3.15 ENERGY

The information in this section is based on the *Interstate 710 (I-710) Corridor Project Energy Report* (March 2012).

3.15.1 REGULATORY SETTING

The CEQA Guidelines, Appendix F, Energy Conservation, state that EIRs are required to include a discussion of the potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

NEPA (42 USC Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts.

3.15.2 AFFECTED ENVIRONMENT

Energy is currently consumed within the Study Area for the construction of public and private projects; operation of automobiles, trucks, and marine vessels; and operation of existing land uses. Automobile and truck fueling stations are located throughout the Study Area.

California is rich in conventional and renewable energy resources. It has large crude oil and substantial natural gas deposits in six geological basins, located in the Central Valley and along the Pacific coast. Most of those reserves are concentrated in the southern San Joaquin Basin. More than a dozen of the nation’s 100 largest oil fields are located in California. In addition, Federal assessments indicate that large undiscovered deposits of recoverable oil and gas lie offshore in the Federally administered Outer Continental Shelf (OCS); although, Federal law currently prohibits oil and gas leasing in that area. California’s renewable energy potential is extensive. The State’s hydroelectric power potential ranks second in the nation (behind Washington State), and substantial geothermal and wind power resources are found along the coastal mountain ranges and the eastern border with Nevada. High solar energy potential is found in southeastern California’s sunny deserts.

California is the most populous state in the nation, and its total energy demand is second only to Texas. Although California is a leader in the energy-intensive chemical, forest products, glass, and petroleum industries, the State has one of the lowest per capita energy consumption rates in the country. The California government’s energy-efficiency programs have contributed to low per capita energy consumption. Driven by high demand from California’s many motorists, major airports, and military bases, the transportation sector is the State’s largest energy consumer. More motor vehicles are registered in California than any other state, and worker commute times are among the longest in the country.

PETROLEUM. California is one of the top producers of crude oil in the nation, with output accounting for more than one-tenth of total U.S. production. Drilling operations are concentrated primarily in Kern County and the Los Angeles Basin; although substantial production also takes place offshore in both State and Federal waters. Concerns regarding the cumulative impacts of offshore oil and gas development, combined with a number of major marine oil spills throughout the world in recent years, have led to a permanent moratorium on offshore oil and gas leasing in California waters and a deferral of leasing in Federal waters. However, development on existing State and Federal leases is unaffected and may still occur within offshore areas leased prior to the effective date of the moratorium.

A network of crude oil pipelines connects production areas to refining centers in the Los Angeles area, the San Francisco Bay area, and the Central Valley. California refiners also process large volumes of Alaskan and foreign crude oil received at ports in Los Angeles, Long Beach, and the Bay Area. Crude oil production in California and Alaska is in decline, and California refineries have become increasingly dependent on foreign imports. Led by Saudi Arabia and Ecuador, foreign suppliers now provide more than two-fifths of the crude oil refined in California; however, California's dependence on foreign oil remains less than the national average.

California ranks third in the United States in petroleum refining capacity and accounts for more than one-tenth of total U.S. capacity. California's largest refineries are highly sophisticated; they are capable of processing a wide variety of crude oil types and are designed to yield a high percentage of light products like motor gasoline. To meet strict Federal and State environmental regulations, California refineries are configured to produce cleaner fuels, including reformulated motor gasoline and low-sulfur diesel.

Most California motorists are required to use a special motor gasoline blend called California Clean Burning Gasoline (CA CBG). In the ozone non-attainment areas of Imperial County and the Los Angeles metropolitan area, motorists are required to use California Oxygenated Clean Burning Gasoline, and the Los Angeles area is also required to use oxygenated motor gasoline during the winter months. By 2004, California completed a transition from methyl tertiary butylether (MTBE) to ethanol as a gasoline oxygenate additive, making California the largest ethanol fuel market in the United States. Four ethanol production plants are located in central and southern California, but most of California's ethanol supply is transported by rail from cornbased producers in the Midwest. Some supply is also imported from abroad.

NATURAL GAS. California natural gas production typically accounts for less than 2 percent of total annual U.S. production and satisfies less than one-fifth of State demand. Production takes place in basins located in northern and southern California, as well as offshore in the Pacific Ocean. California receives most of its natural gas by pipeline from production regions in the

Rocky Mountains, the Southwest, and western Canada. As with crude oil production, California natural gas production is in decline. However, State supply has remained relatively stable due to increasing amounts of natural gas shipped from the Rocky Mountains. California markets are served by two key natural gas trading centers—the Golden Gate Center in northern California and the California Energy Hub in southern California, and the State has nearly a dozen natural gas storage facilities that help stabilize supply.

COAL, ELECTRICITY, AND RENEWABLES. Natural gas-fired power plants typically account for more than one-half of State electricity generation. California is one of the largest hydroelectric power producers in the United States, and with adequate rainfall, hydroelectric power typically accounts for close to one-fifth of State electricity generation. California's two nuclear power plants account for almost one-fifth of total generation. Due to strict emission laws, only a few small coal-fired power plants operate in California.

California leads the nation in electricity generation from nonhydroelectric renewable energy sources. California generates electricity using wind, geothermal, solar, fuel wood, and municipal solid waste/landfill gas resources. A facility known as "The Geysers," located in the Mayacamas Mountains north of San Francisco, is the largest complex of geothermal power plants in the world, with more than 750 megawatts of installed capacity. California has numerous wind farms in five major wind resource areas, and several new projects are currently under construction. The world's largest solar power facility operates in California's Mojave Desert, and numerous other facilities are in the planning and permitting process.

3.15.2.1 ENERGY CONSUMPTION IN CALIFORNIA/LOS ANGELES COUNTY

The following statistics have been provided by the California Energy Commission (CEC) and are current through 2011.

ELECTRICITY. Fueled by population growth, the demand for electricity in California is increasing. California's electricity mix is generated by natural gas (56.7 percent); coal (1.8 percent); large hydroelectric (12.2 percent); nuclear (15.3 percent); and renewable (13.9 percent) sources.

In 2009, California produced 69 percent of the electricity it used; the rest was imported from the Pacific Northwest (7 percent) and the Desert Southwest (24 percent). Natural gas is the main source for electricity, contributing 45.2 percent of the total system power. In 2005, Californians spent $31 billion for their electricity. Table 3.15-1 shows the total electricity consumed in Los Angeles County for 2009.

Table 3.15-1 Annual Electric Consumption in Los Angeles County (2009)

Type of Consumer	Millions of Kilowatt-Hours[1]
Residential	20,503
Non-Residential	49,646
Total	**70,149**

Source: Energy Consumption Data Management System, California Energy Commission, 2009.
[1] A kilowatt-hour is a unit of power equal to 1,000 watts of electricity consumed in one hour.

NATURAL GAS. Only 13 percent of the natural gas California used in 2009 came from in-State production; the rest was delivered by pipelines from several production areas in the western United States and western Canada. California is at the end of those pipelines, forcing it to compete with other states for supplies. Once the gas arrives in California, it is distributed by the State's three major gas utilities—San Diego Gas and Electric, Southern California Gas Company, and Pacific Gas and Electric—which provide a collective total of 98 percent of the State's natural gas. Long Beach and Palo Alto are the only municipalities in California that operate city-owned utility services for natural gas customers.

Electricity generation is the largest user of natural gas, using approximately half of all natural gas in the State. The residential sector uses 22 percent of the natural gas. Of that amount, 88 percent is used for space and water heating. Table 3.15-2 shows the total natural gas consumption in Los Angeles County for 2009.

Table 3.15-2 Natural Gas Consumption in Los Angeles County (2009) in Millions of Therms

Land Use	Millions of Therms[1]
Residential	1,299
Non-Residential	1,651
Total	**2,950**

Source: Energy Consumption Data Management System, California Energy Commission, 2009.
[1] A therm is a unit of heat containing 100,000 British thermal units (Btu).

Liquid Petroleum Gas (LPG) (Propane). Liquefied petroleum gas (LPG) is a mixture of gaseous hydrocarbons, mainly propane and butane that change into liquid form under moderate pressure. LPG (usually called propane) is commonly used as a fuel for rural homes for space and water heating, as a fuel for barbecues and recreational vehicles, and as a transportation fuel. It is normally created as a by-product of petroleum refining and from natural gas production.

TRADITIONAL TRANSPORTATION FUELS (FOSSIL FUELS). Fossil fuels are energy resources that come from the remains of plants and animals that are millions of years old. Fossil fuels, like coal, oil, and natural gas, provide the energy that powers our lifestyles and our economy. Fossil fuels are primarily responsible for fueling our transportation system. Petroleum-based fuels are the standard. Our country's entire transportation infrastructure of pipelines and gas stations is built around fossil fuels. They are the bedrock we base our energy mix on, but they are a limited resource. Once they are gone, they can no longer be part of our energy mix.

A public concern with fossil fuels is that, in addition to their unsustainability as a non-renewable source of energy, there is a negative environmental impact in the use of fossil fuels. The burning of fossil fuels is responsible for emissions that contribute to global climate change, acid rain, and ozone problems. Development of alternatives to traditional transportation fuels is desirable to improve sustainability and reduce impacts of fossil fuel consumption.

ALTERNATIVES TO TRADITIONAL TRANSPORTATION FUELS. Alternatives to traditional transportation fuels are being developed and introduced into the consumer marketplace. Alternative fuels currently in use in the United States include:

- Compressed natural gas;
- Electric (EVC);
- Ethanol, 85 percent (E85);
- Hydrogen (HYD);
- Liquefied natural gas (LNG); and
- Liquefied petroleum gas (LPG).

The following information was prepared by the Energy Information Administration (EIA), the independent statistical and analytical agency within the United States Department of Energy. Each year, the EIA collects data on the number of alternative fuel vehicles (AFVs) supplied, and for a limited set of fleet user groups, the number of AFVs in use and the amount of alternative transportation fuel consumed. The user groups surveyed are Federal and State governments, alternative fuel providers, and transit companies.

Alternative Fuel Vehicles in Use. An estimated 826,318 alternative fuel vehicles were in use in the United States and 136,409 in California in 2009. See Table 3.15.3, below.

Table 3.15-3 Alternative Fuel Vehicles In Use by Fuel Type 2009

Fuel Type	United States	California
Compressed Natural Gas (CNG)	114,270	37,517
Electric	57,185	31,545
Ethanol, 85% (E85)	504,297	51,734
Hydrogen	357	0
Liquefied Natural Gas (LNG)	3,176	1,859
Liquefied Petroleum Gas (LPG)	147,030	13,754
Other Fuels[1]	3	0
Total	**826,318**	**136,409**

Source: Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels and the DOE/GSA Federal Automotive Statistical Tool (FAST).

1 May include P-Series fuel or any other fuel designated by the Secretary of Energy as an alternative fuel in accordance with the Energy Policy Act of 1995.

DOE = United States Department of Energy
GSA = General Services Administration

Alternative Fuel Consumption. The estimated consumption of alternative fuels (in thousand gasoline-equivalent gallons) in California during 2009 is shown in Table 3.15-4.

Table 3.15-4 Estimated Consumption of Alternative Fuels in California by Fuel Type, 2009 (Thousand Gasoline-Equivalent Gallons)

CNG	Electric	E85	Hydrogen	LNG	LPG	Other	Total
92,917	2,102	7,858	0	12,513	12,196	0	127,586

Source: Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels.

3.15.3 Environmental Consequences

3.15.3.1 Permanent Direct Impacts

Build Alternatives. Local energy demand for transportation projects typically is dominated by vehicle fuel usage. Operational energy consumption was estimated for the vehicles (autos, heavy-duty trucks) traveling within the Study Area. Energy calculations are based on the vehicle miles traveled (VMT) (numbers of vehicles, distance traveled) during a typical weekday (Table 3.15-5) for the 2008 base year and each of the project alternatives including No Build. A similar calculation is then performed for each of the scenarios to estimate VMT on an annual basis (Table 3.15-6) by vehicle type.

Table 3.15-5 Operational Daily VMT

Scenario	Daily Study Area VMT (Millions)			
	Automobile	Truck	Truck (Freight Corridor)	Total
2008 Existing	70.9	5.1	--	76.0
2035 Alternative 1 (No Build)	76.9	7.2	--	84.1
2035 Alternative 5A	77.1	7.2	--	84.3
2035 Alternative 6A	77.4	6.6	0.5	84.0
2035 Alternative 6B	77.4	6.6	0.6	84.6
2035 Alternative 6C	77.1	6.7	0.4	84.2

Source: *I-710 Corridor Project Energy Report*, March 2012.
VMT = vehicle miles traveled

Table 3.15-6 Operational Annual VMT

Scenario	Annual VMT			
	Automobile	Truck	Truck (Freight Corridor)	Total
2008 Existing	22,702	1,625	--	24,327
2035 Alternative 1 (No Build)	24,604	2,291	--	26,895
2035 Alternative 5A	24,682	2,303	--	26,985
2035 Alternative 6A	24,778	2,102	174	27,054
2035 Alternative 6B	24,778	2,112	185	27,075
2035 Alternative 6C	24,658	2,133	137	26,928

Source: *I-710 Corridor Project Energy Report*, March 2012.
VMT = vehicle miles traveled

In addition to VMT, travel conditions within the Study Area also influence fuel consumption rates. Without the capacity improvements proposed in the build alternatives, congested traffic conditions are more prevalent throughout the Study Area. These conditions contribute to inefficient energy consumption, as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds along congested roadways.

For the energy consumption calculations, autos are presumed to use gasoline, while heavy-duty trucks in the general purpose lanes of I-710 would use diesel fuel for all of the scenarios. Alternatives 6A/B/C include a freight corridor that would only be utilized by heavy-duty trucks. Under Alternative 6A, heavy-duty trucks using the freight corridor would be diesel-powered, while under Alternatives 6B and 6C, electricity would be used to power the trucks while traveling along the freight corridor. As such, Alternatives 6B and 6C include a wayside electric power distribution system and electrical substations as an element of the freight corridor, which provides electrical power to trucks using the freight corridor. The specific technology for power distribution is not yet determined, though for purposes of analyses, an overhead catenary distribution system (a community-used power system for transportation facilities such as light rail) is assumed and is reflected in the calculations presented below in Tables 3.15-7 and 3.15-8. The ZEE Design Option would result in a very minor increase in electricity consumption due to its extension of the overhead catenary system an additional two miles.

Table 3.15-7 reports annual energy use for vehicles in millions of gallons (autos, heavy-duty trucks) and electricity needed in millions of kilowatt hours (kWh) to provide power for the zero-emission trucks using the freight corridor in Alternatives 6B and 6C. Both VMT and travel speeds, including percentage of travel occurring under stop-and-go conditions, were used to estimate the vehicle fuel consumption for each of the scenarios reported in Table 3.15-7.

Table 3.15-7 Study Area Energy Consumption – Annual

Scenario	Energy Consumption[1]		
	Gasoline (Millions of gallons)	Diesel (Millions of gallons)	Electricity (Millions of kWh)
2008 Existing	1,240	269	--
2035 Alternative 1 (No Build)	1,346	393	--
2035 Alternative 5A	1,343	393	--
2035 Alternative 6A	1,340	398	--
2035 Alternative 6B	1,340	362	183
2035 Alternative 6C	1,341	369	157

Source: *I-710 Corridor Project Energy Report*, March 2012.

[1] Energy consumption was calculated using consumption factors from the EMFAC 2007 model for Los Angeles County, with an average annual temperature of 70°F and humidity of 50 percent. Stop-and-go traffic is estimated to reduce fuel efficiency by 6.12 percent for 2008 existing conditions; 13.47 percent for 2035 no build conditions; and 3.81 percent for Alternative 6 general purpose lanes. The automobile fleet is assumed to be 50 percent LDA and 50 percent LDT1. The truck fleet is assumed to comprise HHD.

°F = degrees Fahrenheit
HHD = heavy-duty trucks
I-710 = Interstate 710
kWh = kilowatts per hour
LDA = light-duty automobiles
LDT1 = light duty trucks

Table 3.15-8 converts these various measures of energy consumption for gasoline, diesel, and electricity shown in Table 3.15-7 into British Thermal Units (BTUs) in order to provide a uniform metric to represent energy consumption for the build alternatives, which is then compared against existing year (2008) and 2035 No Build conditions in the Study Area.

Table 3.15-8 Operational Energy Consumption – Percent Change

Scenario	Study Area Annual BTUs		
	BTUs[1]	% Change from 2008 Existing	% Change from 2035 No Build
2008 Existing	1.78E+14	--	--
2035 Alternative 1 (No Build)	2.06E+14	16.0%	--
2035 Alternative 5A	2.06E+14	15.9%	-0.1%
2035 Alternative 6A	2.06E+14	16.0%	0.0%
2035 Alternative 6B	2.02E+14	13.6%	-2.0%
2035 Alternative 6C	2.03E+14	14.1%	-1.6%

Source: *I-710 Corridor Project Energy Report*, March 2012.
1 Assumes an energy content of 130,500 BTUs per gallon of diesel fuel, 115,000 BTUs per gallon of gasoline, and 3,412 BTUs per kWh of electricity, E+14 = 10 to the 14th power (100 trillion).
BTUs = British thermal units
kWh = kilowatt-hour

Compared to 2008 existing conditions:

- Alternative 1 (No Build) energy consumption increases by 16.0 percent; and
- 2035 Alternative 5A energy consumption increases by 15.9 percent;
- 2035 Alternative 6A energy consumption increases by 16.0 percent;
- 2035 Alternative 6B energy consumption increases by 13.6 percent; and
- 2035 Alternative 6C energy consumption increases by 14.1 percent.

Compared to 2035 No Build conditions:

- 2035 Alternative 5A energy consumption decreases by 0.1 percent;
- 2035 Alternative 6A energy consumption does not change;

- 2035 Alternative 6B energy consumption decreases by 2.0 percent; and
- 2035 Alternative 6C energy consumption decreases by 1.6 percent.

Build alternative improvements would increase average travel speeds during peak hours, remove bottlenecks, and reduce delays. However, VMT in the Study Area would also increase when comparing any of the build alternatives with the 2035 No Build condition. As shown in Table 3.15-7, the build alternatives would result in a slight decrease in gasoline fuel consumption compared to the 2035 No Build condition. Alternative 5A would produce no change in diesel fuel consumption compared to 2035 No Build conditions. Similarly, Alternative 6A would produce a minor 1.3 percent increase in Study Area diesel fuel consumption as truck VMT increases in the Study Area due to the conventionally powered truck trips attracted to the freight corridor in this alternative. For Alternatives 6B and 6C, which include the zero emission freight corridor with electric powered trucks, the diesel fuel consumption is estimated to be 6 to 8 percent less than under 2035 No Build conditions as electric power is substituted for diesel power on the freight corridor.

NO BUILD ALTERNATIVE. Under Alternative 1, the permanent effects on energy consumption discussed above for the build alternatives would not occur for the project itself, but these permanent energy consumption effects would occur for the other transportation improvement projects included in Alternative 1.

3.15.3.2 PERMANENT INDIRECT IMPACTS

BUILD ALTERNATIVES. Indirect manufacturing energy effects involve the one-time, nonrecoverable energy costs associated with the manufacture of vehicles. Indirect maintenance energy effects involve the ongoing, nonrecoverable energy costs associated with the maintenance of vehicles. As described in the *I-710 Corridor Project Energy Report*, this analysis was conducted using the Input-Output Method. This method converts either VMT or construction costs into energy consumption based on existing data from other road improvement projects in the United States using conversions listed in the California Department of Transportation (Caltrans) Energy and Transportation Systems handbook (July 1983).

Using the annual VMT data shown in Table 3.15-6, and considering that the VMT increases in the Study Area would be due to a combination of factors, including increases in population in the region as well as the proposed improvements under the build alternatives, Table 3.15-9 shows that the build alternatives would result in very small increases in indirect energy consumption in the Study Area compared to Alternative 1, ranging from 0.1 to 0.6 percent.

Table 3.15-9 Study Area Indirect Energy Comparison

Description	Study Area Energy Used (Billion BTU/year)				
	2035 No Build	**2035 Alt 5A**	**2035 Alt 6A**	**2035 Alt 6B**	**2035 Alt 6C**
Manufacturing					
Auto Manufacture	34,420	34,529	34,664	34,664	34,497
Truck Manufacture	3,540	3,558	3,545	3,549	3,507
Subtotal	37,960	38,087	38,209	38,213	38,004
Maintenance					
Auto Maintenance	27,777	27,865	27,974	27,974	27,839
Truck Maintenance	6,626	6,660	6,637	6,644	6,566
Subtotal	34,403	34,526	34,611	34,618	34,405
TOTAL	**72,364**	**72,613**	**72,820**	**72,831**	**72,409**
Percentage Change from 2035 No Build	--	0.3%	0.6%	0.6%	0.1%

Source: *I-710 Corridor Project Energy Report*, March 2011.
Alt = Alternative
BTU = British thermal units
I-710 = Interstate 710

3.15.4 Consistency with Energy Conservation Plans

The CEC, California Public Utilities Commission (CPUC), and Consumer Power and Conservation Financing Authority (called the CPA, which is now defunct) approved the final State of California Energy Action Plan in 2003, which was proposed by a subcommittee of these three agencies. The Plan established shared goals and specific actions to ensure that adequate, reliable, and reasonably priced electrical power and natural gas supplies are achieved and provided through policies, strategies, and actions that are cost-effective and environmentally sound for California's consumers and taxpayers. In 2005, an updated Energy Action Plan was adopted by the CEC and CPUC to reflect policy changes and actions after 2003.

The State's energy policies have been substantially influenced by the passage of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. The CEC's *2007 Integrated Energy Policy Report* (IEPR) advanced policies that would enable the State to meet its energy needs in a carbon-constrained world. That report also provides a comprehensive set of recommended actions to achieve these policies.

Rather than produce a new Energy Action Plan, the CEC and the CPUC have prepared instead the Energy Action Plan – 2008 Update that examines the State's ongoing actions in the context of global climate change. The update was prepared using the information and analysis prepared for the recent *2007 Integrated Energy Policy Report*, as well as recent CPUC decisions.

As none of the build alternatives would result in adverse impacts related to energy consumption in the Study Area nor in the South Coast Air Basin (Basin) compared to the No Build alternative, all are consistent with the goals of these energy conservation plans.

3.15.5 Avoidance, Minimization, and Mitigation Measures

3.15.5.1 Construction Minimization Measures

Construction of any of the build alternatives would not result in adverse direct or indirect impacts related to energy consumption in the Study Area nor in the Basin compared to the no build conditions under Alternative 1. No avoidance, minimization, or mitigation measures are required. However, in the interest of promoting energy efficiency, the following measures will be implemented for all build alternatives.

E-1 Prior to the completion of final design, the California Department of Transportation (Caltrans) shall prepare a construction efficiency plan, which will include the following:

- Select disposal sites as close as practicable to the Interstate 710 (I-710) construction area to minimize haul distances and excavation-related fuel consumption
- Reuse existing rail, steel, and lumber wherever possible, such as for falsework, shoring, and other applications during the construction process
- Recycle asphalt taken up from roadways, if practicable and cost-effective
- Using newer, more energy-efficient equipment and maintain older construction equipment in good working order
- Schedule construction operations to result in the most efficient use of construction equipment possible
- Promoting employee carpooling

3.15.5.2 Maintenance Minimization Measures

Maintenance of any of the build alternatives would not result in adverse impacts related to energy consumption in the Study Area nor in the Basin compared to the No Build Alternative.

No avoidance, minimization, or mitigation measures are required. However, in the interest of promoting energy efficiency, the following mitigation measure will be implemented for all of the build alternatives.

E-2 Prior to the completion of project construction, Caltrans shall prepare a maintenance efficiency plan which would include the following:

- Maintain maintenance equipment in good working order
- Schedule maintenance operations to result in the most efficient use of maintenance equipment possible

3.15.5.3 Operational Minimization Measures

Operation of any of the build alternatives would not result in adverse impacts related to energy consumption in the Study Area nor in the Basin compared to the No Build alternative. No avoidance, minimization, or mitigation measures are required. However, in the interest of promoting energy efficiency, the following mitigation measure will be implemented for all build alternatives.

E-3 Prior to completion of final design, Caltrans shall prepare an area lighting plan to identify lighting fixtures that are energy efficient and to identify placement of individual lighting fixtures used for roadway lighting that will provide safety lights for pedestrians and motorists.

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