



Energy and Security Group

APEC 21st Century Renewable Energy Development Initiative (Collaborative VI):

Best Practices in New and Renewable Energy Technologies in Urban Areas in the APEC Region (EWG 04/2008)

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Why consider urban renewables?

Context: Increasingly clean, green, efficient, livable cities; energy-efficient buildings and facilities

- Energy security
- Hedge against fuel price and availability uncertainties.
- Cleaner environment via reducing GHGs, particulates, and other harmful emissions. *Many APEC cities have developed climate change action plans.*
- Economic development from new employment, revenues, and profits
- Improved air quality
- Increased energy efficiency in buildings and industry

Project objectives

This project highlighted best practices in the use of NRE and energy efficient technologies in APEC cities

- Identification of lessons learned
- Review of obstacles preventing or inhibiting the widespread adoption of renewable energy
- Documentation of case studies of successful projects
- Preparation of a roadmap to guide future urban renewable energy development



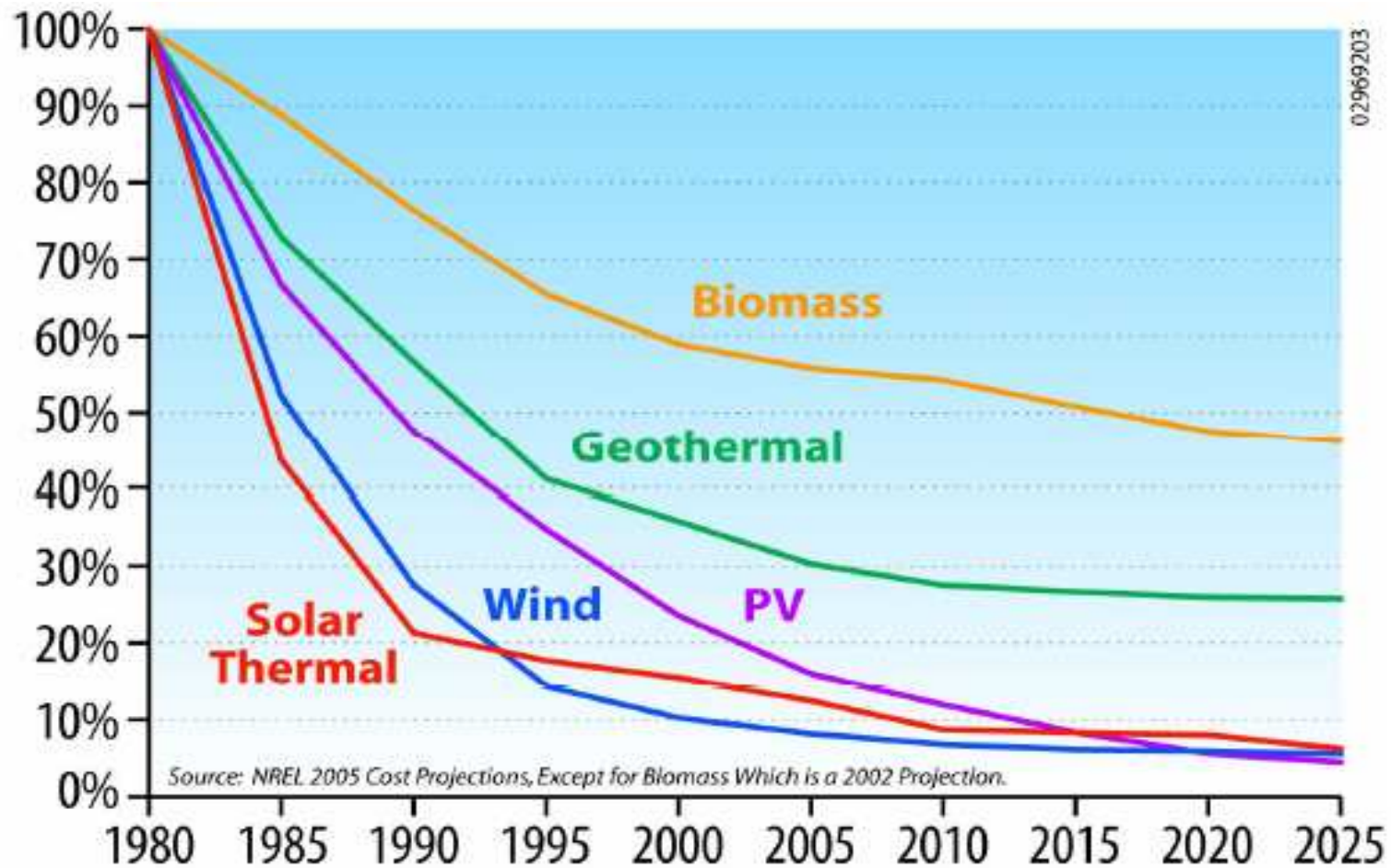
The Largest APEC Megacities (January 2009)

World Rank	City / urban region	Country	Population (millions)
1	Tokyo	Japan	34
2	Seoul	Korea (South)	24
3	Mexico City	Mexico	23
6	New York	USA	22
8	Manila	Philippines	19
9	Los Angeles	USA	18
10	Shanghai	China	18
11	Osaka	Japan	17
14	Canton	China	15
15	Jakarta	Indonesia	15
18	Moscow	Russia	14
19	Beijing	China	13
Total			231

Source: <http://www.citypopulation.de/index.html>

Renewable energy electricity production costs as percentage of 1980 levels

(Source: US NREL)



Benefits of large-scale use of urban renewable energy

- A cleaner, healthier environment through improved local air quality and reduced GHG emissions.
- Greater energy security.
- A greener economy, new green jobs.
- Local industrial development.
- Trade and export opportunities.
- Urban renewal.
- Regional development.
- A safer, more secure, cleaner, reliable and more efficient energy system.

Renewable energy technologies for cities

- Solar thermal (water heating, space heating, process heat)
- Solar photovoltaics (free-standing PV systems and building-integrated PV)
- Wind electric (small turbines on buildings, larger turbines on brownfields)
- Geothermal heat pumps



Building-integrated PV

Monash University (Malaysia)

7.36 kWp amorphous thin-film



Urban solar thermal energy options

- **Technology types**
 - Glazed flat plate collectors (fluid)
 - Unglazed flat plate collectors (swimming pool heating)
 - Flat plate collectors (air)
 - Evacuated tube collectors
 - Parabolic trough collectors
- **Applications**
 - Water heating
 - Space heating
 - *Solar-assisted air conditioning (pre-commercial)*
 - Low- and medium-temperature industrial process heat (IPH)
 - District heating (supplementary energy)
- **End use sectors**
 - Residential
 - Commercial / industrial buildings
 - Institutional buildings (universities, research centers, etc.)
 - Government buildings
 - Commercial / industrial processes

Solar thermal industrial process heat (China)



Residential PV retrofit in Los Angeles



Residential PV retrofit in Los Angeles

24 Sunpower PV panels
5 kWp grid-connected
600 kWh/month

Monthly leasing = 80% of utility charge

\$37,000 capital cost (\$7.50 / kWp)

\$15,000 final cost after state rebate, federal tax credit

5-year accelerated depreciation on \$18,000 (net plus 50% of tax credit)



1.6 MWp rooftop PV system in Northern California (Google)

Largest PV system on a US corporate campus

Integrated with charging stations for plug-in hybrid vehicles

Brownfields to “brightfields”

425 kWp PV system on brownfield (US)



Urban wind power: transforming brownfields (Utility-scale wind turbines at former steel mill (US))

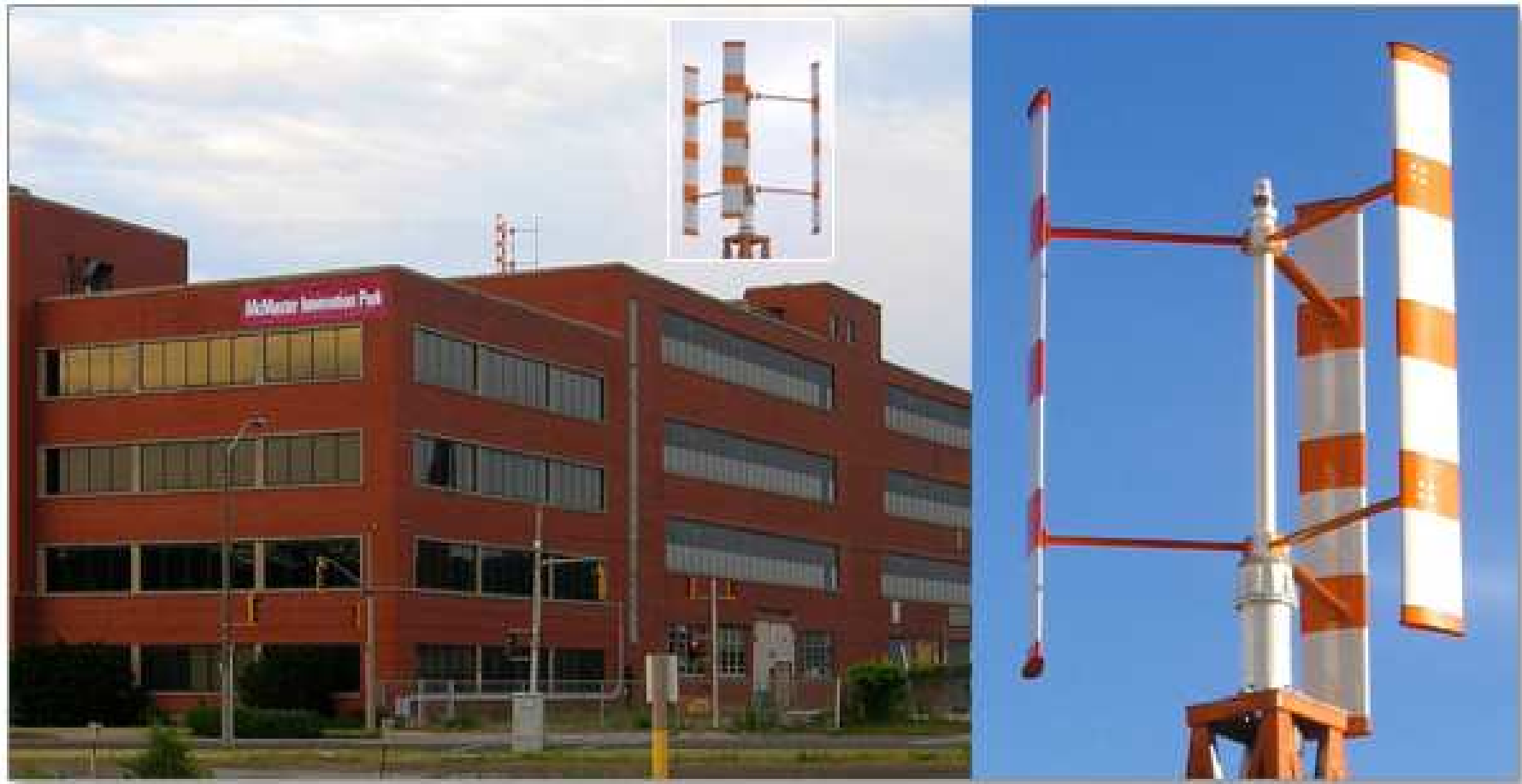


**Figure 5-2: 7.5 MW Urban Windfarm,
Atlantic City, NJ (USA).**



The electricity is used by both the AC Utilities Authority Wastewater Treatment Plant and delivered to the regional electric grid. Source: Newark, NJ (USA) Star-Ledger newspaper, July 21, 2009 http://www.nj.com/news/index.ssf/2009/07/surveys_on_wind_turbines_sent.html

Small wind turbine (Ontario, Canada)



www.cleanfieldenergy.com/site/sub/p_we_installations.php

Obstacles to widespread urban RE

- Policy and institutional
- Financial
- Technology-specific
- Capacity
- Awareness

Some institutional obstacles

- Complex and/or unclear local permitting requirements.
- Land use, zoning, and siting restrictions.
- Restrictions on utility interconnection of RE power generation
- Lack of sufficient inspectors and permitting authorities experienced with RE systems in urban applications.
- Permitting requirements/fees that vary across jurisdictions.
- Lack of certified RE systems for purchasers, lenders, investors, insurance companies and others that meet technical, environmental, safety and performance standards.
- Difficulty for private power developers to sell power generated from RE systems to the grid.
- Protection of contracts and intellectual property.
- Existing electricity laws that can be counter-productive.

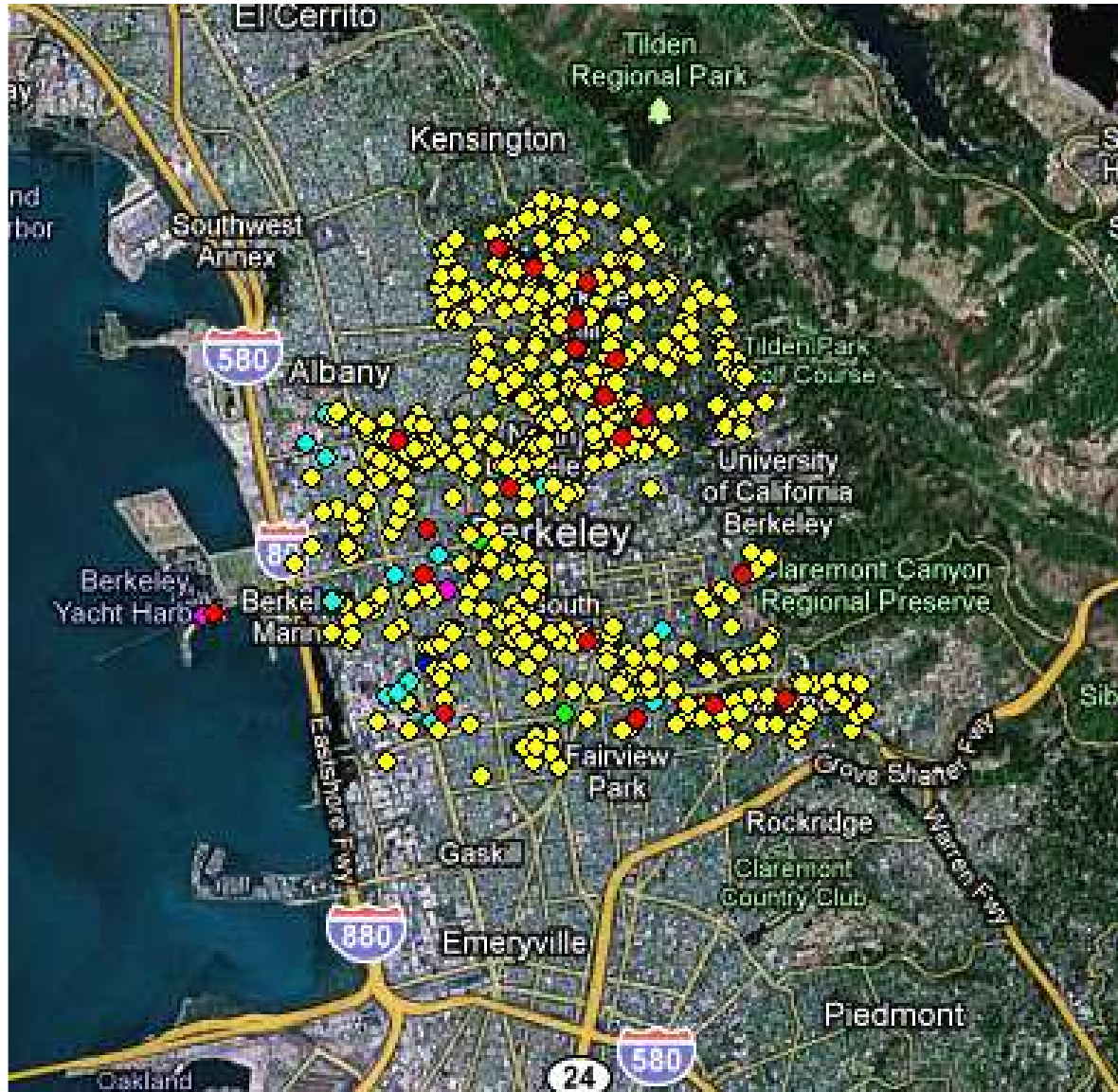
Three policies that promote urban renewables in APEC economies

- *Renewable Portfolio Standards* require a mandated *quantity* of renewable energy (electricity, fuels) to be purchased in a specific time frame. Market participants (e.g., utility) are required to purchase the associated power/fuel.
- *Feed-in-Tariffs* permit producers of RE electricity to connect to the grid and provide electricity at a mandated price. Feed-in-tariffs are options when local governments have jurisdiction to regulate electric utilities.
- *Tendering* uses government-sponsored competitive bidding for acquisition of RE electricity, with long-term contracts awarded to lowest priced projects.

APEC cities: early adopters and leaders in widespread renewable energy and energy efficiency applications

- Early financial and risk underwriting of innovative approaches helps establish RE markets that stimulate technical innovation, “pull” technology enterprises into the marketplace, and allow costs to decline through technology scale-up.
- Policies must evolve with scale-related obstacles to implementation.
- APEC cities are innovation incubators, supporting new technology and policy approaches that would be premature on a national level.
- Pilot / demonstration facilities help stakeholders identify and address potential problems early on.
- Performance standards facilitate technology advancement and cost reductions; prescriptive measures freeze technology.

New tools for urban RE design & mapping



UNEP-sponsored
GPS/GIS mapping of
urban PV and solar
thermal systems

Embedded software
calculates potential
energy production
from individual
rooftops and capital
and operating costs

Source: UNEP DTIE
(Paris 2009)

www.unep.or.jp/letc/Activities/Urban/energy_city.asp



Successful Business Models for New and Renewable
Energy Technology Implementation in APEC



APEC Energy Working Group

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Very useful APEC
counterpart study

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Residential Sector Case Studies

- PR China – Solar Water Heating and Lighting
- Canada - GeoExchange in Residential Buildings
- Malaysia BiPV Application Project

Shandong Solar water heating (PRC)



Commercial Sector Case Studies

- Australia – Queen Victoria Market (photos)
- United States – PV in Wal-Mart Retail Stores
- Chinese Taipei – Green Stadium
- Singapore – Solar Capacity Scheme
- China – BIPV-Suntech Headquarters in Wuxi



Wal-Mart Corporation (US)

- > 7,900 stores in 15 countries
- Corporate sustainability goals
 - obtain 100 percent of energy from renewables
 - create zero waste
 - sell products that sustain resources and environment.
- 7 Wal-Mart stores in California to have 4.6 MWp PV
- SunPower Access Program: power purchase agreement allows customers to obtain environmental and financial benefits of solar power with no upfront capital costs.
- The solar electricity competitively priced, providing Wal-Mart with a long-term hedge against rising peak power prices.

Industrial Sectors

Thailand: – Bagasse-Fired Cogeneration



China: Large Scale Industrial Biogas
Program

Utility Sector

- United States – 1.2 MWp La Ola Solar Farm



- Chinese Taipei – Changbin and Taichung Wind Farms

Roadmap Steps

1. Assess potential impacts of renewable energy
2. Make a commitment to renewable energy and initiate a plan of action
3. Build an effective policy framework
4. Establish rules and regulations
5. Address technical issues
6. Provide access to financing
7. Launch a RE awareness campaign
8. Strengthen local capacity
9. Lead by action
10. Plan management

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http://publications.apec.org/publication-detail.php?pub_id=980

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