

Evaluating Two Timezones and Daylight Saving Time for India

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Abstract

Recently, there has been considerable debate on redefining Indian Standard Time (IST). The suggestions include splitting the country into two timezones, while perhaps introducing daylight saving time (DST). We argue that the IST should remain unchanged. The arguments are centred around India's geography, nation building and practical concerns. The most compelling reason offered in favour of a new IST is better utilization of the power grid. We argue that the issue of timezones or DST and that of power grid utilization are two separate policy questions. They should be disentangled and addressed separately.

1 Why does DST exist ?

Let us start with some geography. The length of the day depends on the latitude. Higher latitudes have shorter days in winter and longer days in summer. Every point on the earth gets an equal amount of sunlight throughout the year. Since the earth's axis is tilted, the latitude determines how sunlight is distributed throughout the year. Lower latitudes (close to the equator) have days and nights of equal length (roughly twelve hours) throughout the year. On the other extreme are the poles, which have a six month long day followed by a six month long night.

The idea of DST is due to William Willett. The basic idea revolves around using the short hours of daylight more productively in the winter by setting the clock back. It was enforced during World War I in England, primarily to conserve coal. The merits and demerits of DST are discussed in the Wikipedia entry for DST [1].

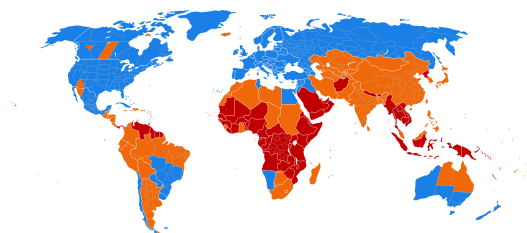


Figure 1: Daylight Saving Time worldwide. Blue regions use DST, red regions never used DST, and orange regions used DST in the past. Image courtesy of Wikipedia [1].

DST is not commonly used, as seen in Figure 1. The parts coloured blue use DST. The red parts never used DST, whereas the orange parts stopped using DST. It is interesting to note that in the case of many countries, the decision to use DST is not a nationwide decision, but a local decision. The US state of Arizona does not follow DST, even though other states do.

2 Why is DST not suitable for India?

India's location on the lower latitudes (8 N–35 N) makes DST unattractive for India. The longest day of the year is the summer solstice, whereas the shortest day is the winter solstice. The length of the day varies from 11.5 hours to 13 hours through the year in the southern city of Chennai. In Srinagar, it varies from 10.5 hours to 14 hours. Clearly, all of India has plenty of sunlight year round. Even in the northernmost city, Srinagar, the sun rises at approximately 7:30am and sets at approximately 5:30pm in the dark days of December.

The argument of energy savings due to DST is not convincing in general, and has yet to be proved. However this argument does not even arise in the case of India due to the abundance of daylight throughout the year.

3 The necessity of timezones

Back to geography now. Unlike DST, which has to do with latitudes, timezones are determined by longitudes. The earth is divided into 360 longitudes. There are $24 \times 60 = 1440$ minutes in a day. This leads to a simple calculation of the earth's speed of rotation, which is $\frac{1440}{360} = 4$ minutes per longitude. The sun should be overhead at noon in local time. Ideally, a timezone policy should try to achieve roughly such a result. The time difference between any two points on earth is four times the number of longitudes separating them. Obviously, it would be impractical to have a separate timezone for each longitude. For convenience, the world is split up into timezones of half hour or one hour increments.

For example, consider Russia, which spans a large number of longitudes. Note that this is primarily due to its geographically higher latitudes, and not solely due to its physically large area. Remember the distortions that occur when projecting from a sphere to a plane, which cause the north pole to be projected to a line on the map. Digression aside, Russia spans eleven timezones, Canada spans six, and the 48 continental states of USA span four timezones.

Separate timezones are meaningful when regions span many longitudes, or are physically separated, or if they are poorly connected. For example, consider islands that are separated by open ocean. On the other hand, nearly all of Western Europe (excluding the UK and Portugal) is on one timezone. Even though the European countries are sovereign territories, a common timezone encourages travel and trade. A train ride from Poland to Spain crosses several countries, but does not require resetting the watch.

On the other extreme is China. China spans longitudes 73 E–134 E compared to India's 68 E–97 E range. Even China's latitude range of 21 N–53 N is much larger than the Indian range of 8 N–35 N. Heilongjiang and Guandong (Canton) in China ex-

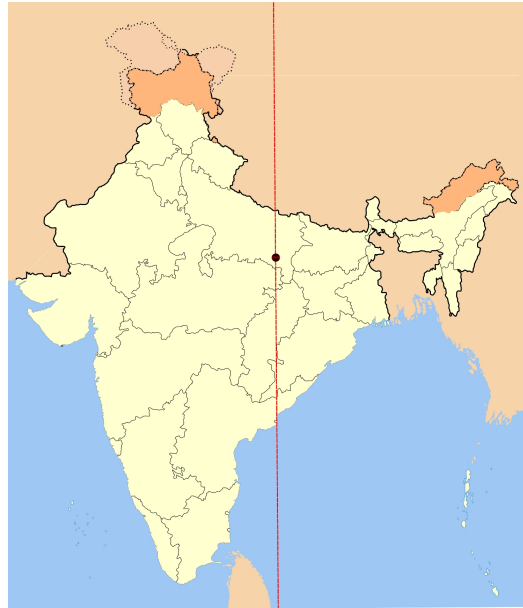


Figure 2: Indian Standard Time (82.5 E). Image courtesy of Wikipedia [3].

perience more variations in daylight than Kashmir and Kerala do. All of China is on a single timezone.

4 Should India have two timezones?

Indian Standard time (IST) is calculated on the 82.5 E longitude, which passes through Mirzapur. This is seen in Figure 2. India is large geographically. Since it is on the lower latitudes, it spans fewer longitudes. For the purpose of discussion, we will consider Calcutta and Mumbai. Calcutta is on the 88 E longitude, whereas Mumbai is on the 72 E longitude. They are separated by 16 longitudes or 64 minutes. Using the easternmost and westernmost points, the difference is roughly two hours. This might tempt us into using two timezones for India. However, one needs to look deeper.

Looking at the population density map of India in Figure 3, we see a large fraction of the population falls within one hour of the IST longitude. Mumbai is roughly 40 minutes to the west of Mirzapur, while Calcutta is 20 minutes to the east of Mirzapur. The longitudes between Mumbai and Calcutta also capture the large part of the Indian population.

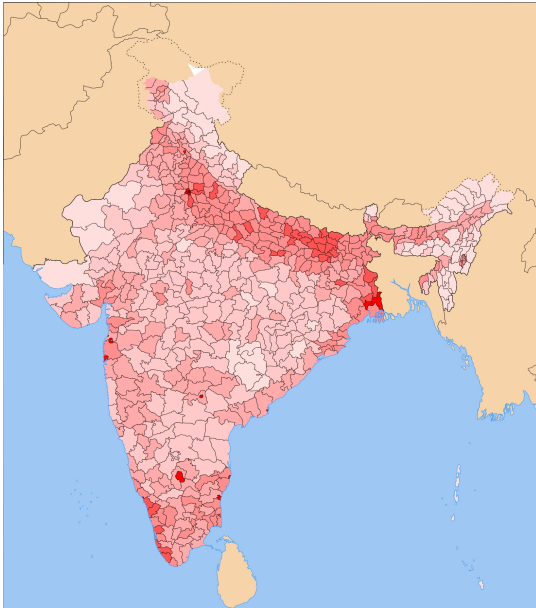


Figure 3: India's population density. Image courtesy of Wikipedia [2].

The beauty of a single timezone lies in its simplicity. Everyone is on the same time!

5 Nation building

It is a delicate decision to carve out the two timezones. Any serious attempt will pass through the boundaries of Uttar Pradesh, Chattisgarh, Orissa, and Andhra Pradesh. These states have nearly even physical structure, with good train and road connectivity between them. A new IST will inconvenience the flow of goods and people. This will also inconvenience the Eastern part of India (the seven sisters and Bengal), which is commercially less powerful than the Bombay-Delhi-Bangalore centric Western India. Nearly all the good ports, with the exception of Calcutta (and perhaps Vishakapatnam), will fall in the Western timezone, further skewing the importance of the Western time. Most of North-East feels geographically, politically and socially disconnected already. No longer being on the same time as Mumbai and Delhi will make matters worse.

6 A new IST will cause inconvenience and confusion

Costs of a new IST will be borne by passenger travel; trains and buses locally, and airlines globally. Consumer electronics that cannot accommodate the change of timezone will have to be discarded. Software maintenance will have to account for this change in time. Financial institutions will have to coordinate their Eastern branches with the Western. The cost is borne by all the citizens of India, everyone we communicate with, and everyone who travels to India. The effects of a new IST will be felt worldwide.

Many embedded systems such as cell phones, wrist watches, internet routers, microwave ovens etc. cannot be upgraded like computers can, and this is only the tip of the iceberg. The costs of upgrading enterprise software (banking, insurance, airline and train reservation systems, billing, payroll etc.) are hard to quantify. The Y2K bug is a good reference point to keep in mind when thinking of upgrading such software. All these costs are eventually borne by the consumer.

A billion people need to readjust their lives, a lot of whom are yet to be educated. Will this create a further divide between the educated and those not fortunate enough to be educated? Quite likely so.

Ad-hoc redefinition of IST might also send a wrong signal to the international community and global investors. There is the risk of coming across as an India that makes mundane policy changes, rather than an India working hard to implement much needed reforms in a variety of sectors.

7 Efficient utilization of scarce resources

Both daylight savings and dual timezones are advocated to ease loads on the power grid, which is a weak argument. It might have worked fifty years ago, when power grids and computers were non-existent. Today, it is through incentives that power consumption must be controlled, rather than with expensive and ad-hoc policies. Utilities should use a pricing model, selling electricity, water, natural gas at different prices throughout the day to ease network congestion. Consumers will react to

these prices, and adjust their lifestyles. If schools and companies want cheaper electricity, they will change working hours in summer and winter. A greater good can be achieved through differential pricing. Those using the most resources during peak demand pay more. A general change in IST is a tax on the entire population, with benefits for a minority. The benefits of differential pricing of utilities, telecommunications, highways, or anything that uses shared infrastructure are well known and a lot has been written about them. Far greater benefits can be realized by doing the right thing, rather than haphardly redefining IST.

8 Existing solutions

Many institutions around the country deal with varying lengths of days and varying sunrise/sunset times in simple but innovative ways. For example, some schools use different working hours in summers and winters. In summer, schools start earlier than in winter. This is also true for many shopping areas, where sundown is the unofficial close of the market. As a result, shops are open later in the summer than in the winter. Even with a change in official time (through timezones or DST), it is likely that these shops continue operating till sundown.

9 Conclusion

India does not need daylight saving time (DST) because there is plenty of daylight throughout the year. The Indian subcontinent is geographically large enough for two timezones. However, taking into account the population density, the simplicity and economic value of one timezone, administrative costs, and nation building arguments, we believe that we are better off leaving IST unchanged.

Efficient utilization of resources such as electricity, water and natural gas should be achieved through incentive based schemes. Incentive based schemes will have a larger payoff in the long run as compared to an ad-hoc policy that redefines IST.

References

- [1] Wikipedia. [Daylight saving time](#).
- [2] Wikipedia. [Demographics of india](#).
- [3] Wikipedia. [Indian standard time](#).

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