

COMPARATIVE ANALYSIS OF BEST PRACTICES OF SUSTAINABLE COMMUNITIES: ASIA PACIFIC RIM AND UNITED STATES

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Summary: The Asia-Pacific region is experiencing rapid urbanization and its environmental impacts simultaneously. APEC member economies produce 55% of the world's GDP and 64% of its greenhouse gas (GHG) emissions, but major cities within the region are implementing sustainable development policies to balance economic growth, quality of life, and environmental health. The U.S. is also taking steps to reduce emissions, both internationally and domestically, including efforts to reduce the knowledge gap between major worldwide GHG emitting countries about their strategies to increase sustainability. In support of this endeavor, this research **examines sustainable city strategies from across the Asia-Pacific region and reviews best practices for potential implementation in the U.S.** Six Asia-Pacific cities were chosen as case studies for this research: Hong Kong, Adelaide, Tokyo, Seoul, Yokohama, and Tianjin Yujiapu. The products of this research, which include individual strategies and broader policies and lessons, are examined for implementation in the context of Denver, Colorado's fixed-rail transit project. The full paper for this research, produced by HUD, will present detailed case study findings and further analysis of U.S. applicability.

Key Words: sustainable development, APEC, Asia-Pacific, greenhouse gas emissions, Partnership for Sustainable Communities, U.S. Department of Housing and Urban Development, renewable energy, public transit, green building

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I. INTRODUCTION

This comparative research focuses on best practice examples of sustainable city strategies across the Asia-Pacific region, and reviews various strategies for potential implementation in United States cities. The objectives of this research are: 1) identifying innovative policy tools or institutional structure to implement the sustainable community agenda; 2) reviewing the impact of these sustainable community projects on economic development and job creation; and 3) examining the applicability of the identified best practices in the U.S. and developing countries. Through these objectives, this paper will act as a preliminary best practices reference for the implementation of sustainable community strategies.

1. Policy Framework

This research supports the U.S. Department of Housing and Urban Development (HUD) in its role in the Partnership for Sustainable Communities (Partnership), as well as the Asia Pacific Economic Cooperation (APEC) Energy Smart Community Initiative (ESCI). The Partnership for Sustainable Communities, formed in June 2009, brings together three major U.S. federal agencies, HUD, Department of Transportation (DOT), and the Environmental Protection Agency (EPA), to improve citizens' quality of life while simultaneously protecting the environment. Later, in November 2010, President Obama and Japan's Prime Minister Kan launched ESCI for the Asia-Pacific region – this initiative aims to foster green growth, sustainable development, and long-term job creation throughout the region. The Initiative will also help realize APEC leaders' goal to reduce the energy intensity of their economies by 25 percent by 2030, and help guide the way to possible adoption of a more ambitious goal. Both the Partnership and ESCI can utilize the best practices research contained in this paper to inform city leaders about innovative strategies to increase sustainability and promote the implementation of such strategies.



2. Case Study and Analytical Framework

Six Asia-Pacific cities were chosen as case studies for this research: Hong Kong, Adelaide, Tokyo, Seoul, Yokohama, and Tianjin Yujiapu. Located across the entire region, these cities were selected based on their strong policy agendas for sustainability, and for their economic importance to the sustainable community worldwide. Additionally, these cities present a wide variety of conditions – political, economic, demographic, and cultural, among others – that affect the types of strategies employed in each, which results in an analysis of strategies suitable for a wide range of situations. Policies and strategies across many subject areas were examined, including greenhouse reduction goals and timeframes, energy, urban transit, land use planning, and green building.

This paper is structured in two parts in order to allow for the most effective presentation of information to support the research objectives. The first section contains an analysis of sector strategies implemented in each case study city, followed by the case of Denver Colorado.³ To better align these strategies with the goals of the Partnership for Sustainable Communities, the best practices are paired with one or more of the Partnership's six guiding Livability Principles. The six Livability Principles listed below guide the analytical framework of the best practices:

1. Provide more transportation choices.
2. Promote equitable, affordable housing.
3. Enhance economic competitiveness.
4. Support existing communities.
5. Coordinate and leverage federal policies and investment.
6. Value communities and neighborhoods.

These principles provide a framework for the identification of best practices in the first section of the paper. The second section of the paper explores implementation of various strategies in the U.S. city of Denver, Colorado.

II. BEST PRACTICES ANALYSIS

In this section, various strategies for increasing sustainability in the six case study cities are compared and analyzed based on innovation, effectiveness, and impact on economic development and job creation. These strategies are aligned with one or more of the six Livability Principles described above, and later evaluated for practical application in HUD-funded community project in Denver, Colorado. Table 1 below summarizes the strategies reviewed in this research.

³ Detailed research on each Asia-Pacific case study city will be contained in a longer version of this paper, to be published for the U.S. Department of Housing and Urban Development.

Overview of City Strategies				
Case Study City	Sector			
	<i>Energy</i>	<i>Urban Transportation</i>	<i>Land Use Planning</i>	<i>Green Building</i>
Hong Kong	<ul style="list-style-type: none"> Renewable fuel mix Offshore wind Waste-to-energy 	<ul style="list-style-type: none"> High-speed and light rail, rapid bus, and ferry Planning standards for pedestrian movement 	<ul style="list-style-type: none"> Planning to minimize need to travel: development around railways and balanced uses Conservation zones 	<ul style="list-style-type: none"> Mandatory commercial building energy efficiency standards District cooling or water-cooled air
Adelaide	<ul style="list-style-type: none"> Green Power Program Smart grid 	<ul style="list-style-type: none"> Massive investment for dedicated rail/bus corridors Bicycle Action Plan Integrated Movement Strategy 	<ul style="list-style-type: none"> High-density mixed-use development <i>Guide to Mixed Use Development</i> City Parklands Trail 	<ul style="list-style-type: none"> Rebates for installation of rainwater tanks, solar panels and hot water systems Retrofitting existing buildings
Tokyo	<ul style="list-style-type: none"> Green Power Purchasing Program and national network Cap-and-trade for large businesses Bond incentives for conservation 	<ul style="list-style-type: none"> First-class transit system Park-and-ride Bike sharing 	<ul style="list-style-type: none"> Transit-oriented regional structure Pedestrian-oriented development Historical gardens 	<ul style="list-style-type: none"> Campaign for Elimination of Incandescent Lamps Facilitate collaboration among solar equipment manufacturers and energy suppliers
Seoul	<ul style="list-style-type: none"> Fuel cell technology Smart Grid Initiative Institute for Solar Energy Systems 	<ul style="list-style-type: none"> No-Drive Day Campaign Flat rate for transit trips and transfers Dedicated bus lanes 	<ul style="list-style-type: none"> National green building standards consider TOD Green Design Project: "city within a park" Green belt 	<ul style="list-style-type: none"> Green rooftop projects C40 Building Retrofit Project Tax incentives for efficient buildings
Yokohama	<ul style="list-style-type: none"> Green Power Project – residential cost assistance Biodiesel fuel for public facilities 	<ul style="list-style-type: none"> Mobility Management Campaign Bike sharing 	<ul style="list-style-type: none"> Integration of land use and transportation Subsidy for inner-city development Greenery Tax 	<ul style="list-style-type: none"> HEMS combined with high-efficiency insulation for 4,000 existing homes and all new homes
Tianjin Yujiapu	<ul style="list-style-type: none"> Smart Energy Networks 	<ul style="list-style-type: none"> Bus rapid transit High-speed rail Underground pedestrian walkways 	<ul style="list-style-type: none"> High-density, mixed-use around Station Cores Land recycling 	<ul style="list-style-type: none"> Building lifecycle development Water and material reduction; operating management

Table 1: Overview of Case Study Strategies by Sector

The chart below shows a comparison of greenhouse gas (GHG) reduction goals set by each case study city. Setting a GHG reduction goal, or multiple goals, over a period of time is a key element of each city's mission to building a more sustainable community. Although

baseline years and goals vary for each city, sometimes drastically, simply setting these types of goals is vital to measuring the effectiveness of individual strategies in a broader context. One of the core goals of the Partnership for Sustainable Communities is to spur improved integration of metropolitan planning strategies. Overarching GHG reduction goals provide clear guidelines for city collaboration, and through these, a city can become a catalyst for similar regional or national action – which is particularly vital where such consensus is currently absent.

GHG Reduction Goals & Timelines

City	Population	GDP Per Capita ⁴	Emissions Per Capita ⁵	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2050
Hong Kong	6,985,000	\$29,990	5.4						30%						
Adelaide	1,200,000	\$57,782	20												60%
Tokyo	13,189,000	\$70,759	4.8						25%						
Yokohama	3,688,000	\$30,211	5.2						25%						80%
Yujiapu	500,000	\$40,900	6.3						30%		50%				
Seoul	10,500,000	\$19,597	3.7						40%						

Table 2: Case Study City Greenhouse Gas Reduction Goals & Timelines

Sources: Asian Green City Index; Hong Kong Climate Strategy and Action Agenda; Adelaide Green City Sector Agreement; Tokyo Climate Change Strategy; Yokohama New Midterm Four-Year Plan; Tianjin Yujiapu Feasibility Study; Seoul Master Plan for Low Carbon, Green Growth

The baseline years and GHG reduction goals vary by city for many reasons. These case study cities were chosen due to their commitment to GHG emission reduction, and show diverse stages of urban development, political structures, geographic locations, and population sizes, among other factors. These factors also affect the GHG reduction goals and timelines for each city, shown above. Tokyo has a comparatively low reduction goal of 25 percent of 2000 levels by 2020; however, the city released about 62 million tons of greenhouse gas emissions in 2000, so a 25 percent reduction would amount to over 15 million tons per year. In comparison, the city of Adelaide released around 29,225 tons of greenhouse gases in its baseline year of 1994. Therefore, meeting its 60 percent reduction goal by 2050 would result in a reduction of around 17,500 tons per year. This is less than one percent of the amount that Tokyo will reduce by 2020. However, Tokyo’s population is nearly 13 times greater than that of Adelaide, and when these reduction amounts are spread out amongst the populations of these cities, they are more comparable. Notably, the per capita emissions in Adelaide are about four times greater than in Tokyo.

⁴ 2011 estimate in U.S. dollars; Yujiapu estimate based on planned daytime population of 500,000 and *Feasibility Study* BAU forecast; Adelaide estimate based on South Australia per capita GDP.

⁵ Tonnes of CO₂ equivalent; Adelaide estimate based on South Australia emissions per capita.

Most Polluted Cities		
<i>City</i>	<i>Annual Mean PM10⁶</i>	<i>Rank</i>
Tianjin	101	73
Seoul	64	143
Hong Kong	50	190
Tokyo	23	514
Adelaide	14	976

Table 3: Case Study City Rankings Among World's Most Polluted Cities
Source: World Health Organization

Another important factor to consider when comparing sustainability strategies in these cities is their levels of pollution as compared to each other and to other cities worldwide. In September 2011, the World Health Organization (WHO) released a ranking of nearly 1,100 cities based on air quality, measured by average annual levels of airborne particles smaller than 10 micrometers (PM10). These particles are mostly sulfur dioxide and nitrogen dioxide from power plants, automotive exhausts, and industry, which are also significant sources of greenhouse gas emissions. WHO recommends an upper limit of 20 micrograms per cubic meter to prevent respiratory problems in humans, and the ranked cities ranged from Ahvaz, Iran, with an annual average of 372, down to Whitehorse, Canada, with only 3. As shown in Table 3, the case study cities of Tianjin and Seoul are the most polluted, as is common with areas that experience rapid urbanization.

As explained, the intensity or progressiveness of the case study cities' goals for GHG reduction is extremely varied. Important to note, however, is that these cities have *all* set such goals. These goals, and many of the supporting objectives and actions, are often contained in a single city plan for sustainability, environment, or a similar subject.

Case Study City	Strategy Document	Implementing Agency
Hong Kong	<i>Climate Strategy and Action Agenda</i>	Environmental Protection Department
Adelaide	<i>Green City Sector Agreement</i> <i>Energy Management Action Plan</i>	City Planning and Development
Tokyo	<i>Climate Change Strategy</i> <i>Environmental Master Plan</i>	Bureau of Environment
Yokohama	<i>New Midterm Four-Year Plan</i>	Climate Change Policy Headquarters
Tianjin Yujiapu	<i>Feasibility Study</i> <i>Guidelines for Sustainable Development</i> <i>Design of Yujiapu Financial Area</i>	Tianjin Bureau of Environmental Protection
Seoul	<i>Master Plan for Low Carbon, Green Growth</i>	Environmental Bureau

Table 4: Case Study City Sustainability Strategy Documents and Implementing Agencies

The following sections will analyze and compare the strategies chosen by each city to support their individual goal by aligning the strategies with the Livability Principles of the HUD-DOT-EPA Partnership. The partnership agencies incorporate these principles into federal funding programs, policies, and legislative proposals. The identification and analysis of best practices in this research provides information to support the partnership's goals of improving housing and transportation options while protecting the environment. The table below summarizes these principles and the case study strategies aligned with each.

⁶ Micrograms per cubic meter.

Principle	Goal	Case Study City Strategies
Transportation Choices	<i>Decrease household transit costs, reduce oil dependence, reduce emissions, and improve air quality and human health.</i>	<ul style="list-style-type: none"> · Variety of modes: high-speed rail, light rail, rapid bus, ferry · Smart ticketing · Single fee structure · Bike lanes · Pedestrian planning
Equitable, Affordable Housing	<i>Increase mobility and lower combined cost or housing and transportation</i>	<ul style="list-style-type: none"> · Energy efficiency = lower utility costs · Mandatory green building standards · Rebates for efficient equipment · HEMS · Transit-oriented mixed-used development
Economic Competitiveness	<i>Provide reliable and timely access to employment and education centers, services, and other basic needs for workers.</i>	<ul style="list-style-type: none"> · Transit-oriented mixed-use development · Compact city model
Support Communities	<i>Increase community revitalization and efficiency of public works investments, and preserve rural landscapes.</i>	<ul style="list-style-type: none"> · Conservation zones · Greenery Tax · Parklands within urban boundaries · Land recycling
Coordination and Leveraging	<i>Align federal policies and funding, and increase effectiveness of all levels of government to plan for future growth, including making smart energy choices.</i>	<ul style="list-style-type: none"> · Investment incentives for renewables · Used cooking oil to biodiesel fuel · Green Power Purchasing for businesses · Green Power Program for government purchasing of renewable energy
Value Communities	<i>Invest in healthy, safe, and walkable neighborhoods – rural, urban, or suburban.</i>	<ul style="list-style-type: none"> · Mandatory planning standards · Underground pedestrian areas (walkways, shopping destinations) · Pedestrian and bicycle safety

Table 5: Sustainability Best Practices Aligned with Livability Principles

1. Provide more effective and energy-saving transportation choices.

Developing safe, reliable, and economical transportation choices can decrease household transportation costs, reduce nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.

Transportation is often one of the highest sources of GHG emissions in cities, so reducing private vehicle use and promoting public transportation is a key strategy for reducing overall emissions. Each case study city has developed or is currently developing a public transportation system that allows residents to travel efficiently while simultaneously reducing individual GHG emissions. Hong Kong, Tokyo, and Seoul have well-established, extensive public transit systems that are widely used among their populations. These cities incorporate high-speed and light rail, rapid and regular bus, and ferry modes into their transit systems to provide a wide range of choices for getting around the city and to other cities without a personal vehicle.

In addition, Adelaide, Yokohama, and Tianjin Yujiapu have set foundations for successful public transit systems that will offer their citizens reliable and economic transportation choices. For example, a \$2.6 billion investment in 2008 to transform Adelaide's transportation network will include many upgrades to increase efficiency, safety, and environmental quality. Reducing transport-related emissions – currently 36 percent of the City's total emissions – is a key goal in Adelaide's *Integrated Movement Strategy*. The public transit investment not only supports this goal, but will also help achieve South Australia's Strategic Plan target of public transit constituting at least 10 percent of weekday passenger vehicle kilometers travelled (VKT) by 2018. Additionally,

Tianjin Yujiapu has four planned and designed subway lines and over 40 kilometers of bus rapid transit lines to provide a convenient and efficient transit system, as well as a high-speed train line connecting Beijing to the district and bus rapid transit systems. Figure 1 below from the *Feasibility Study* for the district shows that increased public transit use – at an estimated 56 percent modal share – and other transportation strategies will decrease transit-related emissions by around 30 percent from the business as usual estimate. The study also contains a cost analysis of each transportation measure, and calculates the cost required to reduce emissions by one tonne

Measure	Cost to reduce 1t of CO ₂ (USD)
BRT	\$0.20
Route bus	\$0.14
Community cycle	\$0.02
Road pricing	\$0.04
Electric car	\$0.03

Table 6: Tianjin Yujiapu Transportation Strategies – Cost to Reduce Emissions

Source: Tianjin Yujiapu Feasibility Study: Final Report 2011

Regional Transportation Investment: Adelaide

Delivered:

- Upgraded two rail lines
- 100 additional buses
- Tramline extensions
- Park and ride installments
- Rail fleet refurbishment

Underway:

- Rail line revitalization for two additional lines
- Rail line extension
- Purchase of electric trains
- Smart ticketing development and testing

Next steps:

- Electrification of two rail lines
- Extension of three additional rail lines
- Introduction of smart ticketing technology system-wide

using each, as shown in Table 6. Although BRT is the most expensive strategy, the *Feasibility Study*, acknowledges that “promotion of only low-cost measures cannot achieve the [emissions] reduction target. The study also advises that because BRT is assumed to be installed across a wider area, it should be examined in conjunction with the City of Tianjin's comprehensive traffic plan when executing it in order to achieve large emissions reductions.

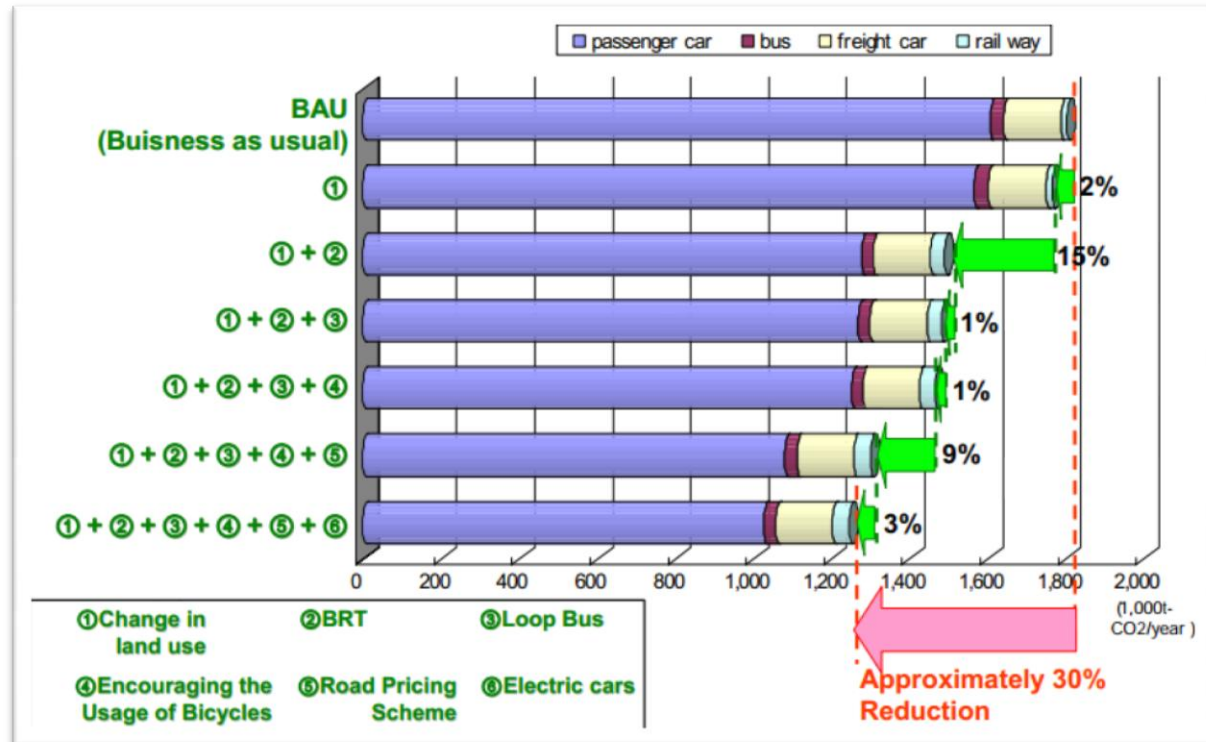


Figure 1: Amount of Reduction in CO₂ Emissions – Tianjin Yujiapu

Source: Tianjin Yujiapu Feasibility Study: Final Report 2011

The ease of use transit modes is a vital factor while establishing the infrastructure for these cities. An innovative strategy exhibited by Seoul is its transit system fee structure. Due to budget constraints, “both central and local government officials have been seeking more affordable ways to expand urban public transport services to meet the rising travel demands of a growing megacity.” (Pucher et al. 44) Transit reforms took place in Seoul in 2004, and in order to encourage ridership, there is a flat charge – equal to about one U.S. dollar – within the city for public transit use. Commuters can change from subways to buses without any extra transit charge. This promotes transit ridership not only through ease of use, but also makes it more economical for commuters, no matter what distance they are traveling. The flat fare structure was used in early years in the U.S. subways systems. It required heavy government subsidies and was difficult to self-sustain without the government intervention. The commitment to Seoul’s transit system by the government shows the value that the city attaches to increasing ridership and cutting emissions from private vehicles. Additionally, operation efficiency is another key factor affecting the ridership and costs. The strategy of increasing the efficiency and reliability of the transit operating system has been implemented so that there is less idling time necessary for passenger boarding and the paying of fares.

Bicycle and pedestrian transportation is becoming increasingly important as part of transit systems in cities. These methods are not only an important emissions-free part of reducing personal vehicle dependence; they are also the most economical choice for residents to travel short distances around cities. Adelaide is the most innovative case study city as far as bicycle transportation – the city is taking countless steps to promote cycling and walking as sustainable transportation options through its *Bicycle Action Plan* and *Integrated Movement Strategy*. Its

strategy to extend the on-street cycle lane network speaks directly to the concept of creating “safe, reliable, and economical transportation choices” that reduce greenhouse gas emissions. The city has dedicated significant funding to providing bike lanes around the city that are positioned between street curbs and on-street parking. This positioning increases the safety of biking around the city because cyclists are separated from traffic on the main roadway. Furthermore, safety specifications for bike lanes have been made requiring them to meet Australian Design Standards and “contribute to the visibility and safety of cyclists.”



Figure 2: Example of Pedestrian and Bicycle Street Enhancements
Source: Adelaide Integrated Movement Strategy

The U.S. Federal Highway Administration disseminates standards for bicycle traffic control devices, such as provisions for signs, pavement marking, and signals, but these standards are limited in their consideration of cyclists’ safety. Adopting strict regulations for bike lane design and safety would be beneficial and promote this sustainable, economical mode of transportation.

2. Promote equitable, affordable housing.

Expanding location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation are the key elements to enhance the principle of integrating housing and transportation planning.

This Livability Principle aims to increase the energy and location efficiency of housing choices. Each of the case study cities is employing green building standards or recommendations in some way, as they realize that these strategies not only reduce emissions from buildings, but also increase the affordability of housing options as energy costs decrease. Case in point, Hong Kong acknowledges in its *Climate Strategy and Action Agenda* that “enhancement of energy efficiency has proven to be a win-win strategy for both the owners [and] users of buildings and for the environment.” Hong Kong has established required green building standards through legislation mandating its Building Energy Codes, which will commence full operation in September 2012. These codes cover lighting, air conditioning, electrical installations, and elevator and escalator installations, among other things. Buildings account for about 90 percent of the total electricity consumption in Hong Kong, so the potential for energy

Yokohama Home Energy Management Systems

Goal: 4,000 homes by 2014

Home Energy Management Systems (HEMS) allow residential energy consumers to visualize, manage, control and reduce energy use and costs. HEMS in Yokohama are unique because they:

- introduce combined patterns of multiple photovoltaic and energy equipments to housings and buildings, and
- minimize energy costs by combining with expansion of efficiency by insulating materials.

Homeowners can reduce or shift energy use during peak times, and can even help electricity providers improve grid efficiency and network reliability.

savings and emissions reduction is large. It is expected that the energy efficiency requirements will result in energy savings for new buildings of 2.8 billion kWh in the first decade of full operation, equivalent to a reduction in carbon dioxide emissions of about 1.96 million tones.

Integrating incentives with flexible policies is an effective strategy for many initiatives. Although mandatory green building standards are desirable to maximize energy efficiency of residences, this strategy is not always legislatively and/or financially possible for cities. Several case study cities have implemented

voluntary strategies that encourage green building without encountering the difficulties of establishing mandatory policies. For example, Adelaide provides rebates for residents and developers of residential properties who install solar panels or convert existing hot water systems to solar, as well as for purchasing and installing rainwater tanks. Yokohama's strategy is gradual – Home Energy Management Systems (HEMS) will first be employed in the homes of government employees, and then expanded to apartment complexes owned by certain parties, and then to all new homes. Additionally, Tokyo's Campaign for Elimination of Incandescent Lamps is a large-scale replacement promotion campaign in cooperation with electric appliance manufacturers, and trade and consumer organizations. As lighting accounts for nearly 20 percent of electricity consumed in households, this program could have a massive effect on overall residential energy use. These incentives or gradual installment strategies from these case study cities may provide good examples of ways to encourage green building when the establishment of mandatory policies is not feasible.

Transit-oriented development (TOD) is a strategy for increasing location efficiency of housing and resident mobility that many cities are embracing worldwide. For example, Hong Kong's development standards contain "sustainable guidelines" that include encouraging the development and use of public transit in metropolitan areas. Well-established cities such as Tokyo and Yokohama have also developed in ways that allow residents to have easy access to transit systems from their homes. However, in order to apply TOD development principles to cities with transit systems that are either undeveloped or developing, policy guidelines are necessary. A good example of this is Adelaide's *Green City Sector Agreement*, which encourages "environmentally sustainable medium to high density residential and mixed

Hong Kong Planning Standards and Guidelines

Section 3: Community Facilities: Locational factors for community facilities serving the wider public:

- The accessibility and the transport needs of staff, users, and visitors should be considered

Section 9: Environment: Guidelines and siting requirements to minimize environmental problems of transit facilities land uses:

- Encourage the development and use of railways, especially in metropolitan and topographically-confined areas
- Promote balanced land uses to minimize the need to travel, hence the traffic volume

use developments in the City.” This policy is supported by Adelaide’s *Guide to Mixed Use Development*, which outlines the benefits of mixed-use TOD, summarized in the Table 7 below, and provides key design principles to be followed in order to reduce the need for residents to travel.

Benefits of Mixed Use Development		
<i>Benefits to the Developer/Investor</i>	<i>Benefits to the Public</i>	<i>Benefits to the Environment</i>
<ul style="list-style-type: none"> · An adaptable building product which contains flexibility to change uses · The opportunity to offer “green developments” that use environmentally efficient materials and designs · Quicker take up rates of residential and commercial tenancies due to tenants residing and working within the same building creating efficiencies · A diverse flow of investment from the different uses in the building · Increased security to tenants due to nature of mixed use developments and complementary hours of operation 	<ul style="list-style-type: none"> · Increased housing, employment, business and investment choice · Bringing together and integrating different land uses and activities, making them readily accessible in one location · The creation of interesting and vibrant streets through the diversification of activities · More efficient use of public infrastructure 	<ul style="list-style-type: none"> · More efficient use of land and reduced car dependency · Opportunity to incorporate new environmentally sensitive “green” technologies
Successful Mixed Use Development Features		
<ul style="list-style-type: none"> · Close proximity to economic, high amenity areas and key attractors (retail, recreation, public transport services and Park Lands) · Good access and visual prominence · Incorporate critical design components, including designing for pedestrian interaction · Separate commercial and residential entrances with each clearly designed · Appropriate design solutions and management practices to address potential conflict and the impact of different uses · Sustainable and energy efficient design · Adaptability to cater for current and future market trends 		

Table 7: Mixed Use Development Benefits and Features

Source: Adelaide Guide to Mixed Use Development

Seoul’s innovative approach to the encouragement of transit-oriented development is the implementation of Korea’s Green Building Certification System (GBSC). When applied to multi-family residences, this system considers several factors in the evaluation of the building’s sustainability that tie closely to transit-oriented development. Among these are (1) distance to public transportation; (2) distance from the center of the apartment complex to the center of the city or district; and (3) providing a community center and/or facilities for community use. The examples from Adelaide and Seoul provide good foundations for encouraging transit-oriented development in order to increase the location efficiency of housing choices for their residents. TOD works best in new cities or expansion. Seoul example is for the old town or the satellite cities being planned and constructed?

3. Enhance economic competitiveness through compact city efficiency.

Improving economic competitiveness is an equally important principle to a sustainable growth in a community. This will require reliable and timely access to employment centers, educational opportunities, services, and other basic needs by workers as well as expanding business access to markets.

Transit-oriented and mixed-use development, as discussed above, can increase residents' accessibility and mobility. These strategies can be valuable to workers and subsequently the economy of cities, when accompanied with an efficient public transportation system. Workers' mobility and accessibility can be improved as well as efficiency. Such improvement expands overall economic efficiency and competitiveness, while still decreasing emissions that would otherwise be generated by workers' travel modes. As the analysis above indicated, the case study cities either have well-established transit-oriented development or are currently developing in a way that allows workers to easily and efficiently travel throughout the city, as well as between other cities.

Tianjin Yujiapu is an example of a city that is in the process of developing these strategies. High density land use will be concentrated around public transportation stations in the district, and several urban functions, such as business, commercial, and residential, will be vertically mixed. "Station Cores" in the district are planned to connect stations with surrounding districts. The integration of business, commercial, and residential uses will increase the mobility of workers, and connecting workers to surrounding financial centers will increase the district's overall economic viability.

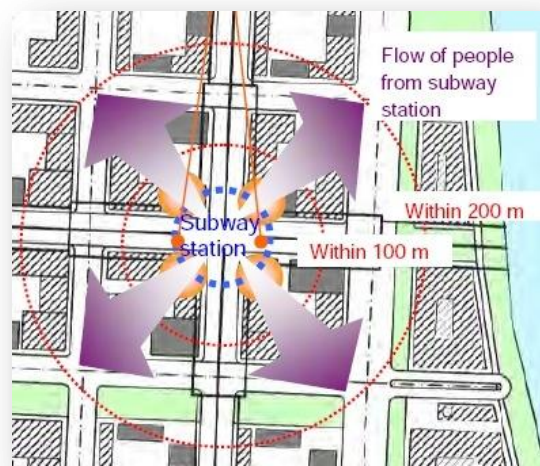


Figure 3: Concept of Tianjin Yujiapu Station Core

Source: Tianjin Yujiapu Feasibility Study

The OECD compact city model is also designed to enhance economic competitiveness of a city. Various characteristics of this model include: high residential and employment densities; mixture of land uses; increased social and economic interactions; multimodal transportation; and high degrees of accessibility. The concept of the compact city has become popular in many OECD countries, particularly in Europe and Japan, and is evident in many of the case study cities in this paper. Through this model, competitiveness can be increased due to increased city attractiveness and lower local pollution, improved quality of life, and cost savings through increased efficiency, energy security, and infrastructure improvements.

OECD Compact City Characteristic	Contribution to Urban Sustainability		
	Environmental Benefits	Social Benefits	Economic Benefits
Shorter intra-urban travel distances	Fewer emissions; less pollution from automobiles	Greater accessibility due to lower cost	Higher productivity due to shorter travel time for workers
Less automobile dependency	Fewer emissions; less pollution from automobiles	Lower transport costs; higher mobility for people without access to a car; improved human health due to more cycling and walking	Development of green jobs/technologies
More district-wide energy utilization and local energy generation	Less energy consumption and emissions per capita		Development of green jobs/technologies; more energy independence
Optimum use of land resources and more opportunity for urban-rural linkage	Conservation of farmlands and natural biodiversity; fewer emissions due to shorter food travel mileage	Higher quality of life due to more recreational activities	Rural economic development (urban agriculture, renewable energy, etc.)
More efficient public service delivery		Public service level for social welfare maintained by improved efficiency	Lower infrastructure investments and cost of maintenance
Better access to a diversity of local services and jobs		Higher quality of life due to access to local services (shops, hospitals, etc.)	Skilled labor force attracted by high quality of life; greater productivity due to more diversity, vitality, innovation, and creativity

Table 8: Compact City Policies: A Comparative Assessment
Source: Organisation for Economic Co-operation and Development

4. Support existing communities.

Through this principle, U.S. Partnership for Sustainable Communities targets toward existing communities through such strategies as transit-oriented, mixed-use development, and land recycling. The goal is to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.

Conservation of green and open space is another key strategy used by cities to support existing communities. Green and open spaces are an important part of every community, not only for their aesthetic value, but also for their social, ecological, and environmental benefits. Particularly in urban areas, green and open space can provide a place to play, meditate, gather, and rest. These spaces give a sense of social place that reinforces community bonds, and provide a refreshing contrast to commercialized and industrialized environments.

Several of the case study cities are making concerted efforts to support their existing communities by safeguarding rural landscapes. Hong Kong's *Planning Standards and Guidelines* direct development control to conserve open spaces with several policies:

- Retain significant landscapes, ecological and geological attributes and heritage features as conservation zones.

- Restrict uses within conservation zones to those that sustain particular landscapes, ecological and geological attributes and heritage features.
- Control adjoining uses to minimize adverse impacts on conservation zones and optimize their conservation value.
- Create, where possible, new conservation zones in compensation for areas of conservation value, which are lost to development.

These guidelines could be used as a good policy foundation for any city wishing to safeguard its rural or natural landscapes. Yokohama is also making efforts to conserve rural lands through its Greenery Tax, which allows the city to purchase and maintain forests, as well as support the revitalization of agriculture.

In addition to conserving rural landscapes, cities are preserving open spaces within city limits. For example, Adelaide works in partnership with the South Australian State Government to develop quality regional open space. One project facilitated through this partnership is the Adelaide City Park Lands Trail, which links individual parks and path networks within the city and surrounding suburbs.



Land recycling, or the reuse of vacant or abandoned property, is also considered as a strategy for supporting existing city communities. This strategy is used extensively in a few U.S. cities, such as brownfield redevelopment in Detroit, but has yet to achieve widespread popularity. An innovative method of land recycling can be seen in Tianjin Yujiapu's semi-permanent "builder's home" model. This unique strategy entails the construction of structurally safe living environments for the construction workforce of the district, which will be demolished after the completion of the project and converted to green spaces. The image to the right is an artist's rendering of the completed district. As shown, there is a large amount of green space on the outer edges of the district. The temporary builder's homes will reside here for the 10 years of the construction project, after which these areas will be converted to the green space.

*Figure4: Artist's rendering:
Completed Tianjin Yujiapu District
Source: Tianjin Yujiapu Feasibility Study*

5. Coordinate and leverage federal policies and investment.

This livability principle aims to align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

Implementing alternative and renewable energy programs is an effective strategy to leverage inter-governmental collaboration and public-private partnership. The reverse is true as well – effective cooperation between public and private entities is necessary for climate change

policies to be successful. Each case study city is making progressive smart energy choices to reduce associated emissions and strengthen economic competitiveness. A key part of each city's strategy is to incorporate increased amounts of renewable energy into their energy mixes. For example, Hong Kong actively promotes the generation and use of renewable energy in public works projects and in the private sector by offering a higher rate of return for local power companies' investment in renewable energy facilities. The Scheme of Control Agreements (SCAs) between the city government and the two power companies, HongKong Electric Company and CLP Power Hong Kong, provide for positive adjustments to the amount of annual return for company shareholders in the form of an Emissions Performance Incentive and an Energy Efficiency and Renewables Incentive, as outlined in Table 9 below. As a result, these power companies have installed solar energy systems at their power stations and are planning to install offshore wind turbines. HK Electric reports that its solar power system at Lamma Power Station helped offset 576 tonnes of carbon emissions in 2011 – equivalent to planting more than 25,000 trees. Its Lamma Island wind farm, targeted for completion in 2015, is expected to produce just under two percent of the company's annual electricity output and offset 150,000 tonnes of emissions each year. The solar system and wind farm are project investments of USD\$2.97 million and \$387 million, respectively.

In addition to these energy sources, Hong Kong will construct and operate solid waste-to-energy facilities, and utilize landfill gas as an energy source. Waste and landfill gas energy strategies offer viable alternatives to cities that cannot make large investments in other renewable energy sources. Yokohama's strategy to collect used cooking oil from elementary schools for refinement into biodiesel fuel to be utilized at public facilities also presents a unique strategy. Both cases have direct and indirect impacts to leveraging public resources and private investments.

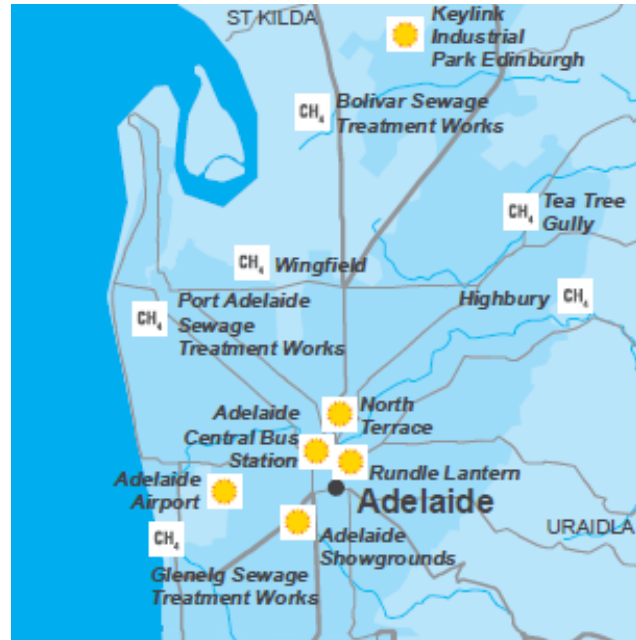


Figure 5: Existing and Proposed Renewable Energy Projects in Adelaide
 Source: South Australia's "A Renewable Energy Plan for South Australia" Strategy Paper

Hong Kong Energy Incentives for Power Companies	
Emissions Performance Linkage Mechanism (Agreement Schedule 4)	
<i>Annual Emissions Performance⁷</i>	<i>Incentive/Penalty Amount (% to be applied to permitted return)</i>
Permissible emissions exceeded by 30% or more	0.4%
Permissible emissions exceeded by 10 – 30 %	-0.2%
Permissible emissions not exceeded by 10%, but not outperformed by 10% or more	0.0%
Permissible emissions outperformed by 10 – 30%	0.05%
Permissible emissions outperformed by 30% or more	0.1%
Energy Efficiency (Agreement Schedule 6)	
<i>Incentive Performance</i>	<i>Incentive Amount (% to be applied to permitted return)</i>
Annual energy saving performance attributable to efficient technologies equal to or greater than 3GWh	0.01%
50 or more annual energy audits completed	0.01%
Renewable Energy Performance (Agreement Schedule 6)	
<i>Proportion of the volume of electricity generated by approved renewable energy systems</i>	<i>Incentive Amount (% to be applied to permitted return)</i>
5% or above	0.05%
Less than 5% and greater than or equal to 2%	0.03%
Less than 2% and greater than or equal to 1.5%	0.02%
Less than 1.5% and greater than or equal to 1%	0.01%
Less than 1.0%	0

Table 9: Hong Kong Renewable Energy and Efficiency Incentives for Power Companies
Sources: Hong Kong Scheme of Control Agreements

Tokyo is another city that promotes the widespread use of renewable energy through government investment, through its Green Power Purchasing Program. Designed to shoulder some of the costs associated with the expansion of the use of renewable energies being pioneered voluntarily by various enterprises, this program will incentivize the purchasing of green power. At its initiation, renewable energy purchases were treated as donations for tax purposes, but this program calls upon the government to have these purchases accounted for as business expenses in order to help companies use renewable energies more readily. Tokyo will also create a national network of green power purchasers, in collaboration with other local governments, in order to accelerate the trend of purchasing renewable energies.

Adelaide presents another good example of regional collaboration. The city participates in South Australia's Green Power program, which set a goal of buying renewable energy for 50 percent of the state government's electricity needs and at least 20 percent of the city government's needs by 2014. In November 2011, the South Australian Government announced that it had reached this goal three years ahead of schedule, and nine years ahead of schedule for the nationally-mandated requirement of having 20 percent of electricity generated from renewable sources by 2020. South Australia established a new goal of achieving 33 percent renewable energy by 2020. An emissions inventory completed in early 2012 for the Adelaide City Council revealed that between 2006 and 2010, city emissions decreased by 7.7%. This was

⁷ Based on Total Permissible Emissions as defined in the Air Pollution Control Ordinance (Cap. 311).

primarily due to the lower carbon intensity of the South Australian electricity grid through the extensive installation of renewable energy. Wind energy installations have been particularly important, with wind providing over a quarter of the State's generated grid electricity as of May 2012. The State Government has also committed to the redevelopment of Tonsley Park in southern Adelaide as a clean technology industry hub, which will provide an estimated annual boost to the economy of over \$400 million and an employment impact of 8,700 jobs. Depending on the cost, this type of regional cooperation can serve as a good model for aligning intergovernmental policies and initiatives for leveraging resources and attracting private participation.

6. Value communities and neighborhoods by promoting non-motorized transportation.

This principle enhances the unique characteristics of all communities by investing in healthy, safe, and walkable rural, urban, and suburban neighborhoods.

An important part of transit systems in cities is bicycle and pedestrian transportation. These systems are not only an important emissions-free part of reducing personal vehicle dependence; they are also the most economical choice for residents to travel short distances around cities. Many of the case study cities are making efforts to provide their residents with walkable neighborhoods and city districts. Hong Kong's *Planning Standards and Guidelines* provide a valuable policy foundation for cities wishing to step up the walkability of their neighborhoods. Making planning standards such as these mandatory, rather than voluntary, is the best way to maximize walkability of city neighborhoods. There are countless benefits of walkable communities, in addition to decreased transportation emissions. They encourage people to be more active and healthy, boost people- and family-oriented community togetherness, and increase accessibility and mobility for children and the elderly. Walkability is one of the effective sustainability strategies that is also able to preserve traditional community characteristics.

Other case study cities are employing innovative strategies to increase pedestrian efficiency and walkability of neighborhoods. Tianjin Yujiapu will utilize bike paths, walking paths, and pedestrian walkways through the detailed plan of underground space. This will include underground shopping malls and other destinations. Also, the city's "Station Cores," described above, will be used to create a comfortable and attractive pedestrian area, expected to be the focal point of pedestrian movement. Finally, Adelaide's *Integrated Movement Strategy* contains a number of provisions for improving pedestrian facilities and access to destinations. The city's vision is one of "a city that is convenient, safe and enjoyable for pedestrians at all hours and which encourages for health and pleasure."

Hong Kong *Planning Standards and Guidelines*

Standards for improving walkability within the city:

- Provide shade for pedestrians to minimize negative effects of the city's hot and humid periods, as well as the rainy season.
- Provision of footbridges should be properly coordinated to cater for the convenient movement of pedestrians.
- For pedestrian underpasses, high quality and well-designed walling and floor materials, lighting, portals, and other design elements should be adopted to achieve visual enhancement and create an interesting and safe environment for pedestrians.

This plan then outlines several specific strategies to support this vision, including modifying roads in favor of pedestrian movement and installing controlled pedestrian crossings at intersections.

III. U.S. DOMESTIC IMPLEMENTATION

The comparative case studies can provide references or guidance for the communities in the United States. Taking Denver, Colorado, in the Southwest United States, as an example, the city received a Sustainable Communities Regional Planning Grant offered through the Partnership for Sustainable Communities. This HUD-initiated grant program supports metropolitan and multijurisdictional planning efforts that integrate housing, land use, economic and workforce development, and infrastructure investments that empower jurisdictions to consider the interdependent challenges of:

1. Economic competitiveness and revitalization;
2. Social equity, inclusion, and access to opportunity;
3. Energy use and climate change; and
4. Public health and environmental impact.

This section describes the purpose of Denver's Sustainable Communities Grant and examines best practices from the case study cities that could be implemented in the project. With a population of 2,850,000, the Denver metropolitan region is comparable in size to the smaller case study cities of Adelaide and Tianjin Yujiapu, so strategies from these cities are reviewed.



Figure 6: New Light Rail Car
Source: Denver Regional
Transportation District

1. Project Description

The City of Denver is a member of the Denver Regional Council of Governments (DRCOG), which received a Sustainable Communities Regional Planning Grant of US\$4.5 million in 2011. The grant assists DRCOG and its 56 members with the planned construction of six new fixed-rail transit lines, with a goal of aligning investments, programs, and policies to generate benefits beyond the transit lines themselves. DRCOG weaves together land use, transportation, and environmental concerns into a fully integrated regional plan: *Metro Vision*. A key target of this plan is to reduce regional GHG emissions from the transportation sector by 60% by 2035. In order to accomplish this goal while simultaneously accommodating a rapidly growing population, the FasTracks program was created to build over 120 miles of rapid transit throughout the region, one of the largest mass transit projects under construction in the U.S. The *Metro Vision* plan provides the foundation for regional efforts to maximize the benefits of this program and other infrastructure investments, and its policies align directly with the six Livability Principles.

2. Best Practices Implementation

A similarity between the regional approaches to transportation development in Adelaide and Denver is the alignment of local policies with state goals for sustainability. The goals of the

DRCOG plan support the State of Colorado’s sustainable community development principles. Likewise, the City of Adelaide entered into its *Green City Sector Agreement* with the State of South Australia, linking sustainability goals and policies at each level of government. This state and regional collaboration offers invaluable support for local initiatives, and is a prime example of the Livability Principle of coordinating and leveraging federal policies and investment, discussed above. A valuable policy tool from Adelaide’s strategy can take this state-local cooperation to a higher level. The City’s agreement “requires that the State Government and the Adelaide City Council...take leading roles in ensuring that ‘green’ principles and policy settings that support sustainability and resilience are embedded into projects, programs and initiatives in the City of Adelaide.” Such an agreement fosters significant, long-term collaboration between the two levels of government, and could be a next step for DRCOG to take in developing its sustainability initiatives.

Another strategy for sustainability that DRCOG can take from the case study cities is the integration of bicycle and pedestrian planning with this transit project. The Sustainable Communities Grant will support the development of rail lines, but this planning process could also consider walkability of areas around transit stations, as many of the case study cities have done. Adelaide and Tianjin Yujiapu have encouraged pedestrian movement around their cities with various strategies: increasing shaded areas, safety features, providing foot bridges and pedestrian underpasses, designating pedestrian routes and a “continuous footpath” concept, and even creating a detailed plan for underground pedestrian space that includes walkways and shopping malls. It would serve Denver well to take pedestrian and bicycle movement into consideration to increase the sustainability of its transportation investment.

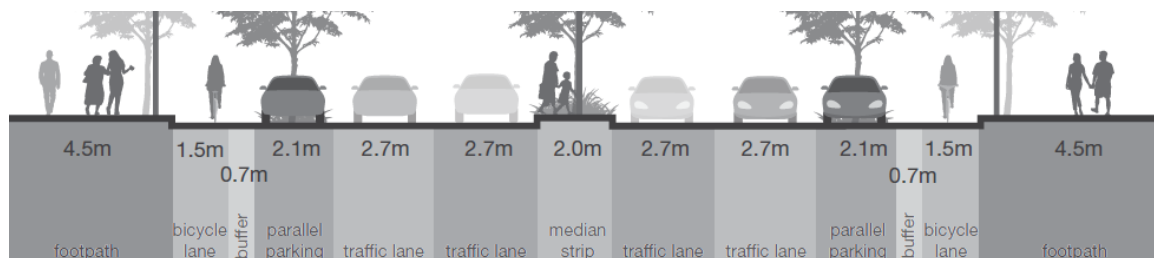


Figure 7: Example of Adelaide Street Space Reallocation

Source: Adelaide Integrated Movement Strategy 2012-22

Bicycle and pedestrian planning support a third sustainability strategy that could be implemented in Denver’s transit project: mixed-use transit-oriented development (TOD). Tianjin Yujiapu presents a valuable model for this strategy. High density land use featuring a mixture of residential, commercial, and industrial uses will be concentrated around transit stations. Following this model, Denver could integrate mixed-use TOD into the development of the planned rail lines. Compact urban planning increases the city’s accessibility and mobility, and has many other benefits, as outlined in Table 8 above.

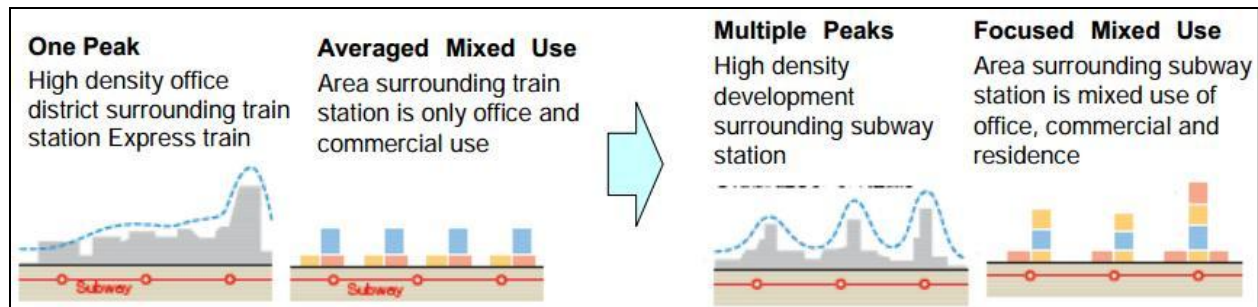


Figure 8: Tianjin Yujiapu Planned Mixed-Use Development

Source: Tianjin Yujiapu Feasibility Study: Final Report 2011

A final strategy from Tianjin Yujiapu that could be incorporated into Denver's transit investment is bus rapid transit (BRT). These faster, more efficient bus lines will be integrated with the district's railway stations, allowing public transit riders greater accessibility to the area while discouraging private vehicle use. This strategy could be applied in Denver, especially in the downtown area, to increase the use of the planned railway system. Financial and other limitations may prevent DRCOG from implementing a rail and BRT system simultaneously, but keeping logistical needs of BRT in mind during the planning process can lead to easier implementation in the future.

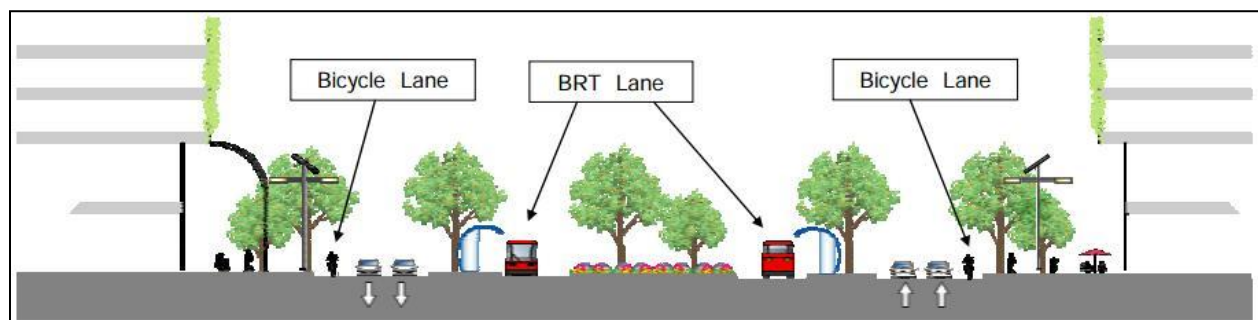


Figure 9: Tianjin Yujiapu Planned Road Section with BRT in Operation

Source: Tianjin Yujiapu Feasibility Study: Final Report 2011

IV. CONCLUSION

This paper serves as an introductory best practices guide to innovative sustainable strategies from across the Asia-Pacific region. Key lessons learned included: 1) Establishing governance framework with national and regional support for local policies is vital to the success of a city's mission to increase sustainability; 2) Policy or financial incentive programs are an important tool, not only for promoting strategies for reducing emissions, but also for fostering a strong foundation for future initiatives through public-private collaboration; 3) Implementation of Transit-Oriented Development is a strategic approach to achieve compact and mixed land use, transportation efficiency, and sustainability goals; 4) Public-private partnership leverages resources and creates consensus within communities; 5) Implementation of energy strategies with promotion of renewable energy and carbon trading or green power purchasing can have long term impacts in any size of the cities; 6) Monitoring and indicator systems are important for

assessing the successes and challenges of each individual strategy and supporting knowledge-sharing.

Among these sustainable policy measures, some are creative and should be considered by U.S. cities: 1) Integration of pedestrian planning and transit – walkability in city planning; 2) Integrated green building and transportation in GHG reduction strategies; 3) Smartphone bike sharing system; and 4) Measurable indicators for monitoring.

Policy measures that would be most effective for the cities in the emerging economies include: 1) Enhancing policy implementation framework: national policy, local regulations and action plans; 2) Enhancing planning framework to incorporate high density mixed-use with transit, public-private sharing profits at station area – land value to finance infrastructure, and 3) Establishing baseline and monitoring indicators.

The full paper for this research, produced by HUD, will present detailed case study findings and further analysis of U.S. applicability. Although this type of best practices identification and analysis is valuable for the development of sustainability strategies in U.S. cities, this simply sets a vague foundation for the planning process. Additional research is still necessary to determine the specific applicability of strategies in U.S. cities – this entails examining each strategy closely to determine its environmental, economic, developmental, and other effects, as well as identifying specific cities for implementation and the conditions that best suit each individual strategy.

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