Comparison of time zone alternatives for the Nordic and Baltic countries

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Background

- Daylight saving time (DST) gives more daylight during the active evening hours (18-22) in the summer time
- However, regular time changes when switching between winter and summer times have potential adverse effects and are experienced as annoying by many
- Thus, it is often felt that the benefits of DST do not surpass the adverse effects of regular time changes

Question

- If DST would be abolished, which time zone(s) would be the recommended choice for the Nordic and Baltic countries?

- We compared seven different scenarios to the current situation in terms of **daylight during active hours** and **potential impacts on collaboration** between the Nordic and Baltic countries and their surrounding regions

Scenarios

	Scenario 0	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Zones	Current zones	Current zones		FI in same time with SE&NO&DK, Baltic countries as now		All in single zone		
System	Current daylight saving time	Permanent summer time	Permanent winter time	Permanent summer time	Permanent winter time	Permanent CET summer time	Permanent CET winter time	Permanent EET summer time
Scenario name	Baseline: Current time system (winter/summer)	Permanent summer time, current zones	Permanent winter time, current zones	Permanent summer time, FI with Nordics	Permanent winter time, FI with Nordics	Permanent CET summer time for all	Permanent CET winter time for all	Permanent EET summer time for all
City								
Estonia (Tallinn)	UTC+2 / UTC+3	UTC+3	UTC+2	UTC+3	UTC+2	UTC+2	UTC+1	UTC+3
Latvia (Riga)	UTC+2 / UTC+3	UTC+3	UTC+2	UTC+3	UTC+2	UTC+2	UTC+1	UTC+3
Lithuania (Vilnius)	UTC+2 / UTC+3	UTC+3	UTC+2	UTC+3	UTC+2	UTC+2	UTC+1	UTC+3
Finland (Helsinki)	UTC+2 / UTC+3	UTC+3	UTC+2	UTC+2	UTC+1	UTC+2	UTC+1	UTC+3
Denmark (Copenhagen)	UTC+1 / UTC+2	UTC+2	UTC+1	UTC+2	UTC+1	UTC+2	UTC+1	UTC+3
Norway (Oslo)	UTC+1 / UTC+2	UTC+2	UTC+1	UTC+2	UTC+1	UTC+2	UTC+1	UTC+3
Sweden (Stockholm)	UTC+1 / UTC+2	UTC+2	UTC+1	UTC+2	UTC+1	UTC+2	UTC+1	UTC+3

UTC time zones used in the compared scenarios.

- Scenarios
  - Scenarios 1 and 2 use the current zones and their current permanent summer and winter times
  - Scenarios 3 and 4 consider the situation where Finland would be with the other Nordic countries
  - Scenarios 5, 6, and 7 have a single time zone for all the Nordic and Baltic countries
- Iceland is not included in the comparison, because it is located so far in west

Viewpoints to answer the question

- Change in
  - Daylight during **all** active hours (05-22)
  - Daylight during **morning** active hours (05-09)
  - Daylight during **evening** active hours (18-22)

- Impacts on collaboration within Nordic and Baltic countries and neighbouring regions

Impact on daylight during active hours

Daylight measures

- We focused on the daylight during **active** hours (05-22), because outside this, most people are indoors and sleeping
- The main difference between scenarios is in the distribution of daylight between morning and evening

- Three measures were calculated
  - Daylight during **all** active hours (05-22)
  - Daylight during **morning** active hours (05-09)
  - Daylight during **evening** active hours (18-22)

Why daylight matters?

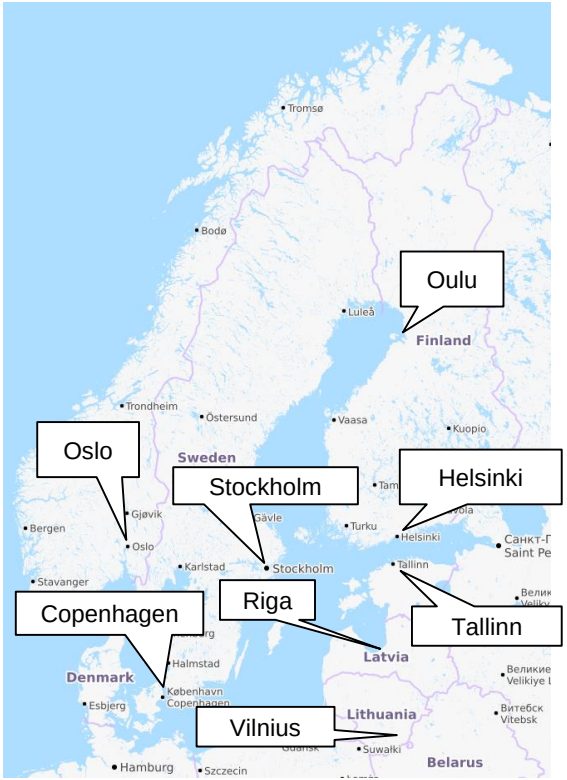
- Daylight during active hours
  - Supports outdoor physical activities and participation in outdoor social events
  - Daylight is beneficial for mental well-being

- Evening light
  - Supports outdoor physical activities during evening hours, can improve public health
  - Supports participation in social activities in the evening
  - Can reduce animal collisions during evening traffic
  - Evening light can slightly reduce energy consumption of households and provide better match with photovoltaic production

- Morning light
  - Supports active commuting to work/school
  - Supports outdoor physical activities during morning hours, can improve public health
  - Can reduce animal collision during morning traffic
  - Morning light exposure may have positive health benefits, e.g. reduce depression and support maintenance of circadian rhythm
    - Evidence comes mostly from clinical studies
    - Estimating the population level impact would require better understanding of daylight exposure in real-world settings

Examined cities

- Daylight impacts on 8 cities were examined
  - Denmark – Copenhagen
  - Finland – Helsinki
  - Finland – Oulu
  - Estonia – Tallinn
  - Latvia – Riga
  - Lithuania – Vilnius
  - Norway – Oslo
  - Sweden – Stockholm



Map from OpenStreetMap.org. License Creative Commons 2.0 CC-BY-SA

Scenarios' influence on active hours with daylight

	All active hours (05-22) with daylight		Evening active hours (18-22) with daylight		Morning active hours (05-09) with daylight	
	MIN	MAX	MIN	MAX	MIN	MAX
1: Permanent summer time, current zones	0%	0%	4%	7%	-15%	-8%
2: Permanent winter time, current zones	-3%	-1%	-35%	-17%	8%	15%
3: Permanent summer time, FI with Nordics	-2%	0%	-25%	7%	-15%	13%
4: Permanent winter time, FI with Nordics	-4%	-1%	-43%	-27%	8%	29%
5: Permanent CET summer time for all	-2%	0%	-35%	6%	-15%	15%
6: Permanent CET winter time for all	-5%	-1%	-67%	-27%	8%	43%
7: Permanent EET summer time for all	-1%	0%	5%	47%	-42%	-8%

Minimum and maximum change in the daylight among the studied cities in different scenarios.

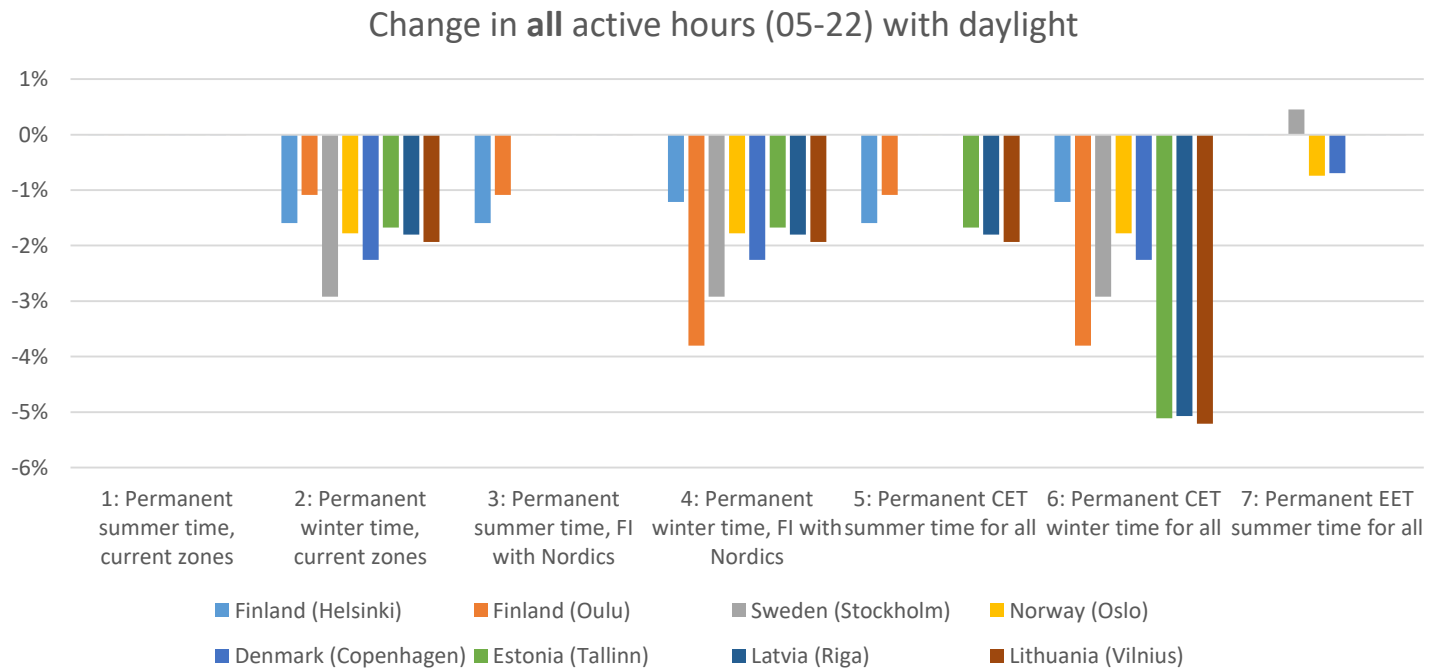
- Table summarises the minimum and maximum change on the daylight measures in the difference scenarios for different locations
- Minimum and maximum is calculated among the studied cities
- Each daylight measure is discussed further in the following slides

Scenarios' influence on active hours (05-22) with daylight

	Active hours (05-22) with daylight	
	MIN	MAX
1: Permanent summer time, current zones	0%	0%
2: Permanent winter time, current zones	-3%	-1%
3: Permanent summer time, FI with Nordics	-2%	0%
4: Permanent winter time, FI with Nordics	-4%	-1%
5: Permanent CET summer time for all	-2%	0%
6: Permanent CET winter time for all	-5%	-1%
7: Permanent EET summer time for all	-1%	0%

- Scenarios 1: **No change** in the (total) active hours with daylight
- Scenarios 2-7: **Reduction** (0% to –5%) in the active hours with daylight

Active hours with daylight by scenario and location

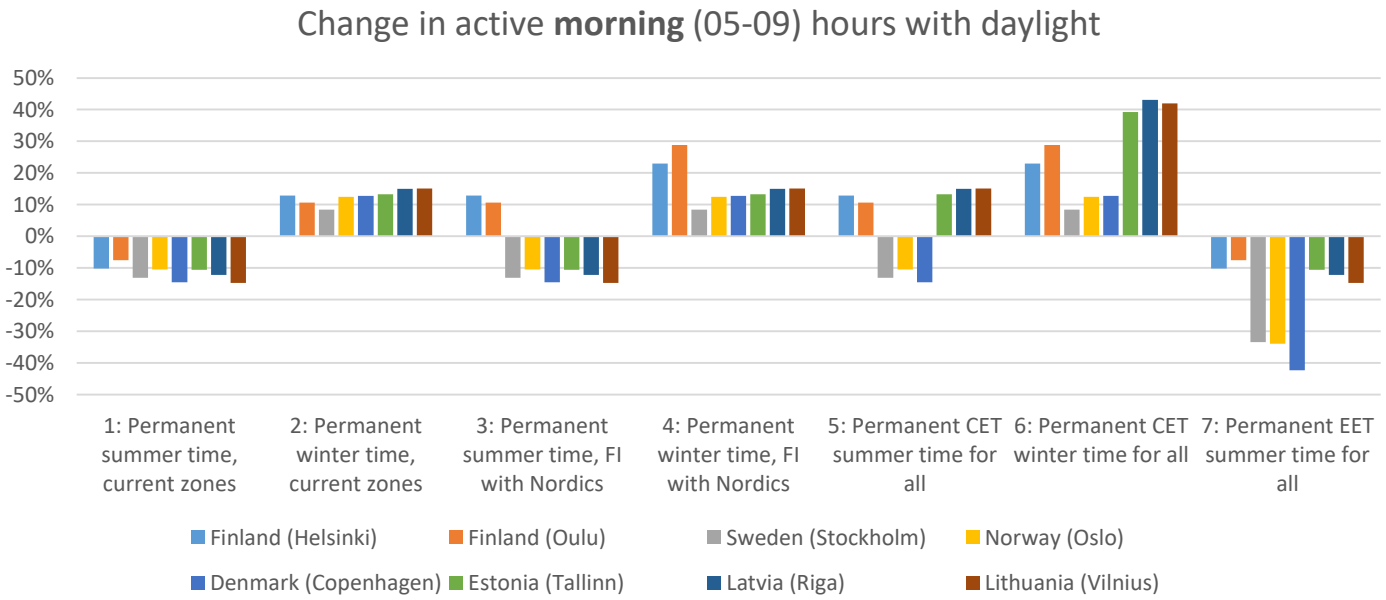


Scenarios influence on morning and evening active hours with daylight

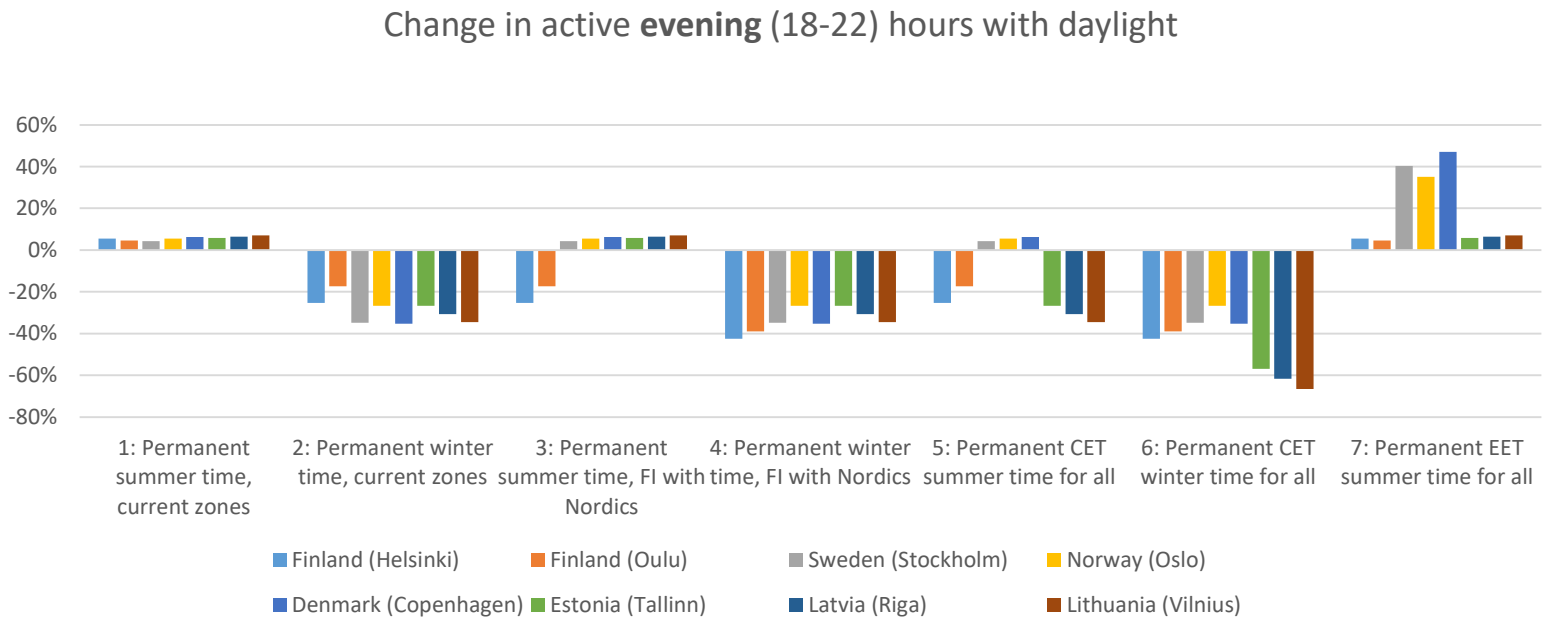
	Evening active hours with daylight (18-22)		Morning active hours with daylight (05-09)	
	MIN	MAX	MIN	MAX
1: Permanent summer time, current zones	4%	7%	-15%	-8%
2: Permanent winter time, current zones	-35%	-17%	8%	15%
3: Permanent summer time, FI with Nordics	-25%	7%	-15%	13%
4: Permanent winter time, FI with Nordics	-43%	-27%	8%	29%
5: Permanent CET summer time for all	-35%	6%	-15%	15%
6: Permanent CET winter time for all	-67%	-27%	8%	43%
7: Permanent EET summer time for all	5%	47%	-42%	-8%

- Scenarios 1 and 7: all countries **gain evening** hours and **lose morning** hours
- Scenarios 2, 4 and 6: all countries **gain morning** hours and **lose evening** hours
- Scenarios 3 and 5: impact is mixed between countries

Active morning hours by scenario and location



Active evening hours by scenario and location



Conclusions of the daylight analysis

- Scenario 1 does not incur reduction of the active hours with daylight, like Scenarios 2-7 do
  - In Scenario 1, the changes in the daylight are smallest and in the same direction in all the countries
  - Scenario 1 has an increase in the evening daylight and reduction in the morning daylight
- Choice between scenarios is essentially a choice between morning and evening hours with daylight
  - The choice between them is essentially a political decision: there is no strong scientific evidence to choose either over another

Impacts on collaboration within Nordic and Baltic countries and neighbouring regions

Time differences to surrounding areas

	Difference (hours) to CET (Brussels) (UTC+1)	Difference (hours) to MSK (Moscow) (UTC+3)	Difference (hours) to Iceland, UK, and Portugal (UTC+0)
Baseline: Current time system	1-2	1-2	2-3
1: Permanent summer time, current zones	1-2	0-1	2-3
2: Permanent winter time, current zones	0-1	1-2	1-2
3: Permanent summer time, FI with Nordics	1-2	0-1	2-3
4: Permanent winter time, FI with Nordics	0-1	1-2	1-2
5: Permanent CET summer time for all	1	1	2
6: Permanent CET winter time for all	0	2	1
7: Permanent EET summer time for all	2	0	3

Impacts on collaboration

- Reasoning
  - Collaboration in terms of **conference calls** and **online meetings** is easier if the two countries are in the same time zone, compared to situation when they are on different time zones
  - **Travelling long distances** from east to west in morning is easier to arrange if east is ahead of west in time zones, vice versa from west to east
  - **Travelling short distances** is easier to arrange if the countries are in the same time zone, compared to situation when they are on different time zones

Impacts

	Baseline: Current time system	1: Permanent summer time, current zones	2: Permanent winter time, current zones	3: Permanent summer time, FI with Nordics	4: Permanent winter time, FI with Nordics	5: Permanent CET summer time for all	6: Permanent CET winter time for all	7: Permanent EET summer time for all
Being in the same time zone facilitates collaboration within Nordic and Baltic region	-	-	-	-	-	All countries	All countries	All countries
Being in the same time (UTC+1) with Central Europe facilitates collaboration	-	-	In UTC+1: DK, NO, SE	-	In UTC+1: DK, FI, NO, SE	-	All countries	-
Being ahead (UTC+2/3) Central/Western Europe makes it easier to reach early meetings a morning flight	All countries	All countries	In UTC+2/3: FI, EE, LT, LV	All countries	In UTC+2/3: EE, LT, LV	All countries	-	All countries
Being in the same time (UTC+3) with Western Russia facilitates collaboration	-	In UTC+3: FI, EE, LT, LV	-	In UTC+3: EE, LT, LV	-	-	-	All countries
Time difference to Iceland, UK and Portugal is smallest (one hour)	-		In UTC+1: DK, NO, SE.	-	In UTC+1: DK, NO, SE.	-	All countries UTC+1	-

Conclusion

- None of the scenarios is a clear winner in terms of collaboration with the surrounding regions (Russia and Central Europe)
- Scenarios 2 and 4 yield benefits only to some of the countries, while other scenarios benefit all in some way

	Baseline: Current time system	1: Permanent summer time, current zones	2: Permanent winter time, current zones	3: Permanent summer time, FI with Nordics	4: Permanent winter time, FI with Nordics	5: Permanent CET summer time for all	6: Permanent CET winter time for all	7: Permanent EET summer time for all
Being in the same time zone facilitates collaboration within Nordic and Baltic region	-	-	-	-	-	All countries	All countries	All countries
Being in the same time (UTC+1) with Central Europe facilitates collaboration	-	-	In UTC+1: DK, NO, SE	-	In UTC+1: DK, FI, NO, SE	-	All countries	-
Being ahead (UTC+2/3) Central/Western Europe makes it easier to reach early meetings a morning flight	All countries	All countries	In UTC+2/3: FI, EE, LT, LV	All countries	In UTC+2/3: EE, LT, LV	All countries	-	All countries
Being in the same time (UTC+3) with Western Russia facilitates collaboration	-	In UTC+3: FI, EE, LT, LV	-	In UTC+3: EE, LT, LV	-	-	-	All countries
Time difference to Iceland, UK and Portugal is smallest (one hour)	-		In UTC+1: DK, NO, SE.	-	In UTC+1: DK, NO, SE.	-	All countries UTC+1	-

Summary of scenarios

Scenario 1 & 2: Permanent summer/winter time, current time zones

Scenario 1: permanent summer time

- No reduction in the total active hours (05-22) with daylight
- Daylight morning hours decrease, evening hours increase
  - Benefits of **evening** light
- Change is very similar in all the countries and relatively small
- Time zone borders stay same

Scenario 2: permanent winter time

- Small decrease in the total active hours with daylight
- Daylight morning hours increase, evening hours decrease
  - Benefits of **morning** light
- Relatively large decrease in evening hours
  - –35% in DK, LT and SE
- Small benefits in terms of collaboration
- Time zone borders stay same

Scenario 3 & 4: Permanent summer/winter time, current time zones, FI with Nordics

Scenario 3: Permanent summer time…

- Same as Scenario 1, except for Finland same as Scenario 2
- For Finland, increase in the morning light and decrease in the evening light
- Time zones change, as Finland changes its zone

Scenario 4: Permanent winter time…

- Same as Scenario 2, except for Finland same as Scenario 6
- For Finland, increase in the morning light and decrease in the evening light (larger than in Scenario 3)
- Time zones change, as Finland changes its zone
- Small benefits in terms of collaboration

Scenario 5: Permanent CET summer time for all

- Single time zone would support collaboration among the Nordic and Baltic countries
- **Changes in the daylight distribution would be smallest in Scenario 5 among single time zone scenarios**
- Active morning daylight hours increase in east (FI, EE, LV, LT) and decrease in west (DK, NO, SE), and vice versa
- Total active daylight hours decrease slightly

Scenario 6: Permanent CET winter time for all

- Single time zone would support collaboration among the Nordic and Baltic countries
- All countries would encounter change, but the **change would be especially large in the Baltic countries**
- Morning daylight hours increase, evening daylight decrease
- Total active daylight hours decrease (the largest effect among the scenarios, but still relatively small)

Scenario 7: Permanent EET summer time for all

- Single time zone would support collaboration among the Nordic and Baltic countries
- Relatively large **reduction of morning and increase of evening daylight for DK, NO, and SE**
- Total active daylight hours decrease very little

Sources

- Analysis is based on the previous work done for Finnish Ministry of Transport and Communication: “Permanent summer or winter time: Framework for impact assessment”
- Sweden and Germany have produces extensive reports on the daylight saving time and its effects, which also summarise many of the impacts of morning/evening light
  - Statskontoret (2018). Kartläggning av tidsomställningens effekter i Sverige (2018:24) [Survey over the effects of time adjustments.]. Statskontoret:Stockholm.
  - Deutscher Bundestag (2016). Bilanz der Sommerzeit, TAB-Arbeitsbericht Nr. 165. Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag (TAB):Berlin

beyond

the obvious

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