Developing a SITING Application for Electric Transmission Facilities

Mary Deming, Southern California Edison Dave Hawkins, Facet Decision Systems, Inc.

International Association for Impact Assessment Vancouver, April 27, 2004

Overview

Project siting and licensing challenges Organizational challenges and issues in the development of the SITING application Capabilities of the SITING Application Overview of the SITING application Evaluates and plans lines/substations Results in website format Lessons learned and next steps

Project Siting and Licensing Challenges

Technical complexity Environmental diversity Stakeholder uncertainties Schedule and budget constraints Decision making at three levels Inter-disciplinary Inter-departmental SCE-external Decision making over time

Triple-Bottom-Line Measurement

SOCIAL Compatible land use Equitable impacts SCE image

ECONOMIC

Economic feasibility Cost-effective mitigation Ease of construction

ENVIRONMENTAL

Protect natural resources Protect cultural resources Preserve scenic resources

Evolution of Electrical Project Decisions

| Decisions | Decision Criteria | Analysis | Review & Approval | Alternatives & Criteria |
|--|----------------------------|---|---|---|
| Site/route identification | Constraints (Pass/Fail) | Expert opinion Binary models Low cost data | Internal to project team | Large # of alternatives Few criteria |
| Site evaluation to select the top few sites/routes | Categorical | Expert opinion Classification models Some high quality data | Project team proxies for stakeholders & regulators | Restricted # of alternatives Multiple account criteria |
| Final evaluation to select and document the "best" site/route | Continuous | Detailed technical models Preliminary design studies Detailed surveys | Input from public & regulators | Few alternatives Detailed technical & multiple account criteria |

Organizational Challenges

Project teams are multi-disciplinary

- Teams require shared data and display, capture of the project history, shared understanding of results
 Decisions involve values in addition to technical information
- Different stakeholders hold different values
- Disclosure involves sensitivities (data, stakeholder values, results)
- Decisions have to be defensible to external stakeholders
- Effective and efficient communication is required

SITING Development Challenges

A vision without the necessary technology early in the project (~1993)
A model without test cases (~1992-2002)
A project without much funding after 1997

SITING Application Characteristics

Data

- GIS layers, secondary data, consultant data, qualitative data, computer generated data
- Display
 - Website format to represent values and display results

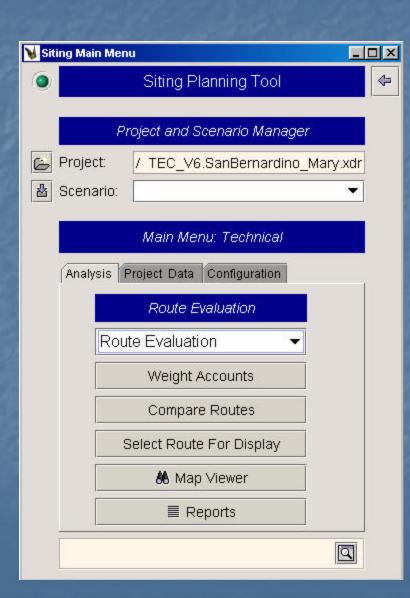
Decisions

- Decision framework can "roll up" to summary scores and "drill down" to explain results
- Documentation
 - Stores alternative scenarios, makes assumptions explicit, supports non-linear problem solving and consensus building

Overall Design of the SITING Technical Model

Evaluation of given sites/routes
Identification of optimal sites/routes

Site Evaluation in SITING

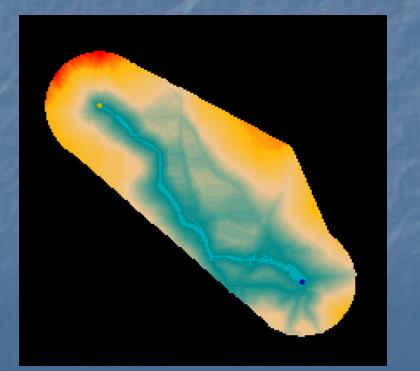


| Co | mpare Route | | | | _ 🗆 🗵 |
|----------|--|----------------|-------------|----------------|-------|
| Resu | IIt Constraints | | | | |
| | Cor | npare Route | | Export Results | |
| <u> </u> | | npure rioute | | | |
| 8 | Scores by accou | nts by measure | | | |
| | Unit_of_Analysis | Utility | Constraints | | |
| | 18 | 0.25 | Pass | | ▲ |
| | 32 | 0.27 | Fail | | |
| | 31 | 0.28 | Pass | | |
| | 28 | 0.29 | Pass | | 1000 |
| | 29 | 0.29 | Pass | | 001 |
| | 45 | 0.29 | Pass | | |
| | 44s | 0.30 | Pass | | |
| | 40 | 0.00 | D | | |
| | | Tot | al Impact | | |
| | | 10 | arimpact | | |
| | 34 | | | | _ |
| | 20- | | | | |
| | 15- | | | | |
| | 16- | | | | |
| | | | | | |
| | 21- | | | | |
| | 24- | | | • | |
| | <u>- 10</u> 244s- | | | | |
| | 28 | | | | |
| | 5 18- | | | | |
| | sid4s- 18 d 18 d 18 d 18 d 18 d 18 d | | | | |
| | 19- | | | | |
| | | | | | |
| | 2- | | | | |
| | 13- | | | | |
| | 38- | | | | |
| | 14- | | | | |
| | 12 | | | | |
| | 0.0 | 0.1 | 0.2 0.3 | 0.4 | |
| | | | LIHERE- | | |

Alternatives are evaluated based on Stakeholder values and given a "Score" based on overall impact.

Corridor Identification in SITING

Based on selected Summary Maps, Corridor Planning will select the route with the least cumulative impacts to the environment. The corridor can be digitized and evaluated against other alternatives.



| ing Main Mer | าน | - 0 |
|--------------|--------------------------------|-----|
| | Siting Planning Tool | 4 |
| P | roject and Scenario Manager | |
| Project: | It2 / TEC_V6.Workshop_review.x | dr |
| Scenario: | PLA_V6.Workshop_final.xdr | • |
| | Main Menu: Technical | |
| Analysis | Project Data Configuration | |
| | Corridor Planning | |
| Cor | ridor Planning 🛛 👻 | |
| | Protect Categories | |
| | 🛆 Generate Corridor | |
| | 👪 Map Viewer | |
| | 遙 Export Corridor | |
| | ■ Reports | |

Overall Design of the Website(s)

Different websites for different scenarios Classification of decision factors (the navigation bar) Comparison of sites (bar graphs) Performance Impact Input data (in pop-up screens) Context (maps)



Executive Summary

Getting Started Purpose

Site Selection Executive Summary

Biological Resources

Cultural Resources

Others CEQA

Community

Summary

Aesthetics Political Land Use

Engineering

Summary

Geophysics Existing Facilities Reliability Cost Summary Geophysics

Existing Facilities Ownership Glossary Contact Us

Environmental Summary

Site Evaluation

Twenty five potential sites for the new 500 kV substation are evaluated here using SCE's SITING computer modeling solution. The SITING tool converts technical indicators into a suitability score between 0 (least impact/best choice) and 1 (greatest impact/worst choice). Performance scores are calculated for each indicator and combined into an overall suitability score for each site. Sites can also be compared based on the raw technical indicators themselves. The Appendix lists all the indicators in detail.

SCE's Transmission Long Range Plan has identified the need for a new AA bank substation in approximately 2008. This is when we expect to exceed the AA bank transformer capacity of Mira Loma substation. To avoid overload at Mira Loma, a

500/230 kV substation will be required somewhere between Etiwanda and San Bernardino substations.

Click for more information

Options

Set in numerical terms, the protection priority for the strategic components. For each component, choose a protection priority factor.

| Select your weighting for Environmental: | High 🗾 👔 |
|--|----------|
| Select your weighting for Community: | High 🗾 👔 |
| Select your weighting for Cost: | High 🗾 👔 |
| Select your weighting for Engineering: | High 💽 🚺 |

Site Comparison ①

A long bar indicates high impact.

40

Score by components

each site.

This chart shows strategic components impacts for

20.9

44.4

48.6

29.6

38.5

37.3

49.2

41.7

26.1

Save your selections

Components Community Cost

Engineering

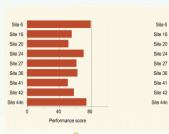
Environmental

Site Performance ①

ter chormanee o

This chart shows the performance for each sites

A long bar indicates good performance

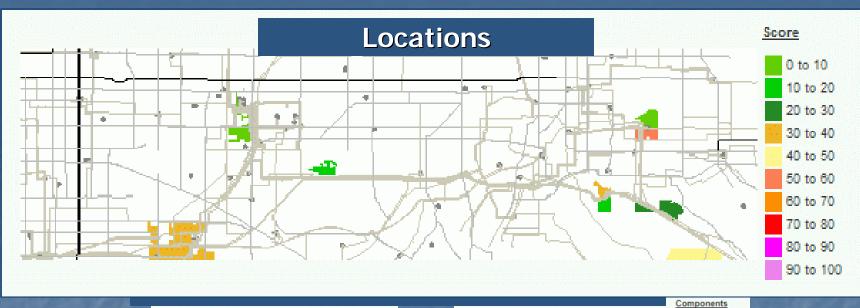


Site Comparison Map 🛈

This map shows all of the site locations and site scores for this project. The site with the lowest score is the best site, as the low score indicates the least impedence or obstacles for building on that site.



Privacy Statement | Disclaimer Footnotes | About this Website



| Site 6Site 6 | ity |
|--|-------|
| 3/80 - 200 - | пу |
| | |
| Site 15 - Site 15 - 41.8 | |
| Site 16 - Site 16 - 44.4 Engineer | |
| Site 18 - 28.8 Environm | ental |
| Site 20 Site 20 48.6 | |
| Site 21 - Site 21 - 39.6 | |
| Site 23 - Site 23 - 44.7 | |
| Site 24 - Site 24 - 29.6 | |
| Site 26 - Site 26 - 32.3 | |
| Site 27 - Site 27 - 38.5 | |
| Site 28 - Site 28 - 28,1 | |
| Site 29 - Site 29 - 30.4 | |
| Site 30 - Site 30 - 336.5 | |
| Site 31 - 28.6 | |
| Site 33 - Site 33 - 36.4 | |
| Site 34 - Site 34 - 34.0 | |
| Site 35 - Site 35 - 27.9 | |
| Site 36 - Site 36 - 37.3 | |
| Site 40 - Site 40 - 39.7 | |
| Site 41 - Site 41 - 49.2 | |
| Site 42 - Site 42 - 41.7 | |
| Site 43 | |
| Site 44n - Site 44n - 26.1 | |
| Site 44s - Site 44s - Site 44s - 35.1 | |
| Site 45 - Site 45 - 37.4 | |
| 0 40 80 0 40 80 | |

Performance Score

Score by Components

Equal weights (original settings)

Options

Set in numerical terms, the protection priority for the strategic components. For each component, choose a protection priority factor.

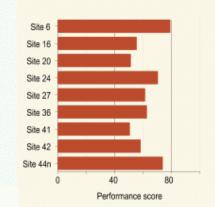
| | Select your weighting for Environmental: | High | 0 | |
|---|--|-----------|---|---|
| | Select your weighting for Community: | High | 1 | |
| | Select your weighting for Cost: | High | 0 | |
| | Select your weighting for Engineering: | High | 0 | |
| | | None | | 1 |
| | Sa | Low | S | |
| | | LowMedium | | |
| - | | Medium | | |

High

Site Performance ①

This chart shows the performance for each sites

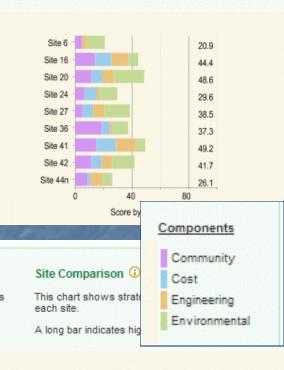
A long bar indicates good performance

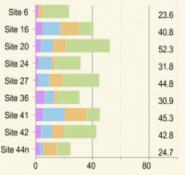


Site Comparison ①

This chart shows strategic components impacts for each site.

A long bar indicates high impact.

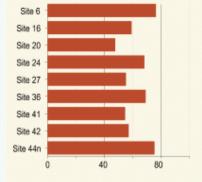




Site Performance ①

This chart shows the performance for each sites

A long bar indicates good performance



Performance score

Score by components

Unequal weights (new settings)

Options

Set in numerical terms, the protection priority for the strategic components. For each component, choose a protection priority factor.

| Select your weighting for Environmental: | High 🗾 🕕 |
|--|----------------------|
| Select your weighting for Community: | Low 🗾 ϳ |
| Select your weighting for Cost: | Medium 🗾 🥡 |
| Select your weighting for Engineering: | Medium 🗾 👔 |
| | Save your selections |

Environmental Summary

EDISON Environmental

An EDISON INTERNATIONAL* Company

Getting Started

Site Selection

Executive Summary

Environmental

Summary

Biological Resources
Cultural Resources
Others CEQA

Community

Summary Aesthetics Political Land Use Engineering

> Summary Geophysics

Existing Facilities Reliability

Cost

<u>Summary</u> <u>Geophysics</u> Existing Facilities

<u>Ownership</u>

Glossary

Contact Us

Privacy Statement | Discialment Footnotes | About this Website SCE believes that a sound environment makes the regions where we operate better places in which to live and work. Accordingly, the company is committed to preserving and protecting that environment for the benefit of its neighbors, customers, employees and future generations. This commitment encompasses full compliance with environmental laws, integration of sound environmental practices into SCE's operations, and a pledge of environmental stewardship in the communities where the company does business.

Environmental Scores

The total score for the Environmental component is made up of several indicators that relate to Environmental issues. The Environmental Scores show the detail on what indicators are part of the Environmental component and how each site scored.
Click for more information

Options

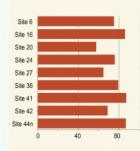
There are no selections required on this page.

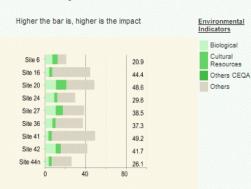
Site Performance (i) Overall performance of each site

Site Comparison ()

Impact on each site by Environmental indicator, as shown in the legend.

Higher the bar is, better the performance





Performance score

Score by indicators

Environmental Cont.

Biological

Within the Environmental decision factor, let us look at the Biological indicators.

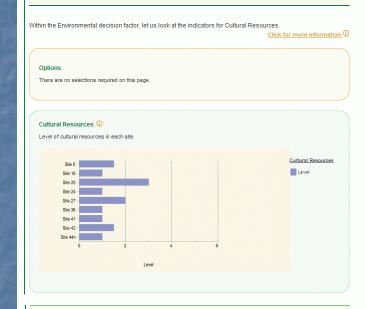
Click for more information (i) Options There are no selections required on this page. Species Bio Diversity () Biologically Sensitive Species () Biologically sensitive species in each site Number of different plant and animal species counted in each site. **Bio Diversity** Biologically Site 6 Sensitive Site 6 Plants Species Site 16 Animals Site 16 Site 20 None or Site 20 Few Site 24 Site 24 Listed Site 27 Species Site 27 Site 36 Listed Site 36 Species Site 41 Site 41 Site 42 Site 42 Site 44n Site 44n 100 50 20 30 Order of magnitude Species Count

Bio Diversity Map 🛈

The locations of the selected sites and the known levels of biological diversity in that area are shown in the map below.



Cutural Resources



Others CEQA

Within the Environmental decision factor, Others CEQA indicators are:

- Agricultural resources
- Air Quality
- Hazards and Hazardous materials
 Mineral resources
- Mineral
- Noise
- Popolation and Housing
 Public services
- Public servic
 Recreation
- Recreation
 Transportation/Traffic
- Utilities and service systems

Under Construction

Community Summary

Community

An EDISON INTERNATIONAL* Comma

SOUTHERN CALIFORNIA EDISON

Getting Started

Site Selection Executive Summary

Environmental Summary **Biological Resources** Cultural Resources Others CEQA

Community

Summary Aesthetics Political Land Use Engineering Summary Geophysics Existing Facilities Reliability Cost Summary Geophysics Existing Facilities Ownership

Contact Us

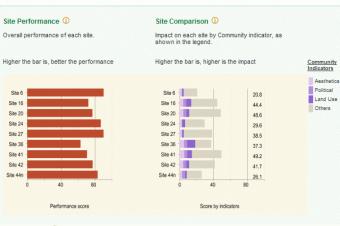
Privacy Statement | Discialment

SCE establishes and maintains positive, constructive working relationships on environmental issues with stakeholders including public policymakers, relevant regulatory agencies, various coalitions, and local communities. SCE supports and encourages early and continuous dialogue regarding its transmission and substation projects. The facility siting process supports SCE's policies by soliciting the values of the affected public/stakeholders with respect to siting a proposed facility. involving the affected public/stakeholders in the development and review of alternatives, incorporating public/stakeholder values in the decision process, and keeping the public/stakeholders informed during all phases of the decision process.

Community Scores

The total score for the Community component is made up of several indicators that relate to Community issues. The Community Scores show the detail on what indicators are part of the Community component and how each site scored. Click for more information

There are no selections required on this page



Land Use Map 🛈

The locations of the selected sites and their relative distance to schools and residential areas are shown in the man below



Options

Glossary

Footnotes | About this Website

Community Cont.

Aesthetics

Within the Community decision factor, let us look at the indicators for Aesthetics.

Click for more information ①

Options

There are no selections required on this page.

Site Visibility ①

Site 6

Site 16

Site 20

Site 24

Site 27

Site 36

Site 41

Site 42

Site 44n

Ô.

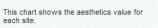
50

Percentage of Site Area

Site Aesthetics ①

This chart shows tpercentage of study area that can see each site.

100





Aesthetics Pristene Environment City Promotes Beauffication Cluttered Views

Political

Within the Community decision factor, let us look at the Political indicator.

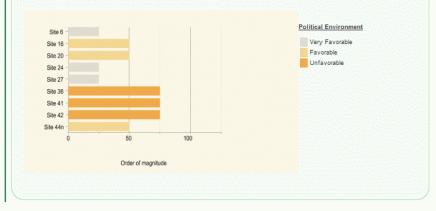
Click for more information (i)

Options

There are no selections required on this page.

Political ()

This chart shows the political climate in the juridiction where the site is located



Defining Land Use Options

EDISON

Getting Started

Site Selection

Executive Summary

Environmental

Summery Biological Resources Outtani Resources

Others CEGA Health and Safety

Summery DMT.

Commonth

SATTRACK! Asstatica Political

Laturities Engineering

Summery **Geophysics** Existing Facilities Relability Cost Summery

Geophysics Existing Facilities Ownershie Glessary

Contact Us

CONTRACTOR DESIGNATION OF THE OWNER OWNER OWNER OWNER OWNER

| | Click for more infor |
|--|----------------------|
| | |
| tions | |
| fire the parameters for land use within 1.12 miles of each sile. | |
| ow luture land designated as Schools: | No 💌 |
| ow future land designated as Vacant | No 🛩 |
| ow luture land designated as Commercial: | No 🦗 |
| ow future land designated as Residential: | No 💌 |
| ow future land designated as industrial. | No 💌 |
| ov future land where the land use designated can change in | Local Contraction |
| a futurera: | No 🐱 |

Land Use Type 🛈

Land Use

wat

This chert shows future Land Use types, within 1/2 miles of site. 1993 Laniil Use tile was used



This chart shows where the site passes or fails land use constraints. No occurrence is a 0410

Land Use Constraints 🗯

346 mm

54 TE

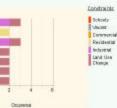
58-20 Plantine dial

City Adv

30.37

Apriluitare statuti

Commercial Sta 20



Land Use Map 🛈

The locations of the selected sites and the land use designations for those locations based on scenario selections. Sites may not be suitable depending on the land use designation

Land Ups

flood

Schoole

Facilities.

Industrial.

Patie

Vacara.



Sites Single Family Residential Other Inntial Rural Residential Anriculture ommercia Industrial Schools (All) itary Installations Recreation Facilities Infrastructures Vacant Water

Land Use

Outions

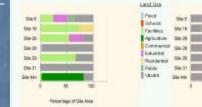
| Define file parameter | a for lend use within 1/2 miles of each site |
|------------------------------------|--|
| Allow future land d | esignated as Schools. |
| Allow future land d | esignated as Vacant: |
| Allow future land d | esignated as Commercial: |
| Allow future land d | esignated as Residential. |
| Allow future land d | esignated as Industriat |
| Allow future land w the futuree | there the land use designated can change in |

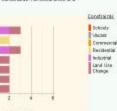
Land Use Type 🛈

This chieft shows future Land Use types, within 1/2 miles of site. 1993 Land Use file with used

Land Use Constraints 💿 This chart shows where the site passes or

talls land use constraints. No occurrence is a 14955





No

No -

Save your selections

Yes 🔻

No 💌 🕦

No 🔹 🕕

No 💌 👔

Occusionce

Engineering Summary

EDISON Engineering

An EDISON INTERNATIONAL* Company

| ~ -1 | | Ctanta d | |
|-----------|-----|----------|--|
| Gei | πna | Started | |

Site Selection

Executive Summary

Environmental

Summary

Biological Resources

Cultural Resources

Others CEQA

Community

Summary

Aesthetics

Political

Land Use

Engineering

Summary 84

Geophysics

Existing Facilities

Reliability

Cost

Summary

Geophysics

Existing Facilities

Ownership

Glossary

Contact Us

Privacy Statement | Disclaimer Footnotes | About this Website The total score for the Engineering component is made up of several indicators that relate to Engineering issues.

Engineering Scores

The Engineering Scores show the detail on what indicators are part of the Engineering component and how each site scored.
Click for more information

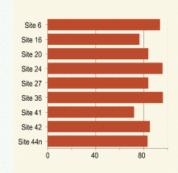
Options

There are no selections required on this page.

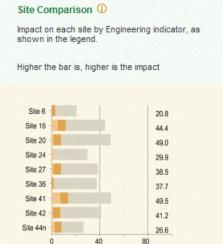
Site Performance ①

Overall performance of each site.

Higher the bar is, better the performance



Performance score



Engineering Indicators

Geophysics

Existing

Facilities

Others

Score by indicators

Engineering

Getting Started

Site Selection Executive Summary

Environmental

Biological Resources

Cultural Resources

Others CEQA

Summary

Aesthetics

Political

Land Use

Engineering

Summary

Reliability

Summary

Geophysics

Ownership

Glossary

Contact Us

Existing Facilities

Privacy Statement | Discialment

Cost

Geophysics

Existing Facilities

Summary



Getting Started

Site Selection

Environmental

Summary

Executive Summary

Biological Resources

Cultural Resources

Others CEQA

Community

Summary

Aesthetics

Political

Land Use

Engineering

Summary

Reliability

Summary

Geophysics

Ownership

Glossary

Contact Us

Existing Facilities

Privacy Statement | Discialmen Footnotes | About this Website

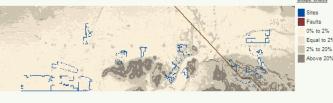
Cost

Geophysics

Existing Facilities

Geophysics







Existing Facilities

Within the Engineering decision factor, let us look at the indicators for the Existing Facilities.

Click for more information

Options

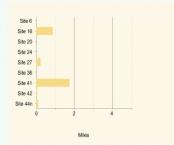
There are no selections required on this page.

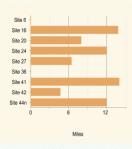
Distance to Existing 220KV Lines ()

Distance to Existing 500KV Lines 🛈

Distance from each site the the nearest existing 220KV line

Distance from each site the the nearest existing 500KV line





Distance to 220 KV & 500 KV Lines Map ()

The locations of the selected sites and their proximity to 220KV lines and 500KV lines are shown in the map below.



Lessons Learned

More GIS data would be better

- But only necessary and sufficient data for the decision are necessary
- R&D and utility planning may operate on different timetables
- It is hard for team members to make assumptions explicit and to structure the decision criteria they use
- Facility projects are complicated to represent in a model
- Everyone wants to be heard and their input considered
- Everyone wants access to the same information and to understand the results

Next Steps and Opportunities

SCE project test Power line and/or substation test State-wide project test Power line application with a CA utility steering group Additional SCE application Long-range planning of the grid State-wide application Long-range planning of transmission corridors and/or renewable development

