INFORMING PUBLIC PARTICIPATION IN NEIGHBORHOOD SCALE PLANNING AND DESIGN

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ABSTRACT

Neighborhood scale planning and design in many areas of the United States has been evolving toward a system of negotiated priorities and agreements. Common models include public workshops and design 'charrettes' which bring diverse stakeholders (citizens, land owners, developers, consultants and public officials, for example) together to develop a mutually acceptable plan. Crucial to the quality and effectiveness of the outcome are decision support tools that help this diverse audience understand, communicate, collaborate and make decisions about complex and often emotional issues of land use and design. Net Energy Communities (NEC), the project summarized in this paper, creates a suite of computer based tools for this purpose. NEC links three types of computer software — the spatial data manipulation, modeling and visualization capabilities of Geographic Information Systems (GIS), the illustration and information retrieval capabilities of multimedia relational databases and, the simulation and comparison capabilities of spreadsheet-based calculation models; into four tools — a site modeller, an elements of neighborhood database, a scenario modeller and a scenario calculator. This paper reports on the NEC project as an example of decision support tools for public participation using illustrations and examples from a 420 acre demonstration neighborhood design in progress for the City of Corvallis, Oregon, USA.

INTRODUCTION

Since the 1980's, the U.S. metropolitan population has grown at twice the rate of non-metropolitan (U.S. Bureau of the Census, 1989). The situation is more so in some areas of the west, Oregon, for example, where population has grown at roughly twice the national rate and is more likely to concentrate in metropolitan areas (Center for Population Research and Census, 1994). Most growth (about 70%) occurs in relatively low density, dispersed suburbs that consume much productive land, are resource-intensive to build, environmentally destructive, inefficient to operate and expensive to maintain (California Resources Agency, 1995).

The energy and environmental consequences alone are significant. Despite a largely successful national effort to improve the energy efficiency of the two principal energy users of most everyone's neighborhood — houses and automobiles — the U.S. continues to consume ever more energy and resources in its residential, commercial and transportation sectors (Energy Information Administration, 1997). The reasons are perhaps more of planning and design than technology and the problem is, in part, the neighborhoods we plan and design. Many are too dispersed to support daily services and public transportation within walking distance, or inappropriately designed to integrate natural means of heating, cooling, reduce paving, conserve urban forests and habitat and so on. As a result, the average U.S household traveled a record 16,600 vehicle miles in 1993 (up 27% in just 10 years) and increased energy consumption to 104 MBtu — equaling 1982 levels and flattening the benefit of twofold and greater increases in the energy efficiency of cars, houses and appliances (Energy Information Administration, 1997). Similar arguments can be made for declining performance against other environmental indicators such as carbon emissions (Interlaboratory Working Group on Energy Efficient and Low-Carbon Technologies, 1997) the rate and quality of urban stormwater run-off and air quality (1000 Friends of Oregon, 1991-97)

At the same time, the public has become outspoken about growth and with a few notable exceptions, slow to adopt more compact, dense settlement patterns that might improve neighborhood energy and environmental performance (Oregon Business Council, 1993). Believing they are protecting quality of life and environment, citizens frequently oppose more dense, mixed use development, implicitly encouraging less sustainable, lower density alternatives. While seemingly attractive in the short term, low density development is costly to communities and detrimental to the environment over the long term.

Yet, that need not be so. Planned and designed appropriately, neighborhoods can create economic opportunity, save energy, reduce carbon emissions, improve water and air quality, preserve open space and habitat and contribute to the perceived quality and livability of the urban environment. The challenge, we believe, is teaching the public to balance these priorities themselves — directing growth toward greater environmental and energy conservation — in ways that 'fit' the unique needs, priorities and circumstances of a particular community.

An opportunity is presented by the changing models and methods of neighborhood planning. Rule-based systems of prescriptive codes and regulations are evolving toward local, collaborative and consensus-based systems of negotiated priorities and agreements. These processes bring diverse sets of people (and their competing values, interests and priorities) together to resolve mutually acceptable urban patterns, forms and arrangements of land uses. At the neighborhood scale, this often takes place highly focused and interactive work sessions, familiarly known to designers and planners as ‘workshops’ or ‘charrettes’ through which citizens, land owners, developers, consultants and public officials, exchange and trade-off ideas, aspirations and agendas for a specific site or area.

The quality and acceptability of the outcome, however, can depend in significant part on an informed public able to discriminate the energy and environmental implications embedded in competing planning and design alternatives. Without improvement in the knowledge, tools and techniques through which communities measure and compare the environmental costs and benefits of competing alternatives, opportunities to influence future development toward more sustainable alternatives will be missed.

Net Energy Communities' tools are designed to help communities — especially smaller ones with fewer planning and design resources — visualize and measure the costs and benefits of alternatives at the earliest stages of planning and design, when crucial directions and decisions about preservation, land use, density and community form are established. The Willamette Valley of western Oregon has many of the developing and 'soon to be developed' neighborhoods we hope to influence with this work. The following paper is illustrated with experience and example from one community's attempt to create a design for a demonstration neighborhood using a participatory public process. The first segment describes our observation of a neighborhood planning and design charrette, highlighting observations and priorities relevant to decision support tool design. The second segment describes the resulting Net Energy Communities tools.

THE DESIGN CHARRETTE

In the spring of 1997, we observed and participated in a public design charrette intended to develop a demonstration neighborhood plan for a 422-acre “neighborhood village” site west of Corvallis, Oregon. The project was initiated to test the degree to which a recently written growth management plan (WCNP, 1996) would lead to economically viable neighborhoods acceptable to stakeholders and the community.

This process spanned four months from February to June. It included two preliminary sessions, two charrette sessions over a period of two days, three debrief meetings and one public review meeting. Charrette participants included a professional team of planning and urban design consultants, planning staff from local jurisdictions, a community task force, and land owners. We observed, documented and critiqued the charrette process for its use of information and visualization aids. To understand the relationship between the flow and process and information, each step was compared to tasks performed, duration, participants, information inputs, media used, decision points and products created. Figure 1 illustrates significant information inputs, discussion and decision-making points. As outlined in the diagram below, this particular process entailed: three pre-charrette sessions (charrette preparation, problem definition, project documentation), two charrette sessions over two days (plan concept, stakeholder input, plan development), two debriefing meetings (consultant review, plan refinement) and one public meeting (community evaluation). Steps are briefly elaborated following.

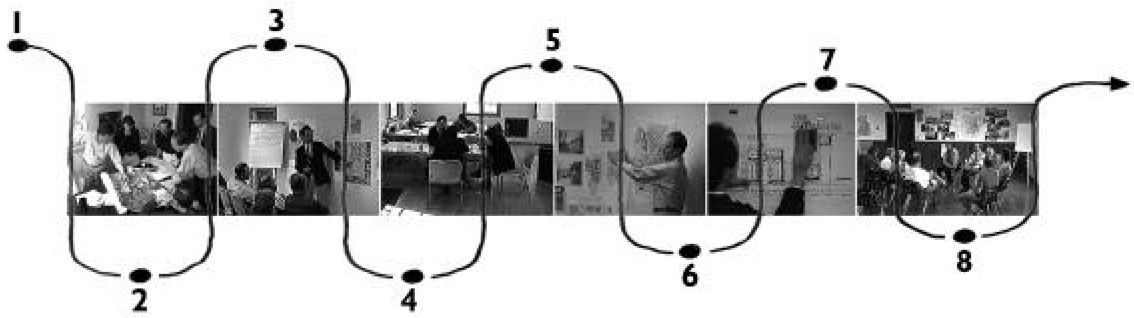

Figure 1: *Steps and images from the West Corvallis Charrette: 1. Charrette preparation; 1. Problem definition; 3. Project documentation; 4. Plan concept; 5. Stakeholder input; 6. Plan development; 7. Consultant review; 8. Plan refinement; 9. Community evaluation.*

Charrette Steps

Preparation, problem definition, documentation

Over the course of three meetings prior to the two-day design charrette, the consultants, with the assistance of staff, completed a series of preparatory tasks. They defined the project and goals of the charrette, collected relevant site and program information, and walked the site. The information collected was then refined and edited to create a single 'opportunities and constraints' map. The community supplied the bulk of the base information for the charrette, while the consultants provided urban design imagery. NEC cross-referenced mapped information to an aerial photograph and a composite map of factors influencing site development.

Shortly thereafter, the consultants began the charrette with an overview of the key issues related to the project, and a review of basic site information. Initial discussion centered around the need for more historical and community-based information, critiquing the conclusions the consultants presented in the opportunities and constraints map. Understanding which areas of the site should be protected from development and why was of particular concern to participants.

Plan concept / stakeholder input

Prior to the public portion of the charrette, the consultants had held a pre-design session aimed at developing initial planning and design concepts. Following the above discussion, the consultants presented this rough scheme and opened the floor to discussion and critique. Discussion primarily focused on the location and design of the commercial center, the relationships of the new neighborhood to an existing trailer park and the adjacent county fairgrounds. Notes and clarifying sketches were made. The full charrette group adjourned until the next day.

Charrette participants had requested imagery of the types of development being proposed by the consultants at the first session. This information was presented at the beginning of the second session. The revised scheme was then presented to the full charrette group and a second discussion session followed. All aspects of the proposed design were reviewed and feedback was provided to the consultants.

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Consultant & subconsultant review
The consultants then took the preferred plan and commentary back to their offices. As part of a concluding review and revision process, they conducted a numerical inventory of land uses. Market, infrastructure and traffic analyses were computed by sub-consultants.

Plan refinement
Based on the results of the analysis by subconsultants, the plan was refined once more prior to public review.

Community evaluation & review
Approximately one month later, the revised plan and the results of the analyses were presented to project stakeholders, including the WCNP Task Force and staff. Some decisions made by the whole group during the charrette had been revised by the consultants in response to some of the analytical information. The consultants received feedback on these changes, in particular. Several months later, the final refinement plan and its associated analyses were presented for commentary at an open public meeting.

Observations and reflections on charrettes

The primary strength of charrette processes is their ability to draw together diverse stakeholders for a common purpose, directly engage diverse values and points of view and stimulate discussion of common (and not common) interests. The process engaged a complex set of issues in whole and integrated ways, including landscape preservation, land use and density, urban form, transportation and marketability. The working method was responsive to individual concerns. Several landowners' ideas were integrated into the plan after discussion and debate. Products were visual and tangible. Plans and sketches demonstrating ideas and principles under discussion emerged before participants' eyes. By the end of the charrette, their effort and investment produced desired results— a plan derived from design-centered negotiations and consensus.

While the interaction and products might be considered successful by most charrette participants, information, examples and feedback was limited in scope, and may have impacted the range and quality of possible outcomes. Choices are compromised when long-term variables such as cost, environment, economy and quality of life impacts are not measured or available. Incomplete environmental information, for example, may result in decisions that inadvertently, but nonetheless, adversely impact the environment or subsequent regulatory review, such as proposing development in a wetland area.

Decisions made in a charrette setting reflect heavily on the level of information, education and understanding available in the room, and the capacity of the audience to communicate and reach consensus (Innes, 1996 and 1998) In an attempt to supplement decision-making, the support tools available such as expertise, handbooks, slide shows, maps, sketches, and forecasts are often provided by workshop facilitators (Center for Livable Communities, 1997)

For site-specific neighborhood planning projects, it is also important that consultants, staff and other participants share their knowledge, while maintaining access to sources outside their areas of expertise. Visualization tools such as maps, photos and interpretive reports are also needed. In the best of circumstances, such tools would be tailored to the needs of the specific project, site and participant group.

Designing tools for public participation

People-centered process

Public participation is a fundamentally social, open-ended and interactive exchange. Effective tools, whatever their purpose, must be designed to augment the human and social processes that underlie that exchange. Tools likely to be most valuable are those that do not intrude on the conversation but help groups of participants see, remember, analyze, measure, compare, collaborate and communicate with each other — better, more clearly, faster, more accurately, more efficiently and with greater complexity.

Tools created for these purposes should be adaptable to each unique project and participant group. Information presented should be adequate to inform participants about the relevant decisions to be made, while not exceeding in volume or technicality the needs of the project or abilities of the participants. Information formats should be legible, and understandable to audiences of diverse interests, backgrounds and working styles.

Working in groups

Much of public process is about working and talking in groups that form and re-form as need and opportunity arises. Some are as small as three people. Others are as large as thirty or more. Groups meet in a variety of formats — seated together facing forward, in smaller groups around tables, in a small cluster around a photograph, drawing or model. To be useful in design charrette venues, information and tools must serve audience sizes and working formats that may vary from auditoriums to groups working around a table. Those most valuable do not intrude but 'fit' the place and the process alongside the many drawings, scales, calculators and reference materials one finds already at the table or in the room of public workshops.

Design "on demand"

Design images and information can be fundamental to informed public participation (Fulton, 1989). In addition to its ability to provide tangible illustration to numbers and analyses of planning, our observation and documentation of public workshops reveals frequent use of design information as an informal means of communication and comparison. Workshop participants brought photographs, books and publications to illustrate concepts or provide examples of 'what works elsewhere'.

Convincing information and examples, however, are not readily accessible to all. Whereas many design professionals carry a familiar set of useful and instructive images and measures in their memory, most non-professionals do not. Those design references that we have encountered in practice are not extensive, well-organized or well-documented. Neither are they measured in forms and formats that can be linked to other decisions.

There is a real need for instructive local and regional examples of buildings and site designs, for housing, commercial, civic and industrial land uses as well as examples of parks and street systems. With imagery and numerical information such as lot and building sizes, density, parking spaces, development costs, energy usage, and environmental impacts, workshop participants could make more informed evaluations of alternatives under discussion.

Diverse working and communication styles

Workshop participants bring different backgrounds, knowledge and preferences to a charrette. Designers, by and large, participate visually via diagram, plan and overlay and sketch. Others tend to participate quantitatively via numbers and diagrams. Still others may be engaged more by speaking, writing, hands-on demonstration or modelling. The challenge is not to choose one, but to cultivate strategies that bridge this mix of information, communication and working styles. Parallel representational strategies are desirable. For example, formats that combine numeric, textual, graphic, and animation together may more successfully communicate to a diverse audience.

Timely feedback

In a process, which by its nature is iterative, it is necessary to frequently evaluate and re-evaluate different alternatives. Visual character and obvious functional traits such as road connectivity, can be critiqued by knowledgeable participants. More complex quantitative analysis, such as an inventory of proposed land uses, density and traffic generated are more difficult and can take several weeks to complete. Computer-based modelling tools offer the opportunity to provide quantitative analyses within a design charrette. For example, the long range energy impacts of varying housing density or reducing travel distances might be measured as alternatives are proposed and considered.

“Hands-on” - digital media
While computer based support tools offer significant advantages in terms of the quality, coordination, depth and legibility of information, digital formats have two significant disadvantages. Many people find computers difficult to engage. Working with them also tends to be primarily an individual not a collaborative or group task. In this regard computers can be a disadvantage in a design charrette where engagement and collaboration of all participants is crucial. Replacing the hands-on process with an entirely digital format would likely be a mistake. Computers (with operators) can serve informational and decision-making support functions well, but should be understood as but one of several tools needed in a charrette process. Skilled operators could work alongside the process, for example, recording decisions and supplying information, yet remain on the fringes of the process.

NEC TOOL SET

Net Energy Communities (NEC) was designed to bring an integrated set of expertise, hardware, software and processes to collaborative neighborhood planning and design. At its core are four separate, but related computer-based decision support tools that together, help define issues and circumstances influencing development choices, increase generation of acceptable alternatives, and measure different alternatives against common performance indicators. The four tools, Site Modeller, Elements of Neighborhood, Scenario Modeller and Scenario Calculator are built from commercially available applications - a Geographic Information System (GIS), a relational database, automated spreadsheets and multi-media.

Site Modeller

Among the obstacles to public participation in neighborhood planning and design is the quantity, diversity and complexity of information necessary to understand a site and the uses proposed for it. Information often resides in many different sources, formats and scales. Materials may be from the state, county, city or landowners, and be in tabular, digital (GIS or CAD), photogrammetric or hand-drawn formats. Assessment and demographic information can be significantly more extensive and detailed than necessary or desired. Many data sets are difficult to cross-reference and explicitly link to familiar images and landmarks of the site.

NEC’s Site Modeller ensures that workshop participants share equal access to information and imagery about a site and its capabilities. The community provides development goals and objectives, and base data and information about a site. NEC compiles, cross-references and, where appropriate, supplements this information, to create a streamlined set of project specific descriptions, maps, diagrams, air photos, videos, photographs, data and ‘suitability’ models.

Information, images and analyses are brought together into a single, integrated digital model. At the beginning of a workshop, the model educates participants about a site's physical character and natural features and about the diverse goals and issues influencing development choices. This same model is subsequently updated throughout the working process to reflect current information and assumptions. As participants move through an iterative planning and design process, alternatives can be measured and compared both visually and quantitatively against up-to-date site assumptions.

Base data layers
Base data layers map key attributes and themes selected for their potential impact and influence on development. Typically these include: geology, soils, topography, slope and aspect, vegetation and wildlife communities, wetlands, flood zones, existing roads, services and buildings, property ownership, zoning and existing land use. Layers can be adapted from digital GIS and CAD models or adapted from other printed or hand drawn media. Data associated with each layer can be represented in tabular form, colored maps and aerial perspective wireframes.

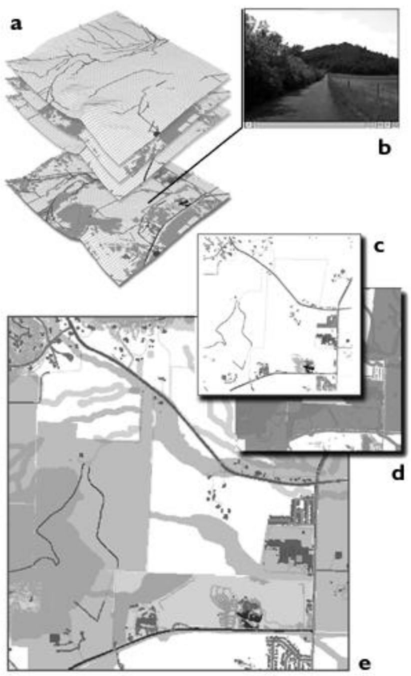


Figure 2: *Excerpts from the Site Modeller: a. GIS base data layers; b. video linked maps; c. base map; d. suitability map; e. charrette design base (base + suitability)*

Suitability maps
Suitability maps simplify and visually model the combinations of data layers and information most influencing development on a site. For example, 'hazard areas' are combinations of attributes that limit or prohibit development. These might include unstable soils, steep slopes, wetlands and flood zones. 'Conservation areas' are combinations of attributes which suggest that limited development can occur or be carried out. These might include riparian corridors and habitat areas. In the future, NEC will create site-specific suitability models and maps unique to the needs of low energy and environmental impact planning and design practices. Areas of a site suitable for naturally heated and cooled buildings, or for surface drainage, for example, can be mapped and illustrated.

Video-linked maps
Videos are linked to data or suitability maps to help participants visualize the connection between the abstract world of maps and numbers and the physical world of land and streams and land uses. At their most simple and rudimentary, videos orient those in the public unaccustomed to looking at maps to more familiar aspects of a site

— a path, street or familiar landmark, for example. Videos can also take participants to specific areas or issues of a site they may never otherwise see or experience — an area of wetland or unique soil conditions that might be inaccessible or ‘out of sight’ to a passersby. And finally, videos can provide a record of areas of a site under infrequent, but extreme, conditions — for example, a stream that floods but soon recedes or a traffic condition that occurs only at peak hours.

Design base maps
Finally, two-dimensional base maps suitable for hands-on planning and design are created from the same data layers and suitability models used to illustrate the site. These drawings can be posted on walls or used as underlays to later design studies.

Elements of Neighborhood

Gaining fair consideration of new or unfamiliar alternatives can be a challenge in a planning and design workshop or charrette. Participants must have confidence that alternatives will perform as promised and also ‘fit’ the unique physical, social, cultural and economic context of a community. Absent that confidence, unfamiliar alternatives may be ignored or opposed, in favor of more familiar, but perhaps lower performing, alternatives. Preferences are often more about the design or experience of a specific example than about the merit or proposed concept or principle itself. For example, density goals of ten dwelling units per acre may be acceptable to participants familiar with positive examples of transit-oriented or mixed use neighborhoods, but unacceptable to others without that experience or familiar only with poor examples.

The Elements of Neighborhood brings a common lexicon of neighborhood design examples to a public workshop or charrette via a multi-media, relational database and a lap-top computer. Six types of examples are represented. *Open Spaces* (green) includes densities and types of open spaces such as neighborhood parks and playgrounds. *Networks* (brown) includes morphologies of water, utility and transportation networks such as grids and nodal systems. *Housing* (yellow) includes densities and types of houses and housing. *Commercial* (red) includes densities and types of commercial buildings such as retail and professional offices. *Industrial* (purple) includes densities and types of industrial buildings and uses such as manufacturing and distribution. *Civic* (blue) includes densities and types of civic buildings and uses such as schools and churches. And, *Streets and paths* (grey) includes sizes and types of streets and paths such as collectors and local streets.

Within each element category are case studies drawn and measured from instructive, real-life examples. Cases are organized by intensity (by dwelling units per acre, for example), planning type (detached or attached, for example) and, within each planning type, by design type (duplex or clustered for example). Each is presented as a ‘whole site’, property line to property line, inclusive of buildings, yards, setbacks, parking and paved areas attributable to it.

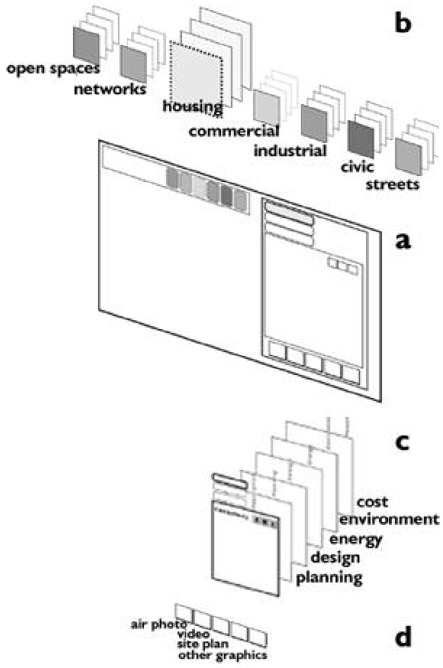


Figure 3: *Conceptual map of the Elements of Neighborhood database. a. Interface design — a 'digital notebook' with the following components: b. Neighborhood Elements — examples of open spaces, networks, housing, commercial, industrial, civic, streets and paths; c. Measured data available for each example — planning, design, energy, environment, cost; d. Visual data available for each example — aerial photos, videos, site plans, floor plans, street elevations, cross sections and so on.*

Digital notebook

The digital notebook can be used in a variety of ways in a working session. Its contents can be projected on a screen or printed and bound in a binder or notebook. The notebook can be searched by land use, key word or performance measure or more casually browsed by 'paging' through images and video clips. Simple colors, large buttons, captions and icons help communicate the structure, organization and operation of the notebook. The notebook may be used as a presentation tool to brief participants on options, or as a reference tool that may intuitively 'browsed' or methodically 'searched'.

Within each category are a series of illustrative case studies. Several kinds of studies are presented in each category. 'Code performers' meet requirements or standards for local planning and design. 'Energy / environment performers' outperform 'code' in areas of energy and/or environmental performance. Local examples demonstrate best local practice. Regional, national and international examples demonstrate best practice in other cities. Design examples demonstrate 'yet to be built' best practice.

Images, narrative and quantitative information cross-reference the physical qualities and character of a case to the words and numbers of planning and design. Narrative and measured data are presented in categories of planning, design, energy, environment, community and cost. Each case example is measured in terms of planning data (e.g. site area, density, parking, employment); design data (e.g. floor areas, facilities, structure types, landscape types); energy data (e.g. space conditioning load, lighting load), and environmental data (e.g. impermeable vs. permeable area, tree cover, stormwater runoff quantity and quality). Visual data include air photos, street level videos and scaled diagrammatic site plans and, where appropriate, floor plans, street elevations and cross sections. Data and illustrations can be examined in larger scale and /or greater detail via 'links' embedded in the notebook.

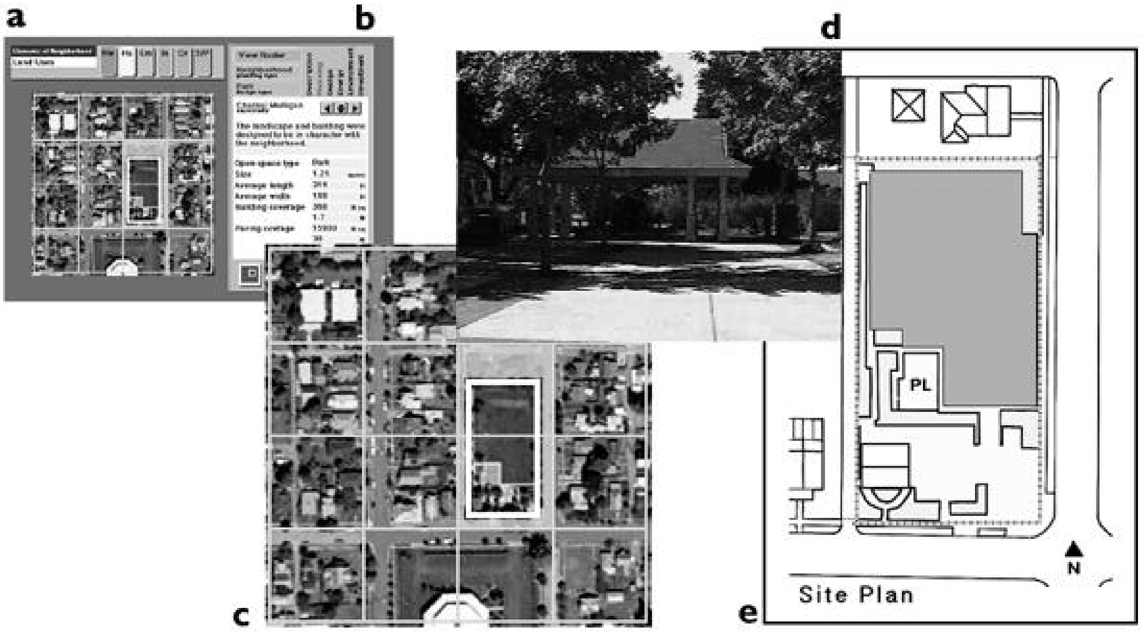


Figure 4: *Visual data excerpts from a typical Elements of Neighborhood 'open space' case: a. Typical screen layout; b. access to measured data sections; c. acre-gridded aerial photo with example highlighted; d. 'view from the street' video; e. scaled site plan color-coded to quantities.*

Energy performance

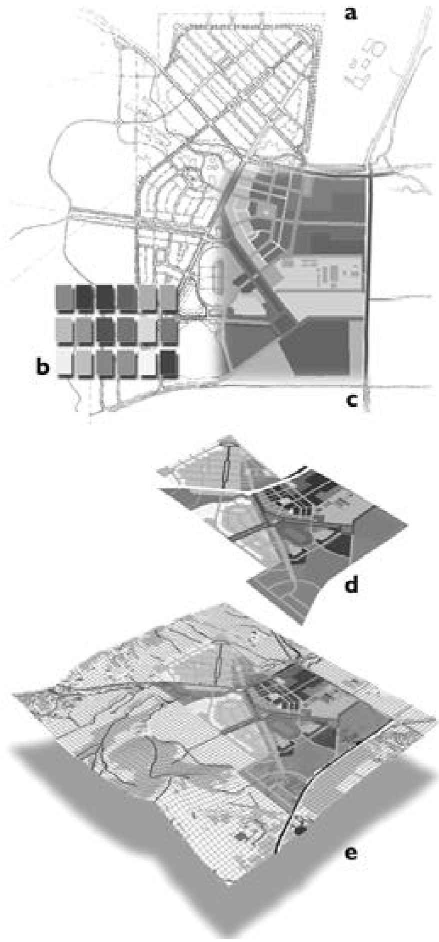
Two kinds of building energy performance data are presented. A checklist, notes which, if any, unique energy conserving features are demonstrated. These include the presence or absence of solar heating; low skin area; high thermal resistance envelopes; thermal mass; natural ventilation; high daylight; summer shading and tempered outdoor spaces. The second, a quantitative analysis of annual energy consumption, reports estimates of annual energy load in total and by sub-categories of heating, cooling and lighting.

Scenario Modeller

Design charrettes are intensely social, hands-on discursive exchanges. In most cases, participants build a plan incrementally and in parts. One scenario might begin with a street layout; another with a layout for commercial center; a third with a network of parks and open spaces, and so on. Ultimately one or more alternative scenarios are generated, each exploring a different planning or design strategy and allocating a land use to every square foot of the site. This is a process well facilitated by hands-on group work and discussion around loose, hand-drawn plans and sketches — products that may be effective collaboration and consensus building tools but hours of development and analysis away from the detail necessary to compare and evaluate what was made.

Scenario Modeller attempts to close this gap by making it possible to visualize form and estimate measured performance together. Working from a planning and design base map created with the *Site Modeller* a scenario may emerge as hand drawn overlays and sketches (to be ultimately scanned and digitized) or created directly in a digital model of the site.

Figure 5: *Excerpts from Scenario Modeller: a. Scenario base drawing digitized from hand-drawn plan; b. Elements of Neighborhood legend; c. Elements assigned to sections of plan; d. Elements assigned to entire plan and illustrated in aerial perspective; e. Completed scenario model draped over 3-d model of site and selected base layers.*



Elements palette
Participants or charrette facilitators build and refine scenarios by assigning Elements of Neighborhood cases to particular areas of a plan. Areas of a plan designated to support a density of 9 to 12 net dwelling units per acre, for example, might be assigned an example of row housing at 12 net dwellings per acre. Other areas might be assigned small-lot detached housing at 9 net dwelling units per acre where that is appropriate.

Suitability
Previously developed models guide the assignment of proposed site elements. For example, housing types more dense than that permitted in a particular area would be prohibited or energy efficient building types that depend on access to sun and wind would be prohibited in microclimatic areas where sun and wind are not adequately available. At appropriate intervals, a 'take-off' function of the GIS software tracks and records how much of which elements are used, and where, in a particular scenario.

3-D Visualization
In the process of building a scenario, a scaled, coded map is created. This map can be manipulated, analyzed and displayed like any other data layer in the *Site Modeller*. It can, for example, be cross-referenced to specific layers and suitability maps, or draped over a 3-D digital model of the terrain to illustrate in aerial view and the potential fit between the proposed scenario and existing conditions.

Scenario Calculator

Design charrettes typically conclude with a summary review and evaluation of chosen alternatives, with an attempt to glean measurable and meaningful conclusions. At this stage, discussion and emphasis shifts from what alternatives are desirable or possible to which alternative or part works best.

Each scenario, for example, might explore different strategies related to utilization of land (e.g. land use intensity and distribution), vehicle trip generation (e.g. vehicle miles traveled), energy efficiency and utilization of renewable energy (e.g. annual heating, cooling and lighting loads), infrastructure layout (e.g. street system geometry), affordability (e.g. density and construction complexity), environmental impact (e.g. water demand and air / water quality) and livability (e.g. proximity to services). Take-offs of how much of what is accommodated in each hand drawn scenario are time consuming and inaccurate. Feedback about anticipated performance typically requires professional review and interpretation. Frequently this occurs later and off-site. As a result, days — sometimes weeks — can separate charrette generated alternatives from feedback, breaking an important and vital linkage of cause and effect in the decision making process.

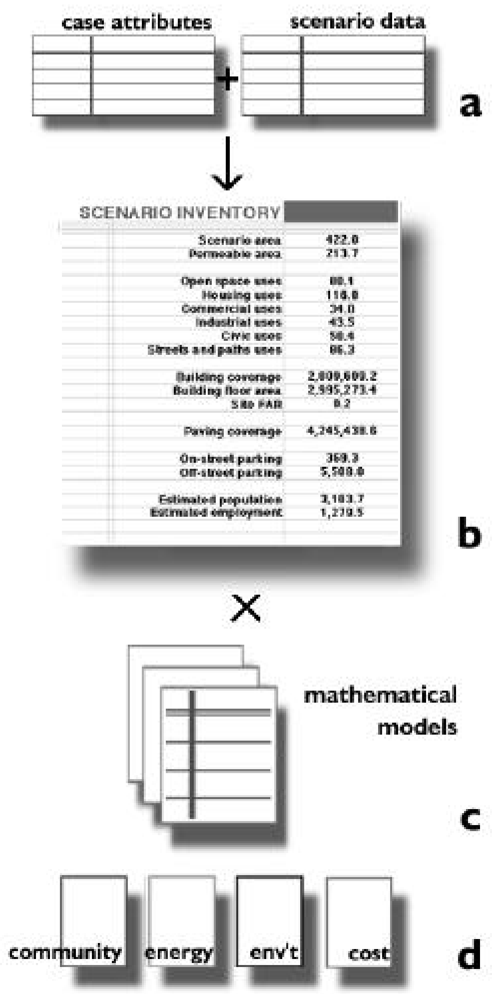
Immediate feedback

Scenario Calculator increases the speed and depth of quantitative and performance feedback that accompanies a proposed alternative. Using site and scenario information created in Scenario Modeller, mathematical models calculate a summary inventory of a scenario and measure a series of performance "proformas" related to Energy, Environment, Community and Cost. To do this, Scenario Calculator extracts and then pro-rates quantitative data about what is included in a scenario from the Scenario Modeller's GIS model and the Elements of Neighborhood database.

Summary inventory

A scenario inventory summarizes the ingredients of a scenario by land use element (networks, open space, housing, civic, commercial, industrial) and pro-rates data associated with each case. An inventory of housing in a scenario, for example, would summarize every housing type used and pro-rate performance data such as gross and net densities, building coverage, total dwellings, total bedrooms, paving coverage, off- and on-street parking, total impervious surface, total vegetated area and energy used. Using these quantities, background mathematical operations will estimate performance based on an open, editable set of assumptions and summarize the results in a series of proforma reports.

Figure 6: *Excerpts from Scenario Calculator: a. quantitative data from Scenario Modeller and Elements of Neighborhood; b. Scenario inventory — a bill of quantities; c. graphs of inventory categories; d. mathematical models; e. community, energy, environment and cost proforma's.*



Energy proforma
An energy proforma, for example estimates energy used in building, transportation and industrial sectors using measures, such as: total energy, total energy per acre, total energy per capita, total energy attributable to buildings, total energy attributable to heating, total energy attributable to cooling, total energy attributable to lighting, total energy attributable to transportation, total energy attributable to industrial processes.

Environment proforma
An environmental proforma estimates environmental impact in categories of air, water and microclimate using measures such as: water demand (e.g. gallons per capita per day), air pollution mitigation (e.g. volume of vegetation and pounds of pollutants removed), storm water quantity (e.g. permeable surface in square feet and runoff in volume) and quality (e.g. amount of pollutant filtration), heat island mitigation (e.g. site albedo) and habitat protection (e.g. percent undisturbed).

Community proforma
A community proforma estimates impact on important community values and attributes. These include: affordability (e.g. percent dwellings affordable at median income), economic opportunity (e.g. potential job sites), proximity to services (e.g. percent of households within one-quarter mile of commercial, civic and open spaces), pedestrian access (e.g. percent of streets with sidewalks, crossings and low traffic speeds), and pedestrian attractiveness (e.g. percent of buildings fronting streets, mix of stores and services, building scale).

Cost proforma
A cost proforma estimates economic impact in categories of construction cost and operating cost. Results are summarized as whole site numbers and broken down by

element in categories of open space, networks, housing, commercial, industrial and civic.

CURRENT STATUS AND FUTURE EFFORT

This paper is written at the conclusion of a proof-of-concept period for Net Energy Communities. Of the four tools, the Site Modeller is the most fully developed. To date, we have built vector and 20' cell raster-based GIS models of physical, natural, cultural and political attributes for the WCNP Plan study area and more detailed, vector and 10' cell raster-based models of the demonstration site within it. Using data from these models we have developed suitability models and site analysis templates. In addition, we have linked video footage of the site and its features to these maps and analyses.

Parallel to this work, we developed the second tool in the set, the Elements of Neighborhood database. About a third of this effort has been directed toward the design of a lap-top computer scaled interface suitable for public workshops and a modular data structure through which the database can be expanded or customized to fit particular projects and communities. The remaining effort has been directed toward developing the content, field work protocols, illustration templates and documenting instructive examples. Approximately thirty examples of open space, housing, commercial, industrial, civic and streets from the Eugene area have been completed. We estimate that an additional thirty cases should be documented and recorded to make the database sufficiently robust to serve the needs of a public design charrette.

Using the WCNP demonstration site model and Elements of Neighborhood cases, we prototyped the third tool, the Scenario Modeller, to illustrate May 1997 design charrette scheme by SRI / Shapiro and Lennertz Coyle and Associates. Elements of Neighborhood cases were assigned to appropriate land use areas and the composite was illustrated in a new scenario map and legend. These may be viewed together with base information and suitability models in aerial perspective.

The fourth tool prototype, the Scenario Calculator is the most complex. We have, to date, automated the process for extracting quantities and associated data from the Scenario Modeller and have started the process of developing the series of reports (scenario inventory, energy pro-forma, environment pro-forma, community pro-forma and cost pro-forma) through which different scenarios could be compared. The first of these, the scenario inventory, is substantially complete. The remaining pro-formas remain in progress pending additional development, testing and refinement of measures and algorithms. Working prototypes of all four pro-formas are anticipated in 1998.

Finally, work outlined above has been undertaken under ‘laboratory’ conditions, in the classrooms, studios and research facilities of a university. The next step is to apply the Net Energy Communities tools under circumstances and conditions that more closely approximate the projects and communities for which these tools are intended. A simulation of these conditions and circumstances is scheduled to take place April through September of 1998 when NEC tools will be used to generate and model an environmentally low-impact scenario for the WCNP Neighborhood Village demonstration site and to compare it with the charrette-generated plan and a baseline plan reflecting current suburban development practices.

Our goal remains to offer Net Energy Communities at modest cost to communities seeking to significantly increase the likelihood that new growth and development will be, in sum, more energy conserving, of lower environmental impact, better design quality and more affordable than prevailing practice. We believe this goal is best accomplished when NEC's expertise and tools are an integral part of a community-based planning and design process.

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