

# Daylight saving time

**Daylight saving time** (**DST**), also referred to as **daylight savings time** or simply **daylight time** (United States, Canada, and Australia), and **summer time** (United Kingdom, European Union, and others), is the practice of advancing clocks (typically by one hour) during warmer months so that darkness falls at a later clock time. The typical implementation of DST is to set clocks forward by one hour in the spring ("spring forward"), and to set clocks back by one hour in autumn ("fall back") to return to standard time. As a result, there is one 23-hour day in late winter or early spring and one 25-hour day in autumn.

The idea of aligning waking hours to daylight hours to conserve candles was first proposed in 1784 by US polymath Benjamin Franklin. In a satirical letter to the editor of *The Journal of Paris*, Franklin suggested that waking up earlier in the summer would economize on candle usage; and calculated considerable savings.<sup>[1][2]</sup> In 1895, New Zealand entomologist and astronomer George Hudson proposed the idea of changing clocks by two hours every spring to the Wellington Philosophical Society.<sup>[3]</sup> In 1907, British resident William Willett presented the idea as a way to save energy. After some serious consideration, it was not implemented.<sup>[4]</sup>

In 1908, Port Arthur in Ontario, Canada, started using DST.<sup>[5][6]</sup> Starting on April 30, 1916, the German Empire and Austria-Hungary each organized the first nationwide implementation in their jurisdictions. Many countries have used DST at various times since then, particularly since the 1970s energy crisis. DST is generally not observed near the Equator, where sunrise and sunset times do not vary enough to justify it. Some countries observe it only in some regions: for example, parts of Australia observe it, while other parts do not. Conversely, it is not observed at some places at high latitudes, because there are wide variations in sunrise and sunset times and a one-hour shift would relatively not make much difference. The United States observes it, except for the states of Hawaii and Arizona (within the latter, however, the Navajo Nation does observe it, conforming to federal practice).<sup>[7]</sup> A minority of the world's population uses DST; Asia, Africa, and Latin American and the Caribbean generally do not.

DST clock shifts sometimes complicate timekeeping and can disrupt travel, billing, record keeping, medical devices, and sleep patterns. Computer software generally adjusts clocks automatically.



Daylight saving time regions:

- Northern hemisphere summer
- Southern hemisphere summer
- Formerly used daylight saving
- Never used daylight saving

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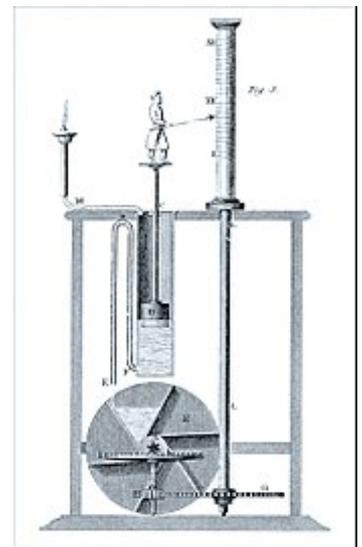
# Rationale

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Industrialized societies usually follow a clock-based schedule for daily activities that do not change throughout the course of the year. The time of day that individuals begin and end work or school, and the coordination of mass transit, for example, usually remain constant year-round. In contrast, an agrarian society's daily routines for work and personal conduct are more likely governed by the length of daylight hours<sup>[8][9]</sup> and by solar time, which change seasonally because of the Earth's axial tilt. North and south of the tropics, daylight lasts longer in summer and shorter in winter, with the effect becoming greater the further one moves away from the equator.

After synchronously resetting all clocks in a region to one hour ahead of standard time, individuals following a clock-based schedule will awaken an hour earlier than they would have otherwise—or rather an hour's worth of darkness earlier; they will begin and complete daily work routines an hour of daylight earlier: they will have available to them an extra hour of daylight after their workday activities.<sup>[10][11]</sup> They will have one less hour of daylight at the start of the workday, making the policy less practical during winter.<sup>[12][13]</sup>

Proponents of daylight saving time argue that most people prefer a greater increase in daylight hours after the typical "nine to five" workday.<sup>[14][15]</sup> Supporters have also argued that DST decreases energy consumption by reducing the need for lighting and heating, but the actual effect on overall energy use is heavily disputed.



An ancient water clock that lets hour lengths vary with season.

The shift in apparent time is also motivated by practicality. In American temperate latitudes, for example, the sun rises around 04:30 at the summer solstice and sets around 19:30. Since most people are asleep at 04:30, it is seen as more practical to pretend that 04:30 is actually 05:30, thereby allowing people to wake close to the sunrise and be active in the evening light.

The manipulation of time at higher latitudes (for example Iceland, Nunavut, Scandinavia, and Alaska) has little effect on daily life, because the length of day and night changes more extremely throughout the seasons (in comparison to lower latitudes). Sunrise and sunset times become significantly out of phase with standard working hours regardless of manipulation of the clock.<sup>[16]</sup>

DST is similarly of little use for locations near the Equator, because these regions see only a small variation in daylight in the course of the year.<sup>[17]</sup> The effect also varies according to how far east or west the location is within its time zone, with locations farther east inside the time zone benefiting more from DST than locations farther west in the same time zone.<sup>[18]</sup> Neither is daylight savings of much practicality in such places as China, which—despite its width of thousands of miles—is all located within a single time zone per government mandate.

## History

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Ancient civilizations adjusted daily schedules to the sun more flexibly than DST does, often dividing daylight into 12 hours regardless of daytime, so that each daylight hour became progressively longer during spring and shorter during autumn.<sup>[19]</sup> For example, the Romans kept time with water clocks that had different scales for different months of the year; at Rome's latitude, the third hour from sunrise (*hora tertia*) started at 09:02 solar time and lasted 44 minutes at the winter solstice, but at the summer solstice it started at 06:58 and lasted 75 minutes.<sup>[20]</sup> From the 14th century onward, equal-length civil hours supplanted unequal ones, so civil time no longer varied by season. Unequal hours are still used in a few traditional settings, such as monasteries of Mount Athos<sup>[21]</sup> and in Jewish ceremonies.<sup>[22]</sup>

Benjamin Franklin published the proverb "early to bed and early to rise makes a man healthy, wealthy, and wise,"<sup>[23][24]</sup> and published a letter in the *Journal de Paris* during his time as an American envoy to France (1776–1785) suggesting that Parisians economize on candles by rising earlier to use morning sunlight.<sup>[25]</sup> This 1784 satire proposed taxing window shutters, rationing candles, and waking the public by ringing church bells and firing cannons at sunrise.<sup>[26]</sup> Despite common misconception, Franklin did not actually propose DST; 18th-century Europe did not even keep precise schedules. However, this changed as rail transport and communication networks required a standardization of time unknown in Franklin's day.<sup>[27]</sup>

In 1810, the Spanish National Assembly Cortes of Cádiz issued a regulation that moved certain meeting times forward by one hour from May 1 to September 30 in recognition of seasonal changes, but it did not change the clocks. It also acknowledged that private businesses were in the practice of changing their opening hours to suit daylight conditions, but they did so of their own volition.<sup>[28][29]</sup>

New Zealand entomologist George Hudson first proposed modern DST.

His shift-work job gave him leisure time to collect insects and led him to value after-hours daylight.<sup>[3]</sup> In 1895, he presented a paper to the Wellington Philosophical Society proposing a two-hour daylight-saving shift,<sup>[10]</sup> and considerable interest was expressed in Christchurch; he followed up with an 1898 paper.<sup>[30]</sup>



George Hudson invented modern DST, proposing it first in 1895.

Many publications credit the DST proposal to prominent English builder and outdoorsman William Willett,<sup>[31]</sup> who independently conceived DST in 1905 during a pre-breakfast ride when he observed how many Londoners slept through a large part of a summer day.<sup>[15]</sup> Willett also was an avid golfer who disliked cutting short his round at dusk.<sup>[32]</sup> His solution was to advance the clock during the summer months, and he published the proposal two years later.<sup>[33]</sup> Liberal Party member of parliament Robert Pearce took up the proposal, introducing the first Daylight Saving Bill to the British House of Commons on February 12, 1908.<sup>[34]</sup> A select committee was set up to examine the issue, but Pearce's bill did not become law and several other bills failed in the following years.<sup>[4]</sup> Willett lobbied for the proposal in the UK until his death in 1915.

Port Arthur, Ontario, Canada, was the first city in the world to enact DST, on July 1, 1908.<sup>[5][6]</sup> This was followed by Orillia, Ontario, introduced by William Sword Frost while mayor from 1911 to 1912.<sup>[35]</sup> The first states to adopt DST (German: *Sommerzeit*) nationally were those of the German Empire and its World War I ally Austria-Hungary commencing April 30, 1916, as a way to conserve coal during wartime. Britain, most of its allies, and many European neutrals soon followed. Russia and a few other countries waited until the next year, and the United States adopted daylight saving in 1918. Most jurisdictions abandoned DST in the years after the war ended in 1918, with exceptions including Canada, the United Kingdom, France, Ireland, and the United States.<sup>[36]</sup> It became common during World War II (some countries adopted double summer time), and was widely adopted in America and Europe from the 1970s as a result of the 1970s energy crisis. Since then, the world has seen many enactments, adjustments, and repeals.<sup>[37]</sup>

It is a common myth in the United States that DST was first implemented for the benefit of farmers.<sup>[38][39][40]</sup> In reality, farmers have been one of the strongest lobbying groups against DST since it was first implemented.<sup>[38][39][40]</sup> The factors that influence farming schedules, such as morning dew and dairy cattle's readiness to be milked, are ultimately dictated by the sun, so the time change introduces unnecessary challenges.<sup>[38][40][41]</sup>

DST was first implemented in the US with the Standard Time Act of 1918, a wartime measure for seven months during World War I in the interest of adding more daylight hours to conserve energy resources.<sup>[42][41]</sup> Year-round DST, or "War Time", was implemented again during World War II.<sup>[42]</sup> After the war, local jurisdictions were free to choose if and when to observe DST until the Uniform Time Act which standardized DST in 1966.<sup>[42][43]</sup> Permanent daylight saving time was enacted for the winter of 1974, but there were complaints of children going to school in the dark and working people commuting and starting their work day in pitch darkness during the winter months, and it was repealed a year later.

## Procedure

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The relevant authorities usually schedule clock changes to occur at (or soon after) midnight, and on a weekend, in order to lessen disruption to weekday schedules.<sup>[44]</sup> A one-hour change is usual, but twenty-minute and two-hour changes have been used in the past. In all countries that observe daylight saving time seasonally (i.e. during summer and not winter), the clock is advanced from standard time to daylight saving time in the spring, and they are turned back from daylight saving time to standard time in the autumn. The practice, therefore, reduces the number of civil hours in the day of the springtime change, and it increases the number of civil hours in the day of the autumnal change. For a midnight change in spring, a digital



DST was first implemented in the United States to conserve energy during World War I. (poster by United Cigar Stores)



When DST observation begins, clocks are advanced by one hour (as if to skip one hour) during the very early morning.



When DST observation ends and standard time observation resumes, clocks are turned back one hour (as if to repeat one hour) during the very early morning. Specific times of the clock change vary by jurisdiction.

display of local time would appear to jump from 23:59:59.9 to 01:00:00.0. For the same clock in autumn, the local time would appear to repeat the hour preceding midnight, i.e. it would jump from 23:59:59.9 to 23:00:00.0.

In most countries that observe seasonal daylight saving time, the clock observed in winter is legally named "standard time"<sup>[45]</sup> in accordance with the standardization of time zones to agree with the local mean time near the center of each region.<sup>[46]</sup> An exception exists in Ireland, where its winter clock has the same offset (UTC±00:00) and legal name as that in Britain (Greenwich Mean Time)—but while its summer clock also has the same offset as Britain's (UTC+01:00), its legal name is Irish Standard Time<sup>[47][48]</sup> as opposed to British Summer Time.<sup>[49]</sup>

While most countries that change clocks for daylight saving time observe standard time in winter and DST in summer, Morocco observes (since 2019) daylight saving time every month but Ramadan. During the holy month (the date of which is determined by the lunar calendar and thus moves annually with regard to the Gregorian calendar), the country's civil clocks observe Western European Time (UTC+00:00, which geographically overlaps most of the nation). At the close of this month, its clocks are turned forward to Western European Summer Time (UTC+01:00), where they remain until the return of the holy month the following year.<sup>[50][51][52]</sup>

The time at which to change clocks differs across jurisdictions. Members of the European Union conduct a coordinated change, changing all zones at the same instant, at 01:00 Coordinated Universal Time (UTC), which means that it changes at 02:00 Central European Time (CET), equivalent to 03:00 Eastern European Time (EET). As a result, the time differences across European time zones remain constant.<sup>[53][54]</sup> North America coordination of the clock change differs, in that each jurisdiction change at 02:00 local time, which temporarily creates unusual differences in offsets. For example, Mountain Time is, for one hour in the autumn, zero hours ahead of Pacific Time instead of the usual one hour ahead, and, for one hour in the spring, it is two hours ahead of Pacific Time instead of one.

Also, during the autumn shift from daylight saving to standard time, the hour between 01:00 and 01:59:59 occurs twice in any given time zone, whereas—during the late winter or spring shift from standard to daylight saving time—the hour between 02:00 and 02:59:59 disappears.

The dates on which clocks change vary with location and year; consequently, the time differences between regions also vary throughout the year. For example, Central European Time is usually six hours ahead of North American Eastern Time, except for a few weeks in March and October/November, while the United Kingdom and mainland Chile could be five hours apart during the northern summer, three hours during the southern summer, and four hours for a few weeks per year. Since 1996, European Summer Time has been observed from the last Sunday in March to the last Sunday in October; previously the rules were not uniform across the European Union.<sup>[54]</sup> Starting in 2007, most of the United States and Canada observed DST from the second Sunday in March to the first Sunday in November, almost two-thirds of the year.<sup>[55]</sup> Moreover, the beginning and ending dates are roughly reversed between the northern and southern hemispheres because spring and autumn are displaced six months. For example, mainland Chile observes DST from the second Saturday in October to the second Saturday in March, with transitions at 24:00 local

time.<sup>[56]</sup> In some countries time is governed by regional jurisdictions within the country such that some jurisdictions change and others do not; this is currently the case in Australia, Canada, Mexico, and the United States (formerly in Brazil, etc.).<sup>[57][58]</sup>

From year to year, the dates on which to change clock may also move for political or social reasons. The Uniform Time Act of 1966 formalized the United States' period of daylight saving time observation as lasting six months (it was previously declared locally); this period was extended to seven months in 1986, and then to eight months in 2005.<sup>[59][60][61]</sup> The 2005 extension was motivated in part by lobbyists from the candy industry, seeking to increase profits by including Halloween (October 31) within the daylight saving time period.<sup>[62]</sup> In recent history, Australian state jurisdictions not only changed at different local times but sometimes on different dates. For example, in 2008 most states there that observed daylight saving time changed clocks forward on October 5, but Western Australia changed on October 26.<sup>[63]</sup>

## **Politics, religion and sport**

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The concept of daylight saving has caused controversy since its early proposals.<sup>[64]</sup> Winston Churchill argued that it enlarges "the opportunities for the pursuit of health and happiness among the millions of people who live in this country"<sup>[65]</sup> and pundits have dubbed it "Daylight Slaving Time".<sup>[66]</sup> Retailing, sports, and tourism interests have historically favored daylight saving, while agricultural and evening-entertainment interests (and some religious groups<sup>[67][68][69][70]</sup>) have opposed it; energy crises and war prompted its initial adoption.<sup>[71]</sup>

The fate of Willett's 1907 proposal illustrates several political issues. It attracted many supporters, including Arthur Balfour, Churchill, David Lloyd George, Ramsay MacDonald, King Edward VII (who used half-hour DST or "Sandringham time" at Sandringham), the managing director of Harrods, and the manager of the National Bank. However, the opposition proved stronger, including Prime Minister H. H. Asquith, William Christie (the Astronomer Royal), George Darwin, Napier Shaw (director of the Meteorological Office), many agricultural organizations, and theatre-owners. After many hearings, a parliamentary committee vote narrowly rejected the proposal in 1909. Willett's allies introduced similar bills every year from 1911 through 1914, to no avail.<sup>[72]</sup> People in the USA demonstrated even more skepticism; Andrew Peters introduced a DST bill to the House of Representatives in May 1909, but it soon died in committee.<sup>[73]</sup>

Germany together with its allies led the way in introducing DST (German: *Sommerzeit*) during World War I on April 30, 1916, aiming to alleviate hardships due to wartime coal shortages and air-raid blackouts. The political equation changed in other countries; the United Kingdom used DST first on May 21, 1916.<sup>[74]</sup> US retailing and manufacturing interests—led by Pittsburgh industrialist Robert Garland—soon began lobbying for DST, but railroads opposed the idea. The USA's 1917 entry into the war overcame objections, and DST started in 1918.<sup>[75]</sup>

The end of World War I brought change in DST use. Farmers continued to dislike DST, and many countries repealed it—like Germany itself, which dropped DST from 1919 to 1939 and from 1950 to 1979.<sup>[76]</sup> Britain proved an exception; it retained DST nationwide but adjusted transition dates over the years for several reasons, including special rules during the 1920s and 1930s to avoid clock shifts on Easter mornings. As of 2009 summer time began annually on the last Sunday in March under a European Community directive, which may be Easter Sunday (as in 2016).<sup>[54]</sup> In the U.S., Congress repealed DST after 1919. President Woodrow Wilson—an avid golfer like Willett—vetoed the repeal twice, but his second veto was overridden.<sup>[77]</sup> Only a few U.S. cities retained DST locally,<sup>[78]</sup> including New York (so that its financial exchanges could maintain an hour of arbitrage trading with London), and Chicago and Cleveland (to keep pace with New York).<sup>[79]</sup> Wilson's successor as president, Warren G. Harding, opposed DST as a "deception", reasoning that people should instead get up and go to work earlier in the summer.

He ordered District of Columbia federal employees to start work at 8 am rather than 9 am during the summer of 1922. Some businesses followed suit, though many others did not; the experiment was not repeated.<sup>[11]</sup>

Since Germany's adoption of DST in 1916, the world has seen many enactments, adjustments, and repeals of DST, with similar politics involved.<sup>[80]</sup> The history of time in the United States features DST during both world wars, but no standardization of peacetime DST until 1966.<sup>[81][82]</sup> St. Paul and Minneapolis, Minnesota, kept different times for two weeks in May 1965: the capital city decided to switch to daylight saving time, while Minneapolis opted to follow the later date set by state law.<sup>[83][84]</sup> In the mid-1980s, Clorox and 7-Eleven provided the primary funding for the Daylight Saving Time Coalition behind the 1987 extension to U.S. DST. Both senators from Idaho, Larry Craig and Mike Crapo, voted for it based on the premise that fast-food restaurants sell more French fries (made from Idaho potatoes) during DST.<sup>[85]</sup>

A referendum on the introduction of daylight saving took place in Queensland, Australia, in 1992, after a three-year trial of daylight saving. It was defeated with a 54.5% "no" vote, with regional and rural areas strongly opposed, and those in the metropolitan southeast in favor.<sup>[86]</sup>

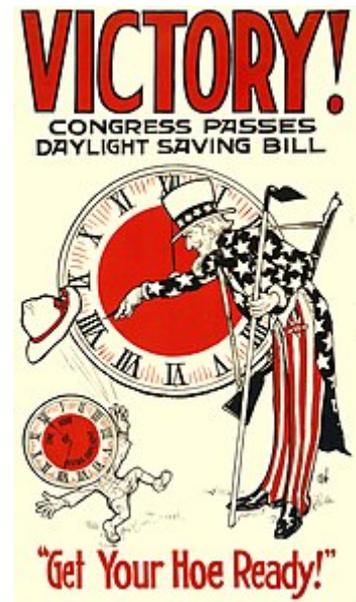
In 2005 the Sporting Goods Manufacturers Association and the National Association of Convenience Stores successfully lobbied for the 2007 extension to U.S. DST.<sup>[87]</sup>

In December 2008 the Daylight Saving for South East Queensland (DS4SEQ) political party was officially registered in Queensland, advocating the implementation of a dual-time-zone arrangement for daylight saving in South East Queensland, while the rest of the state maintained standard time.<sup>[88]</sup> DS4SEQ contested the March 2009 Queensland state election with 32 candidates and received one percent of the statewide primary vote, equating to around 2.5% across the 32 electorates contested.<sup>[89]</sup> After a three-year trial, more than 55% of Western Australians voted against DST in 2009, with rural areas strongly opposed.<sup>[90]</sup> Queensland Independent member Peter Wellington introduced the Daylight Saving for South East Queensland Referendum Bill 2010 into the Queensland parliament on April 14, 2010, after being approached by the DS4SEQ political party, calling for a referendum at the next state election on the introduction of daylight saving into South East Queensland under a dual-time-zone arrangement.<sup>[91]</sup> The Queensland parliament rejected Wellington's bill on June 15, 2011.<sup>[92]</sup>

In the UK, the Royal Society for the Prevention of Accidents supports a proposal to observe SDST's additional hour year-round, but that is opposed by some industries, by some postal workers and farmers, and particularly by those living in the northern regions of the UK.<sup>[9]</sup> In the United States, several states do not participate in daylight saving time, including parts of Arizona.<sup>[93]</sup> Some states, including Indiana, have begun participating in daylight saving time as recently as 2006. In 2022, the U.S. Senate unanimously approved a bill to make DST permanent, starting November 2023.<sup>[94]</sup>

Russia declared in 2011 that it would stay in DST all year long (UTC+4:00); Belarus followed with a similar declaration.<sup>[95]</sup> (The Soviet Union had operated under permanent "summer time" from 1930 to at least 1982.) Russia's plan generated widespread complaints due to the dark of winter-time mornings, and thus was abandoned in 2014.<sup>[96]</sup> The country changed its clocks to standard time (UTC+3:00) on October 26, 2014, intending to stay there permanently.<sup>[97]</sup>

## Religion



Retailers generally favor DST; United Cigar Stores hailed a 1918 DST bill.

Some religious groups and individuals have opposed DST on religious grounds. In the past, some Christian groups and individuals criticized it for being a deviation from "God's Time",<sup>[98]</sup> while for religious Jews and Muslims it makes religious practices such as prayer and fasting more difficult or inconvenient.<sup>[99][68][69][70]</sup> Some Muslim countries, such as Morocco, temporarily abandoned DST during Ramadan, while Iran maintains DST even during Ramadan.<sup>[70]</sup>

In Israel, DST has been a point of contention between the religious and secular, resulting in fluctuations over the years, and a shorter DST period than in the EU and US. Religious Jews prefer a shorter DST<sup>[a]</sup> due to DST delaying the time for morning prayers, thus conflicting with standard working and business hours. Additionally, DST is ended before Yom Kippur (a 25-hour fast day starting and ending at sunset, much of which is spent praying in synagogue until the fast ends at sunset) since DST would result in the day ending later, which many feel makes it more difficult.<sup>[b][68][100]</sup>

In the US, Orthodox Jewish groups have opposed extensions to DST,<sup>[101]</sup> as well as a 2022 bipartisan bill that would make DST permanent, saying it will "interfere with the ability of members of our community to engage in congregational prayers and get to their places of work on time."<sup>[69]</sup>

## Impacts

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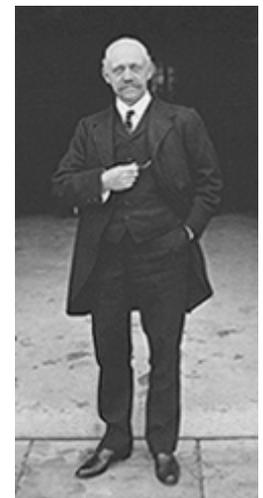
Proponents of DST generally argue that it saves energy, promotes outdoor leisure activity in the evening (in summer), and is therefore good for physical and psychological health,<sup>[103]</sup> reduces traffic accidents, reduces crime or is good for business.<sup>[104]</sup> Opponents argue the actual energy savings are inconclusive.

A 2017 meta-analysis of 44 studies found that DST leads to electricity savings of 0.3% during the days when DST applies.<sup>[105][106]</sup> Several studies have suggested that DST increases motor fuel consumption,<sup>[107]</sup> but a 2008 United States Department of Energy report found no significant increase in motor gasoline consumption due to the 2007 United States extension of DST.<sup>[108]</sup> An early goal of DST was to reduce evening usage of incandescent lighting, once a primary use of electricity.<sup>[109]</sup> Although energy conservation remains an important goal,<sup>[110]</sup> energy usage patterns have greatly changed since then. Electricity use is greatly affected by geography, climate, and economics, so the results of a study conducted in one place may not be relevant to another country or climate.<sup>[107]</sup>

Later sunset times from DST are thought to affect behavior; for example, increasing participation in after-school sports programs or outdoor afternoon sports such as golf, and attendance at professional sporting events.<sup>[111]</sup> Advocates of daylight saving time argue that having more hours of daylight between the end of a typical workday and evening induces people to consume other goods and services.<sup>[112][104][113]</sup>

Many farmers oppose DST, particularly dairy farmers as the milking patterns of their cows do not change with the time.<sup>[114][115][116]</sup> and others whose hours are set by the sun.<sup>[117]</sup> There is concern for schoolchildren who are out in the darkness during the morning due to late sunrises.<sup>[114]</sup> DST also hurts prime-time television broadcast ratings,<sup>[118][114]</sup> drive-ins and other theaters.<sup>[119]</sup>

It has been argued that clock shifts correlate with decreased economic efficiency, and that in 2000 the daylight-saving effect implied an estimated one-day loss of \$31 billion on U.S. stock exchanges,<sup>[120]</sup> Others have asserted that the observed results depend on methodology<sup>[121]</sup> and disputed the findings,<sup>[122]</sup> though the original authors have refuted points raised by disputers.<sup>[123]</sup>



William Willett independently proposed DST in 1907 and advocated it tirelessly.<sup>[102]</sup>

## Health

There are measurable adverse effects of DST on human health.<sup>[124]</sup> It has been shown to disrupt human circadian rhythms,<sup>[125]</sup> negatively impacting human health in the process,<sup>[126]</sup> and that DST increases health risks such as heart attack,<sup>[114]</sup> and traffic accidents.<sup>[127][128]</sup>

A 2017 study in the *American Economic Journal: Applied Economics* estimated that "the transition into DST caused over 30 deaths at a social cost of \$275 million annually", primarily by increasing sleep deprivation.<sup>[129]</sup>

A correlation between clock shifts and increase in traffic accidents has been observed in North America and the UK but not in Finland or Sweden.<sup>[130]</sup> Four reports have found that this effect is smaller than the overall reduction in traffic fatalities.<sup>[131][132][133][134]</sup> In 2018, the European Parliament, reviewing a possible abolition of DST, approved a more in-depth evaluation examining the disruption of the human body's circadian rhythms which provided evidence suggesting the existence of an association between DST and a modest increase of occurrence of acute myocardial infarction, especially in the first week after the spring shift.<sup>[135]</sup> However a Netherlands study found, against the majority of investigations, contrary or minimal effect.<sup>[136]</sup> Year-round standard time (not year-round DST) is proposed by some to be the preferred option for public health and safety.<sup>[137][138][139][140][141]</sup> Clock shifts were found to increase the risk of heart attack by 10 percent,<sup>[114]</sup> and to disrupt sleep and reduce its efficiency.<sup>[142]</sup> Effects on seasonal adaptation of the circadian rhythm can be severe and last for weeks.<sup>[143]</sup>

## Social relations

DST likely reduces some kinds of crime, such as robbery and sexual assault, as fewer potential victims are outdoors after dusk.<sup>[144][145]</sup> Artificial outdoor lighting has a marginal and sometimes even contradictory influence on crime and fear of crime.<sup>[146]</sup>

In 2022, a publication of three replicating studies of individuals, between individuals, and transecting societies, by Ben Simon, Vallat, Rossi and Walker demonstrate that sleep loss affects the human motivation to help others, which in their fMRI findings is "associated with deactivation of key nodes within the social cognition brain network that facilitates prosociality."

Furthermore, they detected, through analysis of over 3 million real-world charitable donations, that loss of sleep inflicted by the transition to Daylight Saving Time, reduces altruistic giving compared to controls (being states not implementing DST). They conclude that implications for cooperative, civil society are "non-trivial."<sup>[147]</sup>

Cho, Barnes and Guanara, in their study which also took advantage of sleep manipulation due to the shift to daylight saving time in the spring, analyzed archival data from judicial punishment imposed by U.S. federal courts which showed sleep-deprived judges exact more severe penalties.<sup>[148]</sup>

## Inconvenience

DST's clock shifts have the obvious disadvantage of complexity. People must remember to change their clocks; this can be time-consuming, particularly for mechanical clocks that cannot be moved backward safely.<sup>[149]</sup> People who work across time zone boundaries need to keep track of multiple DST rules, as not all locations observe DST or observe it the same way. The length of the calendar day becomes variable; it is

no longer always 24 hours. Disruption to meetings, travel, broadcasts, billing systems, and records management is common, and can be expensive.<sup>[150]</sup> During an autumn transition from 02:00 to 01:00, a clock reads times from 01:00:00 through 01:59:59 twice, possibly leading to confusion.<sup>[151]</sup>

## Remediation

Some clock-shift problems could be avoided by adjusting clocks continuously<sup>[152]</sup> or at least more gradually<sup>[153]</sup>—for example, Willett at first suggested weekly 20-minute transitions—but this would add complexity and has never been implemented. DST inherits and can magnify the disadvantages of standard time. For example, when reading a sundial, one must compensate for it along with time zone and natural discrepancies.<sup>[154]</sup> Also, sun-exposure guidelines such as avoiding the sun within two hours of noon become less accurate when DST is in effect.<sup>[155]</sup>

## Terminology

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As explained by Richard Meade in the English Journal of the (American) National Council of Teachers of English, the form *daylight savings time* (with an "s") was already in 1978 much more common than the older form *daylight saving time* in American English ("the change has been virtually accomplished"). Nevertheless, even dictionaries such as Merriam-Webster's, American Heritage, and Oxford, which describe actual usage instead of prescribing outdated usage (and therefore also list the newer form), still list the older form first. This is because the older form is still very common in print and preferred by many editors. ("Although *daylight saving time* is considered correct, *daylight savings time* (with an "s") is commonly used.")<sup>[156]</sup> The first two words are sometimes hyphenated (*daylight-saving(s) time*). Merriam-Webster's also lists the forms **daylight saving** (without "time"), **daylight savings** (without "time"), and **daylight time**.<sup>[157]</sup> The Oxford Dictionary of American Usage and Style explains the development and current situation as follows: "Although the singular form *daylight saving time* is the original one, dating from the early 20th century—and is preferred by some usage critics—the plural form is now extremely common in AmE. [...] The rise of *daylight savings time* appears to have resulted from the avoidance of a miscue: when *saving* is used, readers might puzzle momentarily over whether *saving* is a gerund (the saving of daylight) or a participle (the time for saving). [...] Using *savings* as the adjective—as in *savings account* or *savings bond*—makes perfect sense. More than that, it ought to be accepted as the better form."<sup>[158]</sup>

In Britain, Willett's 1907 proposal<sup>[33]</sup> used the term *daylight saving*, but by 1911 the term *summer time* replaced *daylight saving time* in draft legislation.<sup>[102]</sup> The same or similar expressions are used in many other languages: *Sommerzeit* in German, *zomertijd* in Dutch, *kesäaika* in Finnish, *horario de verano* or *hora de verano* in Spanish, and *heure d'été* in French.<sup>[74]</sup>

The name of local time typically changes when DST is observed. American English replaces *standard* with *daylight*: for example, *Pacific Standard Time* (*PST*) becomes *Pacific Daylight Time* (*PDT*). In the United Kingdom, the standard term for UK time when advanced by one hour is *British Summer Time* (*BST*), and British English typically inserts *summer* into other time zone names, e.g. *Central European Time* (*CET*) becomes *Central European Summer Time* (*CEST*).

The North American English mnemonic "spring forward, fall back" (also "spring ahead ...", "spring up ...", and "... fall behind") helps people remember in which direction to shift the clocks.<sup>[159][64]</sup>

## Computing

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Changes to DST rules cause problems in existing computer installations. For example, the 2007 change to DST rules in North America required that many computer systems be upgraded, with the greatest impact on e-mail and calendar programs. The upgrades required a significant effort by corporate information technologists.<sup>[160]</sup>

Some applications standardize on UTC to avoid problems with clock shifts and time zone differences.<sup>[161]</sup> Likewise, most modern operating systems internally handle and store all times as UTC and only convert to local time for display.<sup>[162][163]</sup>

However, even if UTC is used internally, the systems still require external leap second updates and time zone information to correctly calculate local time as needed. Many systems in use today base their date/time calculations from data derived from the tz database also known as zoneinfo.

## IANA time zone database

The tz database maps a name to the named location's historical and predicted clock shifts. This database is used by many computer software systems, including most Unix-like operating systems, Java, and the Oracle RDBMS;<sup>[164]</sup> HP's "tztb" database is similar but incompatible.<sup>[165]</sup> When temporal authorities change DST rules, zoneinfo updates are installed as part of ordinary system maintenance. In Unix-like systems the TZ environment variable specifies the location name, as in TZ=' :America/New\_York '. In many of those systems there is also a system-wide setting that is applied if the TZ environment variable is not set: this setting is controlled by the contents of the /etc/localtime file, which is usually a symbolic link or hard link to one of the zoneinfo files. Internal time is stored in time-zone-independent Unix time; the TZ is used by each of potentially many simultaneous users and processes to independently localize time display.

Older or stripped-down systems may support only the TZ values required by POSIX, which specify at most one start and end rule explicitly in the value. For example, TZ=' EST5EDT, M3.2.0/02:00, M11.1.0/02:00 ' specifies time for the eastern United States starting in 2007. Such a TZ value must be changed whenever DST rules change, and the new value applies to all years, mishandling some older timestamps.<sup>[166]</sup>

## Permanent daylight saving time

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A move to permanent daylight saving time (staying on summer hours all year with no time shifts) is sometimes advocated and is currently implemented in some jurisdictions such as Argentina, Belarus,<sup>[167]</sup> Iceland, Kyrgyzstan, Morocco,<sup>[51]</sup> Namibia, Saskatchewan, Singapore, Turkey, Turkmenistan, Uzbekistan and Yukon. Although Saskatchewan follows Central Standard Time, its capital city Regina experiences solar noon close to 13:00, in effect putting the city on permanent daylight time. Similarly, Yukon is classified as being in the Mountain Time Zone, though in effect it observes permanent Pacific Daylight Time to align with the Pacific time zone in summer, but local solar noon in the capital Whitehorse occurs nearer to 14:00, in effect putting Whitehorse on "double daylight time".

Advocates cite the same advantages as normal DST without the problems associated with the twice yearly time shifts. Additional benefits have also been cited, including safer roadways, boosting the tourism industry, and energy savings. Detractors cite the relatively late sunrises, particularly in winter, that year-round DST entails.<sup>[13]</sup>

**YOU CAN'T STOP TIME...**



**But you can turn it back one hour at 2 a.m. on Oct. 28 when daylight-saving time ends and standard time begins.**

A 2001 US public service advertisement reminded people to adjust clocks.

The United Kingdom and Ireland put clocks forward by an extra hour during World War II and experimented with year-round summer time between 1968 and 1971.<sup>[168]</sup> Russia switched to permanent DST from 2011 to 2014, but the move proved unpopular because of the late sunrises in winter, so in 2014, Russia switched permanently back to standard time partially.<sup>[169]</sup> However, the change to permanent DST has proven popular in Turkey, with the Minister of Energy and Natural Resources saying the practice saves "millions in energy costs and reduces depression and anxiety levels associated with short exposure to daylight".<sup>[170]</sup>

In the United States, the Florida, Washington, California, and Oregon legislatures have all passed bills to enact permanent DST, but the bills require Congressional approval in order to take effect. Maine, Massachusetts, New Hampshire, and Rhode Island have also introduced proposals or commissions to that effect.<sup>[171][172][173][174][175]</sup> Although 26 states have considered making DST permanent, unless Congress changes federal law, states cannot implement permanent DST—states can only opt out of DST, not standard time.<sup>[176]</sup>

Since 2014 Scott Yates, a former journalist and publicist, created the site *#LockTheClock - Stop Changing Clocks for Daylight Saving Time* (<https://www.sco.tt/time/>) and has been aggressively lobbying for permanent DST in the whole of USA.<sup>[177]</sup> Florida senator Marco Rubio has also been particularly insistent on this issue.<sup>[178]</sup> So much so that the United States has begun the process of making daylight saving time the permanent time across all participating states, with the Senate passing the Sunshine Protection Act by unanimous consent on March 15, 2022. If it were to pass through the House of Representatives and be signed by President Joe Biden, any state in the United States currently observing daylight saving time would begin to do so year-round starting in November 2023.<sup>[179]</sup>

In September 2018, the European Commission proposed to end seasonal clock changes as of 2019.<sup>[180]</sup> Member states would have the option of observing either daylight saving time all year round or standard time all year round. In March 2019, the European Parliament approved the commission's proposal, while deferring implementation from 2019 until 2021.<sup>[181]</sup> As of October 2020, the decision has not been confirmed by the Council of the European Union.<sup>[182]</sup> The council has asked the commission to produce a detailed impact assessment, but the Commission considers that the onus is on the Member States to find a common position in Council.<sup>[183]</sup> As a result, progress on the issue is effectively blocked.<sup>[184]</sup>

Experts in circadian rhythms and sleep caution against permanent daylight saving time, recommending year-round standard time as the preferred option for public health and safety.<sup>[137][138][139][140]</sup> However, some experts recommend permanent daylight saving time when compared to the annual switch to and from.<sup>[185][186]</sup>

Various chronobiology societies have published position papers against adopting DST permanently. A paper by The Society for Research on Biological Rhythms states: "The authors take the position that, based on comparisons of large populations living in DST or ST or on western versus eastern edges of time zones, the advantages of permanent ST outweigh switching to DST annually or permanently."<sup>[187]</sup> The World Federation of Societies for Chronobiology stated that "the scientific literature strongly argues against the switching between DST and Standard Time and even more so against adopting DST permanently."<sup>[188]</sup> And the American Academy of Sleep Medicine having the position that "seasonal time changes should be abolished in favor of a fixed, national, year-round standard time."<sup>[189]</sup> In the EU, the European Sleep Research Society has stated that "the scientific evidence presently available indicates installing permanent Central European Time (CET, standard time or 'wintertime') is the best option for public health."<sup>[190]</sup>



The William Willett Memorial Sundial in Pettis Wood, south London, is always on DST.

## By country and region

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- [Daylight saving time in Africa](#)
- [Daylight saving time in Asia](#)
- [Summer time in Europe](#)
- [Daylight saving time in the Americas](#)
- [Daylight saving time in Oceania](#)

## See also

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- [Analysis of daylight saving time](#)
- [Winter time \(clock lag\)](#)

## Notes

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- a. starting after [Passover](#) and ended before [Yom Kippur](#) (less than 180 days)
- b. Although DST does not impact the duration of the fast, which is 25 hours regardless, many find it easier to start and end earlier rather than later.

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## Further reading

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## External links

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