

Issue No. : 3/2015  
July 2015



(FOR PRIVATE CIRCULATION ONLY)

# S P E NEWS LETTER

A QUARTERLY PUBLICATION OF THE SOCIETY OF POWER ENGINEERS (INDIA)



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## THE SOCIETY OF POWER ENGINEERS (INDIA) VADODARA CHAPTER (ESTD. 1996)

FF-48, Avishkar Complex, Old Padra Road, Vadodara – 390 007

Phone: (0265)232 2355

E -mail: [spevadodara01@rediffmail.com](mailto:spevadodara01@rediffmail.com)

Web: [www.spevadodara.in](http://www.spevadodara.in)

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## SPECIAL INVITEE TO THE EXECUTIVE COMMITTEE

Er. N. Dinker

## Events

On 10 Jun 2015, Neotech Technical Campus, Virod-Vadodara in association with Society of Power Engineers (I), Vadodara Chapter had organised a 1-Day Seminar on "Energy Management & Audit in Industry".

The following experts from SPE(I), Vadodara delivered speeches on the subjects related to the theme.

1. Er. SM Takalkar, 2. Er. (Dr.) BG Desai, 3. Er. PA Shah, 4. Er. RM Panchal, 5. Er. BN Raval

## Acknowledgments

Following members have donated to SPE(I), Vadodara

- |   |                     |          |
|---|---------------------|----------|
| 1 | Er. (Dr.) B G Desai | Rs. 1000 |
| 2 | Er. B N Raval       | Rs. 1000 |
| 3 | Er. P A Shah        | Rs. 1000 |
| 4 | Er. R M Panchal     | Rs. 1000 |
| 5 | A Well Wisher       | Rs. 1000 |

SPE(I), Vadodara Chapter thanks to the above donors. SPE(I) further expects similar response from members as well as well wishers.

## From The Chairman's Desk

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Since the formation of new government in Centre, several initiatives have been taken for implementation of information technology in many fields of life to empower citizens to use full potential of its benefits. This month, Prime Minister Mr. Narendra Modi launched Digital India Programme, which is aimed to integrate the

government with people through the technology and deliver services digitally to all.

The programme is focused on three key areas, digital infrastructure as a utility to everyone, governance and services on demand and digital empowerment of citizens. It will be integrating many projects like digital locker for sharing e-documents, myGov.in for participation of common citizens in governance, goals of Swachha Bharat Mission, digital signature using Adhar Cards, online registration system for e-Hospital applications, national scholarship portal and many more. It also has ambitious plan to connect all Gram Panchayats in India to digital highways and program to digitize records is started in the country that will drastically reduce the cost of paper work.

Broadband highway is one of the pillars of the programme, which will replace all old exchanges of BSNL with modern equipment and will provide several Wi-Fi hotspots throughout the country. The impact of the programme will be phenomenal and boost the electronics equipment manufacturing in India. There lies tremendous scope for young entrepreneurs to develop software and applications for making the program very efficient and user friendly. It is to be noted that seeds of important components of Digital India Programme were laid before more than two decades, resulting into development of connectivity and infrastructure platforms like NIC, C-Dot, UID, GIS etc.

The success of this programme will depend upon the ability of government in dealing with many issues and challenges prevailing in the country concerning power and energy, water resources, telecommunication infrastructure, cyber security, human infrastructure, bureaucratic delays, etc.

Let us all hope that ambitious e-plans drawn by the Central Government bears the desired fruits.

**G. V. Akre**  
**Chairman**

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## Editorial

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The Education System in the years following the Independence was in the primitive stage. The percentage literacy was much lower. The ordinary matriculate also found jobs in school, bank, post office, railway, income tax etc. The contemporary Government realised the need to allocate more funds for Education. Training to

teachers was found necessary. Colleges introduced special Graduation courses for making available qualified teachers for primary and secondary schools. The percentage literacy started increasing. Opening schools in the remote villages reduced time spent by the students on travel to distant places. Many benevolent individuals, groups and trusts came forward to assist the state and the central governments in the noble cause. The facilities for college education also started increasing.

Irrigation, Power and industries had become priority then. The requirement of Engineers and skilled work force started increasing exponentially. The IIT and regional engineering colleges were established. The skilled work force was made available by establishing Industrial Training Institutes (ITI). For sustainable development, the power sector had to grow in the same pace. However, due to innumerable technical and financial constraints, the power sector always chased the demand. This resulted in slowing down the industrial growth. This affected the employment opportunities. The quest for the education in science and technology gained momentum. Number of colleges and universities started increasing.

Unfortunately, the population at the time of Independence, which was around 33 Crore, started rising rapidly due to many reasons including availability of good medicines and surgical facilities. Till early 70s food production in the country was not enough to feed the population. Statutory rationing was in force. The country depended upon import of food grains from countries like USA. The Indian Government lead by late PM Smt. Indira Gandhi took up a challenge to make the country self-sufficient in food. The Government was successful but simultaneously the crude oil prices increased more than 100%. The petrol which used to cost Rs.4.0 per litre, soared to Rs.8.50. Diesel also became costly. The farmers using diesel engines for irrigation, turned to electric motors. This is because of the difference in cost. Agriculture demand started going up and up. Subsidised power supply to agriculture sector and control of tariff for other categories of consumers, started inflicting burden to the coffers of state owned Electricity Boards. Industrial growth had a crippling effect. The political will started dominating the power sector. The technical and commercial aspects of Power Generation Transmission and Distribution were ignored, while power was considered as charity. This widened a gap between the tariff of Industrial category and other categories of the consumers.

The industrial sector did not grow faster owing to shortage of forex and curbs on import. The job market was very low, as the import of technology and machinery/plant could not be materialised. The Government lead by late PM Shri Narsinharao with the then Finance Minister Shri Manmohan Singh broke the ice by implementing open door policy for

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international trade and commerce. There were hues & cries while section of industry and business feared loss of “Swadeshi” culture as well as invasion of foreigners. In the decade following the adoption of open trade policy, the fear totally vanished and development & trade took quantum jump. The forex started piling up. Power sector had a positive impact. The growth of IT sector revolutionized every walk of life in the country. Element of competition compelled the manufacturers and service providers to improve the quality

The requirement for skilled man power needed more academic institutions. The Governments with little fund to spare for education, opted for private parties to establish and run the technical colleges & institutions. The education thus turned to a profitable business. The need for number of skilled man power was satisfied but the quality of engineering and other graduates passing out each year, degraded fast. The reason is simple; the capitation fee paying capacity of parents was

weighed against the marks scored in 10<sup>th</sup>/12<sup>th</sup> Standard by the students.

Now the table has started in the reverse direction. Lot many new technical colleges are opening but aspirants are reducing. Many institutions are reeling under the loss due to vacant seats. Job market is slowed down. No doubt last quarter has shown some improvement.

Need of the hour is therefore to frame new education policy with an emphasis on quality education. A Public Private Partnership (PPP) model should also be worked out, which may help the down trodden to get quality education at reasonable capitation fee. For admission in Engineering colleges a benchmark of total of English, Maths & Science marks should possibly improve the quality of Engineering pass out.

**SM Takalkar, Editor**

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## **Grid Management Challenges Renewable Energy**

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**Er. BB Mehta, Chief Engineer**

**State Load Despatch Centre, GETCO, Gotri, Vadodara**

### **INTRODUCTION**

The renewable energy is an emerging need of power sector. In renewable energy, wind and solar energy has a lion's share. While the solar energy is predictable to some extent, the wind energy is totally in-predictable. Absorbing such power in to Grid poses a challenge to SLDC, particularly in Gujrat State.

### **CHARACTERISTICS OF WIND GENERATION**

The change in atmosphere leads to variation in generation of wind power. Frequent variations in velocity of wind change the wind generation. It is difficult to predict the availability of wind on real time basis.

### **CHALLENGES OF SCHEDULING**

One of the leading challenges is a “must run” status of wind generation. Whenever generation from Wind Farm is to be injected in to Grid, no scheduling is applicable.

Scheduling of costlier gas based generation when the system demand is high and wind generation is on lower side and backing down of cheaper generation, particularly in night hours and in rainy season, when system demand is remaining less and wind generation is on higher side, amounts to a financial loss to the utility.

To avoid this situation, Gujarat State must manage Over Drawl and Under Drawl within limit of  $\pm 150$  MW or 12 % of its scheduled Generation, which is a difficult task.

Further, critical aspects of system like Voltage control and stability of the Grid, are badly affected. Also consumption of Reactive Power increases, resulting into increase in system losses and low voltage at tail end.

Huge capacity addition in wind generation results into instability in Grid and creates load management problem due to uncertainty in generation.

### **EFFECT ON OTHER CONVENTIONAL PLANTS**

Thermal plant takes time to pick up and back down. Hence, managing wide variation of wind generation in real time by regulating thermal plant, may not be easy.

Gas plant may ramp up / down quickly. To keep costly gas base generation on bar to handle wind variation leads to merit order violation.

Hydro Power Plants having small amount in terms of MW are generally operated as per irrigation water requirement. Therefore, 100% reliance on them would be fatal. Besides the state of Gujarat is deficient in small hydro potential.

Frequent Pick up and Back-down of Conventional Generation leads to an uneconomical operation of power plants and is detrimental to its life period..

### **DISPATCH ABILITY**

Adequate grid infrastructure is needed to transmit the wind energy to the load centres as the wind power plants are at remote locations. The long distance causes constraints in the grid parameters in the form of voltage variations.

Transmission network developed for wind stations remains unutilized during low wind generation scenario, and causes high voltage due to Ferranti effect.

Due to intermittent characteristic of wind, generator startup will take place multiple times during a day, resulting in huge quantum of reactive power absorption from the grid, causing voltage excursions / voltage stability. As on the date, the wind generator cannot work without the Grid support. This is known to all the wind power generators.

### **DEVIATION IN SETTLEMENT MECHANISM**

All of a sudden rise in wind energy injection leads under drawl at State-regional periphery. The state genera-ting stations and

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interstate generating stations - SGS/ISGS cannot back down at such a faster rate with reference to rate of rise in wind energy injection. Hence, State will under draw with respect to schedule. Under draw in a time block in excess of lowest of 12% of schedule or 150 MW (whichever is lower) is not allowed.

And if frequency is more than 51.10 Hz then State has to pay penalty at the rate of Rs. 1.78/unit for such violation.

In other words, wind generators are being paid at preferential tariff (in case of sale to DISCOM) or get benefit of wheeling, as the case may be, whereas State has to pay penalty or gets nothing for under draw in excess of 12% of schedule or 150MW (whichever is lower). This situation is not good for the State utility hosting the wind power generation.

#### **PECULIARITIES OF WIND INJECTION**

- Unless there is a grid constraint, wind energy injection is considered under MUST RUN status. Wind energy injection is intermittent in nature and is one of the most affecting factors in maintaining deviation limits.
- Variation in wind energy injection recorded in a day is some times as high as 1500 MW.
- The recorded peak wind energy injection is 2500 MW.
- For several days wind energy injection is less than 50 MUs.
- In last year, there were 257 days when variation in wind energy injection in a day, was more than 500 MW for 7 days. For 94 days it was more than 1000MW..

#### **WAY FORWARD**

Govt. of Gujarat has an ambitious target of harnessing 60,000MW of wind generation by the year 2020-22.

In such a scenario, the Grid will have to take up the following:

1. Realistic and accurate wind generation forecasting
2. Balancing Mechanism.
  - i. Developing gas based generating station and special APM gas allocation.
  - ii. Development of Micro and Mini grid with RE generation.
  - iii. Pumped storage. (No installation & old non-working)
3. Network development (Green Corridor) seamless grid operation with balancing mechanism to overcome wind characteristics.
4. Establishment of REMC with full-fledged forecasting mechanism in collaboration with stake holders.
5. RE grid code shall be prepared and implemented.
6. Sharing of static & variable data by Wind developers.
7. Sharing real time wind generation data of each wind mills existing and upcoming.
8. Sharing real time weather data of each wind mills existing and upcoming.
9. Last but not the least, regulatory and commercial framework to even out the burden on hosting State due to suspension of RRF mechanism

#### **CONCLUSION**

Absorption of large block of wind power is a big challenge to the state utility hosting wind generation. The Technical and Commercial implications have to be addressed if large chunk of power is to be absorbed in the grid.

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## **Distributed Generation**

- Er. ND Makwana  
nd\_makwana@yahoo.co.in

At the initial stage, the power system was standalone type having only generation and associated distribution network. It was a local system for town or city and hence no transmission network was needed. But with the passage of time and with industrialization, concept emerged for centralized generation to have low generation cost. Technological development has made it feasible to produce higher capacity generators and with such high capacity generator, power available was more than local uses. The surplus power was thus extended to nearby cluster through power line. Thus induction of transmission element in power system brought revolution leading to generate more power at a station and sending it to various load centres. More generators were installed at a station and operated in parallel.

Standalone system has shortcoming like wide frequency excursion and instability. For better performance, various power plants at different locations were interconnected through transmission network and operated in synchronism, forming Grid system. This made system strong and stiff due to higher inertia and larger system bias. The trend continued to

form State, Regional, National and International Grid with complex transmission network and super power plants, as they exist today. This was the phase of integration, concentration and centralization.

Conventional distribution system has a step down transformer with low voltage lines feeding to numbers of consumers in the cluster. Such pattern is being followed for many years but recently new concept has emerged. Each consumer is provided with individual step down transformer of the capacity matching the demand of the concerned consumer. This arrangement, amongst others, has principal advantage of control over technical as well commercial losses. This arrangement has more distribution transformers and less distribution lines i.e. ratio of LT/TC is low. This is known as high voltage distribution system. In effect, this is distributed distribution system, as voltage stepping down is at each location of its use, rather than common for the cluster. This is a type of micro level decentralization approach.

In federal governance structure, various administrative powers for the matters pertaining to state list and common list are

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vested in State Government for area specific administration. Under 'Panchayati Rajya' governance and powers are distributed to local authority up to State, District, Taluka, City, Town and Village level. This is adopted for area specific efficient administration. Here decentralization is for efficiency.

Conventional energy is produced by burning fossil fuels. This may be lignite, coal, crude oil, petroleum or natural gas etc. All these are carbon/hydrocarbons. Heat is released due to exothermic reaction of oxygen of air with carbon content in the fuels, the process commonly known as burning. The heat energy so released is used in many ways. Heat may be directly used for heating and drying etc. Heat can be used to generate steam and run engine to get mechanical power and ultimately to get electricity.

Human body requires energy for various activities by different organs. Herein energy is produced by reaction between carbon and oxygen locally at the location where energy is required. Carbon is collected through food taken by body in the form of carbohydrate. Oxygen is captured by RBC of blood in lungs from the air containing oxygen inhaled from the atmosphere. These oxygen and carbon are made available throughout the body. Whenever, wherever and whatever energy is required by any organ, is produced locally. Carbon dioxide and water formed during reaction is thrown back to atmosphere during exhale. This is natural distributed energy generation.

Now scope of conventional energy is limited and hence trend is to resort to non conventional ways for energy. Such sources are wind mills, PV panels, agricultural, industrial and domestic waste, waste heat recovery from industrial process, human and animal excreta etc. All these energy sources have limitation in terms of inputs, unit size and space required for bulk production. Therefore, such non-conventional energy plants may be small and distributed throughout. This is practical compulsion for distributed energy generation.

Distributed generation is in its original form of power system and also natural as in human body. It is the most efficient as in administrative governance and manages loss control as in high voltage distribution system. All related issues such as feasibility for bus extension for new bay at corresponding sub-station,

feasibility of Right of Way for new line entry / exit in congested surrounding of sub-station, right of way for new line and cost are avoided. Now power system expansion shall have more and more part of distributed generation and therefore burden of strengthening of transmission network will reduce to that extent. Network congestion and resultant generation backdown can be avoided.

Original power systems were standalone type with all elements like generation, transmission, distribution etc. under one agency. All such systems were integrated as State Grid under single agency as State Electricity Board. But now SEBs have been unbundled as separate wings of generation, transmission and distribution. Transmission has only two players e.g. State Transmission Utility (Transmission Company a component of unbundled SEB) and Central Transmission Utility (Power Grid Corporation). But generation and distribution have numbers of participants. This is decentralization of management of power system. Each constituents may act in its own interest being independent entity and hence co-ordination may be vital issue.

Synchronous grids up to Regional level are reasonably strong and stable. Only Eastern and North Eastern Regions are small and require synchronous link. Asynchronous inter-connections amongst regions seem to be ideal setup to form a National Grid and to exchange power. Synchronous interconnection has advantage of strengthening system stiffness, making it more stable. However, it has minus points also like increase in fault level, stability issue, higher losses, etc. But the most adverse is uncontrolled power flow and multiplication of constituents of different status, aggravating the problem of operational co-ordination. All India synchronous Grid is established and is in operation for about an year now. System bias may be in the range of 2500 to 3000 MW/Hz. With this and equally high system inertia, now power system is most secure in terms of frequency control. But threat due to undisciplined and self centered behavior of multiple constituents, cannot be over looked. It will be better to wait and watch the future performance whether thing go well or need review to revert or rearrange in future as in above cases. Perhaps the distributed generation may be an answer to many problems related to the grid.

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## Random Thoughts

- N. Dinker

### Amazing!

This write up may contain only few words. But an indepth thought may have to be given to appreciate when we talk of nature's invaluable gifts bestowed on 'man'. Amazing! nothing but Amazing!! When we compare it with man's own

innovations and creations which pale into insignificance.

Most of us have a tendency to evaluate any problem on superficial level. Let us just take an example of our faculties – 'EAR', 'EYE', 'HEART'. To us these are just to hear, see and keep our entire system operative. It may however be unknown to

many of us, the intricacies, precision and perfection with which Nature has designed and provided us these faculties. It will really baffle us and make us spellbound.

Our EAR is 100 times as complex as a 240 string grand piano. It has 24000 vibrating strings and all these compact in one-millionth the size of a concertgrand!

Our EYE has about one million rods and cones, sensitive to light, telegraphing impulses to the brain through 338,000 nerve cables.

Our HEART is expanding and contracting at the rate of 40 million times a year using 400 million berrylike structures in our lung to collect Oxygen and eliminate impurities.

What more do we require to become humble in front of HIM!

### HURRY – The Race of Life – What for?

An anecdote

I was cycling and noticed a person in front of me, about ¼ of km, I decided to try to catch him. I had about a km to go on the road before turning off.

So I started cycling faster and faster and just a few minutes I was only 100 yards behind him, so I really picked up the pace and pushed myself.

Finally, I caught up with him and passed him by I felt so good 'I beat him' of course but he didn't even know we are racing. After I passed him, I realised that I had missed my turn, had gone nearly six blocks past it, and had to turn around and go all back.

Isn't that what happens in life when we focus on competing with coworkers, neighbors, friends, family, trying to outdo them? We spend our time and energy running after them and we miss out our own paths to our destinies.

The problem with unhealthy competition is that it is a never

ending cycle. What is important is to take what life has given you. There is no competition in destiny.

Run your own race and wish others well.

### Conversation in the Womb

Following is a conversation between twins in their mother's womb.

Baby1. And you, you believe in life after birth?

Baby2. Absolutely. It is obvious that the life after birth exists. We are here to become stronger and to get ready for whatever awaits us next.

Baby1. This is absurd. There is nothing after birth! What would life look like outside the womb!

Baby2. Well, there are many stories about the other side. I have heard there is a blaze of light there, thousands of things to live for. For example, I have heard that we will eat with our mouth there.

Baby1. That's silly. We have an umbilical cord and that is how we eat. Life just ends at birth period. That's the way it is and we must accept it.

Baby2. Alright, then allow me to think differently. I like to believe that in the next world, we will be able to see our mother and that she will take care of us.

Baby1. Mother? You mean that you believe in Mother? Oh! So where is she?

Baby2. Everywhere, don't you see it! She is everywhere all around us. We are part of her and it's. Thanks to her that we are living right now. Without her, we wouldn't be here.

Read the above a second time by changing some words. Change the word BIRTH to DEATH, WOMB to WORLD, MOTHER to GOD. You will find mystery unveiling!

## List of membership during Quarter

Sr. No.	G.R. No.	Name	Member	Sr. No.	G.R. No.	Name	Member
1	2201	Vaidya Dhaval P	Member	7	2207	Kshire Ninad S	Student Member
2	2202	Thakkar Tarang V	Life Member	8	2208	Desai Varshil A	Student Member
3	2203	Shah Ashish P	Associate Member	9	2209	Dhebar Anilkumar H	Member
4	2204	Darji Pradipkumar S	Associate Member	10	2210	Patel Mayur N	Member
5	2205	Panchal Utkarsh N.	Member	11	2211	Kudalkar Rijwan S	Life Member
6	2206	Joshi Namra	Member	12	2212	Tilwalli Mohan R	Life Member

## Up-gradation of Life Member to Life Fellow

1. Er. KG Shah Life Fellow
2. Er. JD Wadhwa Life Fellow

## Chapter's Activity

- ❖ On 15 Apr 2015, the chapter organised a lecture on "HVDC". The speaker was Er. Nihar Raj, Asstt. V.P. (Tech.) ABB India Limited, Vadodara.

The topic was related to advantages, disadvantages of "HVDC" over AC, impact on Grid, precautions to be taken etc.

The lecture was well attended and appreciated by the members.

- ❖ On 28 May 2015 the Chapter organized a lecture on 'Grid Management Challenges in Renewable Energy' at GETRI Auditorium. The speaker was Er. BB Mehta, CE(LD, SLDC, GETCo, Gotri. While stressing the need of renewable energy in present time, he deliberated on the Issues and Challenges for Grid Management, particularly in Gujarat Grid. His article is published in this issue. He stated that due to "Must Run Status" of renewable source, the

utilities are forced to back down their cheaper generation and avail costly renewable. He added that the utilities of the State, which are hosting the renewable suffer from generation imbalance. The utilities non hosting States just escape by fulfilling Renewable Purchase Obligation(RPO).

The lecture was well received by the members.

- ❖ On 23 Jun 2015 the Chapter organized a talk br Er. Ravindra Pandeji, Associate GM, M/s Schneider Electric, Mumbai. The topic was IEC-31439-1&2(Switch Board) and IEC-61439-6(Bus ways).

The topic was related to LT distribution network in the major Industrial Units. The lecturer gave detailed account of IEC which are responsible for bringing out better technology and control equipment.

## Members' Views

Er. Hemant T Dhruv, Life Member of SPE(I)-Vadodara gave his views about the technical article published in last SPE News Letter, April-2015 issue as under:

Quote : "SPE News Letters are educative in general and the technical articles are of profound knowledge in particular for readers. Not only it adds to our knowledge but cultivates the habit of reading such technical matters.

Editorial Board deserves appreciation for the same". Unquote

Editorial Board thanks Er. Dhruv for sending his views and further appeals members and readers to send their frank views about the contents of SPE News Letter. Your views and suggestions will be taken sportingly.

## Merit Awards

Every year SPE(I), Vadodara distributes Merit Awards to those members who have contributed significantly in **Power Sector** or Speciality in their

field. Those members who have received such honour, may send their nominations. The nominations should reach by **02 Sep 2015**.

## Request for Donation

The Vadodara Chapter is a leading chapter of SPE(I). In addition to the swelling membership, consistency of activities makes the chapter unique. With rising cost of commodities and other items, the Chapter needs funds all the

time. An appeal is, therefore, made to all the readers to generously give donations to the Vadodara Chapter of SPE(I). All the donations will be properly receipted duly acknowledged in the SPE NEWS LETTER.

Book - Post

Printed Matter

From :  
**The Society of Power Engineers (India)**  
**Vadodara Chapter**  
FF-48, Avishkar Complex,  
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To \_\_\_\_\_  
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