles)>.
56. Kaufmann, "Living the Green Life."
57. Lloyd Alter, "The Glidehouse Is At The End Of The Road For Green Modern Prefab," *Treehugger*, 11/18/09, web <<http://www.treehugger.com/modular-design/the-glidehouse-is-at-the-end-of-the-road-for-green-modern-prefab.html>>

prepared for larger scale production, focusing on "reasonably affordable," "green modular designs" that would be "more accessible for everyone."<sup>52</sup> At a starting price of \$360,000, exclusive of site, Glidehouses ended up being relatively inaccessible in terms of cost.<sup>53</sup> Its advertising therefor said little about price and emphasized instead a house "designed for inspired green living." Cost savings would derive from the use of systems designed "to be at least 50–60% more efficient than average homes, reducing your monthly operating costs while keeping you comfortable!" More important, the house would help its inhabitants participate in a system of broader ecological values encapsulated in the firm's five "EcoPrinciples—Smart Design, Eco Materials, Energy Efficiency, Water Conservation, and Healthy Environment."<sup>54</sup> It would facilitate a lifestyle commitment to long-term globally-oriented economy. The first of the five EcoPrinciples, "smart design," sets up not only the characteristics of the house, but also the way in which homeowners could live consistently with ecological values: "Maximize the utility of everything, think long-term, remain flexible and always strive for beauty. Smart design is the foundation of any green life."<sup>55</sup> In this context, the price of the factory-built house becomes almost inconsequential to the larger issues in play: "Going green is as much about personal well-being as it is about the planet's well-being."<sup>56</sup> The house requires the adoption of a mass-production spirit not so much to save money, or to accept the logic of industrialization but to espouse an ecological spirit. This, of course, requires its own revision of values.

Despite highly favorable reviews and enthusiasm, mkDesigns sold only a few of its mass-production houses and was forced to discontinue production and sell its designs to Blu Homes in 2009. One conclusion reached was that "We thought we were building a housing type that would be affordable and accessible to all, while ignoring the fact that they all had to go on one-off sites purchased by individuals."<sup>57</sup> Their effect on the housebuilding industry, they found, had been inconsequential. Blu Homes has had similarly minimal impact in terms of price and volume, selling six house models ranging from about \$400,000 to \$1,000,000 to just 125 clients in the last eight years.

The five examples here hint at why the dream of the architecturally significant factory-built house has never quite come to fruition. The seemingly obvious price benefits derived from economies of scale, waste reduction, and assembly have almost always been harder to achieve and sustain than anticipated. At the same time, the social values enshrined in the home have moved in their own directions as tastes and desires have changed, and the hoped-for appeal of technologically advanced production has not consistently benefited sales. The dream of the factory built house remains elusive, and these examples make it clear that architects will only succeed in achieving it if they look way beyond the intrigue of production toward the challenges of effective marketing and sustaining volume sales over the long term.