Looming Power Crisis in Andhra Pradesh

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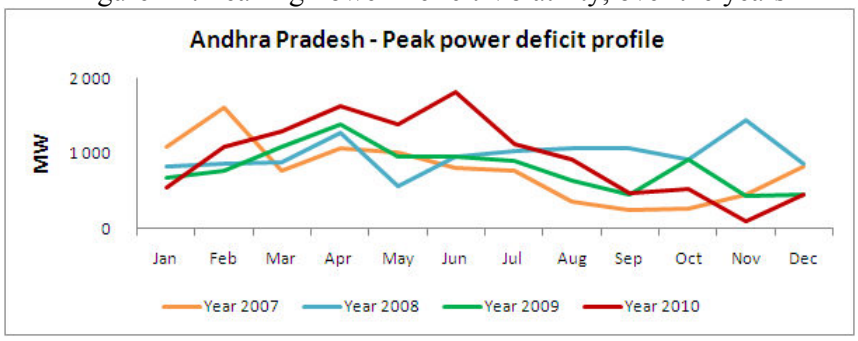
Background

Energy is considered as an important source of growth and development, all over the world. Electric power generated out of different primary energy sources is a basic component of infrastructure base for the growth and development. However, inadequate investment in the power sector in India has been, for a long time, haunting the development prospects of the country and hence a cause of major concern. Andhra Pradesh is one of the Indian states that are slogging with power sector reforms and restructuring of the sector in order to improve overall performance and efficiency of the sector. Although operational performance of power sector in the state has improved but it failed to meet the increasing demand.

Andhra Pradesh has been experiencing increasing energy deficits since 2004-05. Energy deficit has increased from a negligible 0.7% in 2004-05 to 6.6% in 2009-10 and to a whopping 22.8% in 2012-13 (as per load generation balance report 2012-13, Central Electricity Authority, 2013). The reasons for the increasing deficit can be mainly traced to the inability of the state to increase energy availability, mostly due to inadequate generation. The peak power deficit volatility seems to be high in Andhra Pradesh (Figure 1). As a matter of fact, in Andhra Pradesh, like Karnataka and Kerala, the State owned generation remains the dominant source of energy supply. The Non-conventional energy units in the state contribute only 4% of the installed generation capacity. Though there is a substantial contribution of independent power producers, accounting for 24% of energy generation in the state; the power shortage still dominates the scene.

Figure - 1: Peaking Power Deficit Volatility, over the years



Source: Central Electricity Authority.

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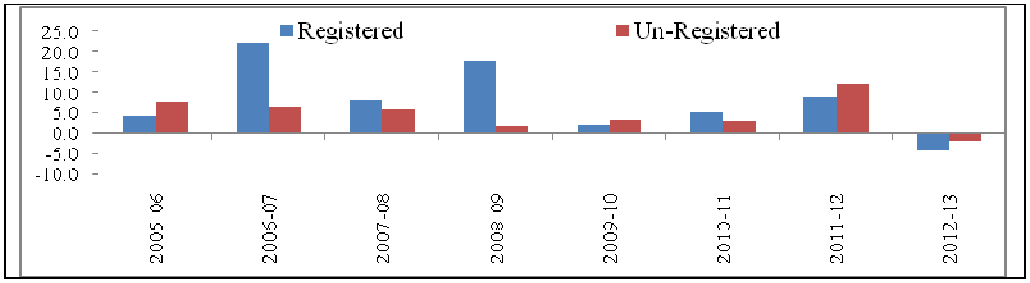
The frequent power cuts, therefore, is a regular phenomenon in the state. For more than six months a year, rural areas have been affected with power cuts; they get less than half a day power supply. The Industry too is immensely affected leading to production gaps. In one of the CII survey, it was pointed out that, in order to meet their delivery schedule, the industry would be willing to spend additional cost to meet their additional power requirements for the critical period of power shortages, the average cost per unit being Rs.7.7 per unit.

M/s Reliance decision to withdraw the supply of natural gas from its K-G D6 basin to gas based power utilities in private sector in the state, also has handicapped the IPPs to generate to their capacity. It was pointed out that around 3407 MW of power could be produced by the 12 IPPs in the State, which are currently running 60-70 % below their capacity. The whole business sector in the state including small to large scale industry became casualty for the crisis in the power sector.

Power holidays had been a difficult proposition for the industry, especially when it went upto 12 working days per month in recent times. The road was even tougher for the Micro, Small and Medium Scale Enterprises (MSMEs), as their only source of supply is APTRANSCO, unlike some of the large scale industries, who could afford to have Captive Generating plants for their needs.

The manufacturing sector, both registered and un-registered, has witnessed a negative growth during 2012-2013 (Figure 2), one of the major reasons being lack of the required power supply, which has not even impacted the production but also employment.

Figure 2: Annual Growth (%) of Manufacturing Sector in Andhra Pradesh



Note: For 2012-13 it based on advanced estimates.

Source: Socio-Economic Survey of Andhra Pradesh 2012-13, Planning Department, GoAP.

Policy Context

In the all India context, Andhra Pradesh is the fourth largest state in India in terms of population, but its power consumption is one of the lowest. Its contribution to power generation and consumption in India is below its population share. In fact Andhra Pradesh is one of those states in India in which most of the villages are electrified. About 85% of the households have got an electricity connection. Since 1980s, the power consumption for agricultural use has been increasing. The poor industrial base of the state, till 1990s, kept its industrial consumption low (about 30% only, when compared to other states like: Gujarat – 40.67; Karnataka – 51%; Tamil Nadu 40%; Maharastra – 37.58%).

Andhra Pradesh's per capita power consumption is one of the lowest in India. States such as Gujarat, Punjab and Haryana are having 1.5 times of higher per capita power consumption than that of Andhra Pradesh. Even Tamil Nadu is also ahead of Andhra Pradesh. The lower requirement and hence the low per capita could be due to the expected power shortages and frequent power cuts might be impeding to unleash the potential growth in the industrial base of the state especially the rural industry. Agriculture can, to some extent, manage with frequent and long duration power cuts but not necessarily, the industry. In fact, past many years, the electricity supplied for agriculture use is approximately around seven hours a day. On the other hand, Industry, especially many of the manufacturing units, would need 24 hours supply.

The populist measures initiated in the State, during mid 1980s, on the one hand, affected the state revenues, and on the other, it converted the potential investments into subsidies. In this process, investment in the power sector got a back seat. Since the formation of the State, power sector, along with irrigation, in Andhra Pradesh were the priority sectors in the state budget and planning. Since 1980s, there has been a clear gap between the Government's populist initiatives and the energy policy. There was no clear cut approach to enhance power generation since 1980s, though the free supply of electricity for agricultural usage continued. Most of the electricity for agriculture was used in lifting the ground water through various kinds of pump sets. Besides, the policy regime also expanded coverage of electrified villages. On the whole the policy regime has expanded the consumer base and thereby power consumption without a corresponding additions to existing generating capacity.

Post liberalisation, private players have been invited to build capacity, which in turn would lead to meet the rapid increase of demand**.** In fact, the Ministry of Power took the first major step to

invite private sector participation in generation business by allowing 100% foreign ownership of generating plants and offered these owners guaranteed returns and generous investment incentives.

The Electricity Act 2003 eliminated licensing requirements for new generating plants and allowed the generators to sell electricity to any licensee or to the end customers directly. The Act also provided a broad institutional and legal framework for Independent Power Producers (IPPs) in India. The Electricity Act 2003 also allows open access thereby facilitating the generators and consumers to tie-up directly. The tariff of these plants will be market driven and not determined by the regulator but the entire risk will be borne by the developer.

Though the policies are in place, but the existing basic infrastructure for such industrial development i.e. electricity, was not sufficient to meet the growing demand. Industry base of the state was not so great till 1990s; it was basically an agro-based industry. The base of the power sector was not supportive of the encouraging first ever state industrial policy of the 1990s. The crisis in power sector and hence power shortage had discouraged industrial development in the state; it has even resulted in the negative growth of industrial sector at one phase during 1990s.

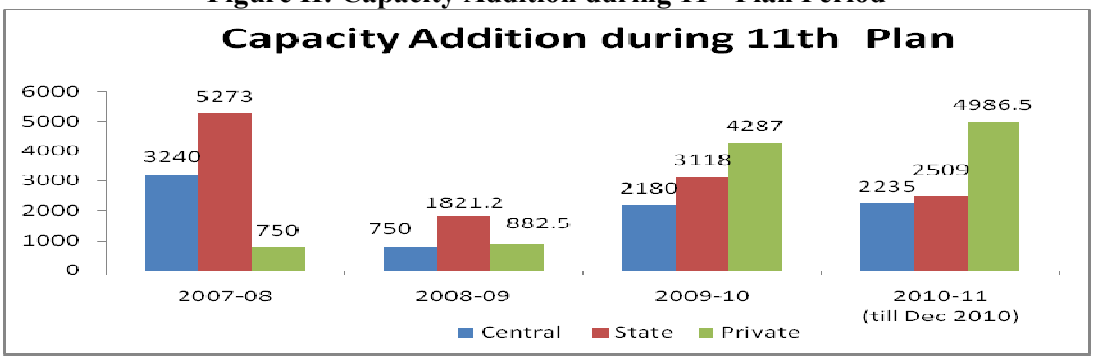
The 1990s power crisis had brought back the power sector into policy priority. Reforms in power sector has streamlined its performance and facilitated participation of the private sector in power generation. Since the inception of reforms and restructuring, Andhra Pradesh power sector has been regarded as one of the best in its performance. However in respect to reforms and restructuring of power sector in the state the demand side management was given priority while sidelining the equally important supply side management of the power sector.

Therefore, the state being the best in operational performance does not ensure its power generation capacity as well as the actual generation/supply sufficient to meet the increasing demand from various sectors. In fact, presently, Andhra Pradesh is descended to be fourth largest in overall generating/installed capacity (incl. State, central and private sectors), next to Maharashtra, Gujarat and Tamil Nadu. Indeed Andhra Pradesh used to enjoy second position in generating capacity for a long time until late 1990s. In case of state sector's (i.e. APGENCO) generating capacity, Andhra Pradesh still continues to be the second largest next only to Maharashtra. The growth of private sector in power generation particularly in Gujarat and Tamil Nadu could be the reason why these states being smaller in size with respect to population and

geographical area when compared to Andhra Pradesh, they are ahead of Andhra Pradesh in terms of power sectors' installed/generating capacity.

There has been a considerable increase in the share of IPPs in Capacity addition (Figure II). The IPPs provided 34% share in the total capacity addition (40% State sector and 26% by the Central sector), during the 11th Plan period. However, most of this addition was through gas based thermal power systems.

Figure II: Capacity Addition during 11th Plan Period



Source: CEA.

Energy Resource

The discovery and development of natural gas reserves at Krishna-Godavari (popularly known as K-G) basin and gas production in K-G D6 field which is developed by M/s Reliance, was the impetus behind such private investment in the state.

In India, of the total natural gas reserves estimated at 1330.3 Billion Cubic Meters (BCM), about 70% of the reserves are at offshore locations. Andhra Pradesh is the third largest in terms of natural gas reserves at inland locations next to Assam and Gujarat. The state's reserves are estimated at 42.3 billion cubic meters, comprising 3.2% of the total reserves including offshore, in India; whereas Gujarat accounts for 6.36% of such reserves. However, all the primary energy sources are under the direct control of the Government of India. Thus, allocation of the gas to power plants located in the state has to come through the Central authority, i.e. Government of India. State authorities do not have any decisive power in the development, production and allocation of gas.

With regard to the state sector, most of its generating capacity installed in the state, was based on Hydel and Thermal, particularly Coal based, systems. These two systems, Hydro (23%) and

Coal based Thermal (31.6%), of the state sector contribute to about 55% of the total generating capacity in the state.

A large part of the Hydel based generating capacity in the state is located at four projects- Srisailam (left and right together 1700 MW), Nagarjuna Sagar (around 1000 MW including right and left canals), Jurala (240 MW) on river Krishna, and Sileru (700 MW, incl. lower and upper Sileru) on river Sileru. Besides, there are few smaller Hydel based plants with a low (less than 100 MW) generating capacity. Indeed, Hydel based system is a clean technology (in terms carbon cycles) and one of the forms of renewable energy sources of power generation. But the capacity utilisation of Hydel projects depends on the reservoir water level which in turn depends on rainfall in the catchment area of the river. During 2012-13, due to poor rainfall in the catchment areas of rivers, especially that of river Krishna, not more than 10% of the Hydel system based generating capacity installed in the state is utilised.

With respect to Coal based energy system, it is a major primary source of energy for the power generation, particularly in Andhra Pradesh. In India a total of about 293.5 Billion Tonnes of coal reserves are estimated, of which about 22.2 billion tonnes of coal estimated reserves, comprising 7.6% of the total in India, are located in Andhra Pradesh. However, institutionally coal is pre-dominantly managed through a number of companies which are directly under the control of Government of India.

It is said that the country as whole is having Coal reserves sufficient for the next 200 years. However, the current rate of extraction is said to be one of the lowest in India when compared to other countries. Also the coal production in India has been falling short of demand. Power sector is one of the major consumers of the coal produced in the country; it consumes around 75% of the coal. The gap in demand and domestic production/supply of Coal is bridged through imports of coal. A large portion of new additions in Coal dependent Thermal based generating capacity in the country especially that in private sector, is depending on the coal imports. But the changing international prices of coal imports, is affecting the cost of power generation in the country.

Present installed thermal power plant in India is about 170 GW, yet maximum capacity connected to grid is 110GW, which means about 60GW of capacity is not available for use. One important reason is the Plant Load Factor (PLF) in power plants, which are low with a gap of somewhere around 15-20% in PLF. This could be improved by adopting better management practices and technology up-gradation.

With 127.5 GW capacity coal fired thermal power plant in operation in India, and an estimated 88 GW addition during 12th Plan period 2012-2007, there is a dire need to optimize the operation of power plants to improve operation efficiency and reduce discharge to atmosphere.

In Andhra Pradesh around 50% of the total generating capacity (inclusive all sectors, state central and private sectors) is coal dependent thermal based power plant. Most of the coal based thermal based generating capacity is in either state or central sector. Private sector participation in this system is, so far, very meagre. It could be due to non availability of domestically produced coal for the private sector power plants and dependency on imported coal. Nevertheless, there are upcoming power plants mostly dependent on imported coal, like the Ultra-Mega Power Plant at Krishnapatnam with a generating capacity of 3000 MW.

Power Generation: Short of Demand

Having these governing conditions given the generating capacity at 16095 MW (as on 31st March 2012) in the state, the likely power generation while assuming an ideal plant load factor (PLF), taking into account past performance, one can presume at 12185 MW per hour or 106743 Million Units (MU) per year (Table 1). Power generation based on different primary energy sources have different PLF depending on the supply of primary energy. Among all, coal based thermal power plants have shown the highest average PLF in India. Such thermal plants in Andhra Pradesh have also shown better performance in PLF. The nuclear power plants in India have shown an average PLF less than 65% so far. Hydro power plants are also very unlikely to cross 60% PLF on an average in a year. Similarly the case of renewable energy resource (RES) based power plants.

Under such ideal and maximum possible generation situation, the power generation in the state could have balanced with energy requirement in the state, since past few years. AP would have been self-sufficient and self-reliant. On the contrary, even the maximum possible generation situation in the state falls short in meeting its peak load demand which is, as per Central Electricity Authority estimate, at around 15000 MW for the year 2012-13.

Table 1: Installed Capacity of Power Sector in Andhra Pradesh, 2012

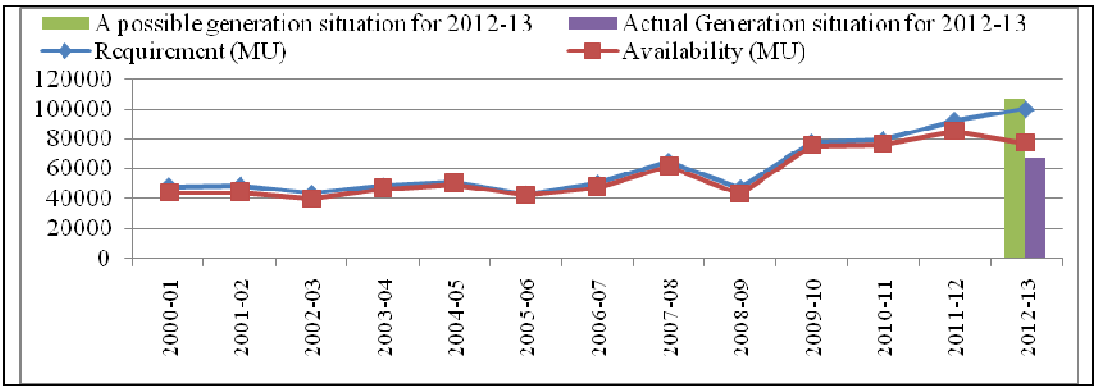
Sno	Sector	Installed Capacity (MW)	% of Sector	Possible Generation			Actual Generation		
				PLF (%)	MW	MU	PLF (%)	MW	MU
1	State Hydro	3735	23.2	60	2241	19629	11	246	2159
2	State Thermal – Coal	5093	31.6	80	4074	35688	85	3463	30335
3	State RES	222	1.4	60	133	1166	10	13	117
4	Private Thermal – Coal	150	0.9	80	120	1051	80	96	841
5	Private Thermal – Gas	3098	19.3	80	2479	21714	50	1239	10857
6	Private Thermal – Diesel	37	0.2	60	22	193	50	11	97
7	Private RES	664	4.1	60	398	3487	50	199	1744
8	Central Thermal – Coal	2821	17.5	90	2539	22244	85	2158	18907
9	Central Nuclear	276	1.7	65	179	1570	65	117	1021
Total		**16095**	**100**	**75.7**	**12185**	**106743**	**61.9**	**7543**	**66077**

Note: 1. Under three sector – State, Private, and Centre share for the state; and different sources of energy – Hydro, Thermal based on Coal, Gas and Diesel; Nuclear and Renewable Energy Sources (RES); 2. **PLF** - Plant Load Factor; **MW** - Mega Watts; **MU** - Million Units; 3. Installed Capacity is as on 30th March 2012, we do not have information on additional capacity ready for the generation during 2012-13.

Source: 1. For installed capacity-Ministry of Power; 2. For possible generation, author's calculations by assuming a possible PLF; 3. For actual generation author's calculation based PLF performance during 2012-13.

Nevertheless, the actual situation shows that power generated (7543 MW per hour or 66077 MU per year) in the state is well below the possible generation situation and the energy requirement (Figure 2). One can also observe from the Central Electricity Authority (CEA) estimations, the trend in energy requirement and availability for Andhra Pradesh (Figure III). The trend indicates increasing energy requirement in the state. Although there has been a gap between energy requirement and energy availability, widening gap is explicit during 2012-13. The CEA energy availability estimate includes assured or committed purchases from the sources outside the state also. Our estimates for the year 2012-13 include the power generation within the state that includes state, centre and private sector.

Figure III: Power Generation situation in Andhra Pradesh



Note: Generation in Million Units (M U) equals to GWh, for a year.

Source: 1. For trend line Central Electricity Authority based on its Load Generation Balance Reports of various years, Ministry of Power, Government of India; 2. For possible and actual generation situation during 2012-13, they are authors calculations.

If we consider the deductions in the total electricity generated, in respect of a small portion of it goes to auxiliary consumption of generating stations/plants and a considerable proportion of it under transmission and distribution, the net availability for final consumption is even low. Although the auxiliary consumption cannot be avoidable, T&D loses can be minimised if not be fully avoidable. In fact, the four DISCOMs were left with weak system of energy accounting. Problems such as widespread electricity theft, low metering, billing and collection, etc., led to revenue leaks and poor financial performance. In 2009, only 42% of the electricity distributed was billed, the balance being accounted for as T&D losses or unmetered agricultural consumption. In order to counter the T&D losses, Government of Andhra Pradesh made significant improvements in Metering, especially in Urban areas. As per CEA, Andhra Pradesh has achieved 100% metering both at the 11KV feeder level and the distribution transformer level. Andhra Pradesh also reported 100% metering of individual consumers, except for agricultural consumers. With the exception of non-metered agricultural usage, Andhra Pradesh experiences one of the lowest T&D losses in the country.

Factors of Concern

The power generated within the state (state/private/central sector) is below the demand during 2012-13 and hence purchases from outside the state systems – other states or centre (i.e. in addition to the usual share), might have filled such a huge gap to some extent, but certainly it could not balance the energy deficit. Therefore, the gap in energy availability and requirement led to unprecedented power cuts in the state. Herein one can make a point that it is a supply side management problem. First of all the generating capacity installed in the state as of today is not sufficient to meet increasing demand and become self-reliant. Secondly, considerable portion of wastage under T&D loses, out of whatever is generated.

Besides, the power generation in the state during 2012-13 was below its usual average. The performance of its Hydro power plants was poor due to poor rainfall in the river Krishna catchment area during 2012-13 and the poor performance of the Srisailam power plant, which was affected with floods in 2011, severely impacting the Plant. The average PLF of all Hydro plants in the state was very low, probably the lowest, which was just around 11% in 2012-13.

Secondly, the gas production from KG D6 field has not been as it was expected initially, at 40 MMSCMD. Initially, it was producing 37 MMSCMD and thereafter the production was reduced gradually to 34, 27 and 22 MMSCMD till during the last year, 2012-13. It worsened the situation when the M/s Reliance had withdrawn the supply of gas from 1st March 2013, to gas

based power plants (about 25 in number) all over the country including six such plants in the state. The six gas based plants in the state with a total generating capacity of around 2700 MW requires 13.65 MMSCMD of gas to utilise its full capacity (at least 90% PLF) but that quantity of gas was never been supplied to the plants since their commencement of power generation; maximum they were supplied to was 6.43 MMSCMD which is less than half of the required. Thus, the half of the capacity has been under utilised.

Thirdly, even for the thermal power plants, the coal supplied was not meeting the demand in the state. Because of under utilisation of Hydro and gas based power plants the pressure on thermal power stations, already functioning at high PLF, has increased. As the domestic supply to state power plants, based on allocations of Government of India, is not meeting the actual requirement for the thermal plants in the state in order fill the power shortage, state had to fall back on coal imports which has become costly in the recent period with a rise in international prices of coal. The coal production rate in India with respect to its coal reserves is one of the lowest in the world. Besides, there is an increase in the price of domestic coal. The Government of India encouraged private investment in coal production. In fact, one of the reasons for the recent increase in coal prices, inspite of the profit making coal PSUs, is to create a level playing field for the private sector.

Fourthly, not all power generated from the private plants are being sold in the plant location state alone. As mentioned in a Review on Power Sector by Prime Minister's Office, some of the private power plants are exporting power to the neighbouring states or to other private companies, at a higher price than that was agreed with the respective State Governments'. There were even warnings issued by CEA for violating Power Purchase Agreements, especially with regard to gas based IPPs.

Fifth, there has been wastage in supply of power generated due to transmission and distribution (T&D) loses despite the continuous efforts to reduce such losses. Although there seems to be drastic reduction in T&D loses from one-third of the total electricity units available to less than one-fifth, it is 10-15%, but it would well be underestimated.

Sixth, delay in release of the state budget funds on account of power subsidies to the distribution companies. It weakens financial leverage of the distribution companies to make purchases or imports. As a result the recent rating for the performance of distribution companies all over

India reveals that once one of the best performing DISCOMS of Andhra Pradesh, are doing poorly in the recent past.

Concluding Remarks

On the whole, the state has not taken measure for the supply side management as much as that of the demand side management of the power sector. State doesn't have its reserve of generating capacity to fall back on for the rising demand. If Andhra Pradesh have had mapped out the future energy requirements and made a perspective plan with a corresponding action plan, it would have managed the crisis better. In fact, there were grand preparations and targets at the state as well as at national levels, for the 12th Five Year Plan that began in 2012. During the 12th plan, Andhra Pradesh is expected to add over 7580 MW of power. However, considering various issued, mentioned earlier, Andhra Pradesh will be unable to meet its peak power demand for the entire 12th plan period.

According to a CII-Athena Informatics analysis (Power Scenario in Southern India, 2012), the energy requirement in the state is expected to increase from around 84 billion units (in 2011-12) to over 173 billion units by the end of 2020-21. The increase is expected to be driven mainly by industrial sector whose percentage consumption is expected to increase from 32% (in 2011-12) to over 44% in 2020-21. Whether the State will be able to meet such a rise in demand? This calls for Supply Side Management. Thus, the Government of Andhra Pradesh must relook at its strategies, especially supply side management, and come up with a comprehensive energy policy for the state with a strong linkage with policy execution.

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