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Bundesamt für Energie BFE
Geräte und wettbewerbliche Ausschreibungen

Bericht vom 18. Dezember 2024

Effizienzanforderungen für lokale Raumheizgeräte (LSH) und Raumklimageräte (RAC)

Szenario-Modellierung für die Schweiz

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1 Zusammenfassung

Bei dem vorliegenden Dokument handelt es sich um eine nicht-technische Zusammenfassung. Die gesamte Studie, auf Englisch verfasst, befindet sich im Anhang.

1.1 Ausgangslage

Seit 2013 bzw. 2015 gelten in der Europäischen Union (EU) Mindestanforderungen an die Energieeffizienz von Klima- und Einzelraumheizgeräten. Das bedeutet, dass die betroffenen Geräte nur dann in Verkehr gebracht werden dürfen, wenn sie diese Mindestanforderungen erfüllen. Die Schweiz hat diese Anforderungen weitgehend identisch in Schweizer Recht nachvollzogen. Einzig für elektrische Einzelraumheizgeräte gelten in der Schweiz ab Januar 2024 strengere Anforderungen. Geregelt ist dies in der Energieeffizienzverordnung (EnEV; RS 730.02).

Parallel haben einige Kantone Verbote für den Einbau oder Ersatz von elektrischen Einzelraumheizgeräten eingeführt, welche jedoch nicht im Fokus der vorliegenden Untersuchung liegen.

In der EU steht nun eine Revision der Anforderungen an. So stellt sich die Frage, ob die Schweiz diese Anforderungen nachvollziehen und ob sie ggf. strengere Anforderungen erlassen soll. In diesem Lichte hat das Bundesamt für Energie BFE die Beratungsbüros BSS Volkswirtschaftliche Beratung aus Basel und van Holsteijn en Kemna VHK aus den Niederlanden beauftragt, eine Studie anzufertigen.

1.2 Ziele

Mittels Modellierung prüft die Studie,

1. wie sich eine Übernahme der neuen EU-Effizienzanforderungen und
2. wie sich strengere Vorschriften, die über die der EU hinausgehen,

auf Endnutzer (Energieeinsparungen, Total-Lifecycle-Costs) und Hersteller (Einschränkung des Angebotes und Marktakteure, Absatzzahlen) in der Schweiz auswirken.

1.3 Untersuchungsszenarien

Die drei untersuchten Szenarien sind:

1. Alter Status quo (BAU): Abbild der aktuellen Regulierung bis Ende 2023, basierend auf den bestehenden EU-Vorgaben (Verordnung 2015/1188), ohne zusätzliche Anforderungen in der Schweiz.

2. Neuer Status quo (BAU1): Enthält zusätzlich zu den BAU-Vorgaben die strengeren Schweizer Anforderungen, die ab Januar 2024 gelten und eine Mindestenergieeffizienz von 39% für elektrische Einzelraumheizgeräte (eLSH) vorschreiben (mit Ausnahme von Handtuchwärmern).
3. Nachvollzugsszenario: Übernahme der neuen EU-Vorschriften (Verordnung 2024/1103) in die Schweizer Regulierung. Dabei sollen allerdings die strengeren Schweizer Vorgaben für Einzelraumheizgeräte beibehalten werden. Dies führt zu keinen grossen Änderungen gegenüber BAU1, ausser dass Handtuchwärmer erstmals reguliert werden und effizienter werden müssen.

Ferner prüft die Studie, ob und inwiefern für die Schweiz Potenzial besteht, strengere Vorgaben zu erlassen, die über die Vorgaben der EU hinausgehen.

1.4 Untersuchungsrahmen

Die Untersuchung konzentriert sich auf elektrische Einzelraumheizgeräte (eLSHs) und Raumklimageräte (RACs) in der Schweiz und deckt den Zeitraum von 1990 bis 2050 ab[1]. Die Analyse berücksichtigt sowohl historische Entwicklungen als auch prognostizierte Trends, wobei Daten und Annahmen aus EU-weiten und Schweizer Quellen verwendet werden.

Der Fokus liegt auf verschiedenen Gerätetypen, darunter tragbare und fest-installierte eLSHs (einschliesslich Handtuchwärmer), sowie tragbare und fest-installierte RACs mit einer Kapazität unter 12 Kilowatt (kW).

Gasbetriebene oder mit flüssigen Brennstoffen betriebene LSH sind in den Berechnungen enthalten, werden aber aufgrund ihres geringen Einflusses nicht explizit aufgeführt. Mit festen Brennstoffen (Holz, Pellets, Kohle) betriebene LSH wurden von der Analyse ausgeschlossen.

1.5 Methodik

Als Grundlage für die Modellierung dient das Ecodesign-Impact-Accounting-Modell der Firma VHK, welches in der EU für Wirkungsmessungen im Kontext der EU-Ökodesign-Regulierung eingesetzt wird. Im Rahmen der Studie haben wir dieses Modell an die Schweiz angepasst. Dazu haben wir eine umfangreiche Dokumenten- und Datenanalyse durchgeführt, drei Fachgespräche mit Stakeholdern und Experten geführt und einen Validierungsworkshop mit fünf Experten und Stakeholdern durchgeführt.

1.6 Unsicherheiten

Für zentrale Inputs des Modells liegen für die Schweiz nur begrenzte Informationen vor, z.B. zur Heizleistung, Energieeffizienz und durchschnittlichen Lebensdauer der Geräte, zur Verteilung des Absatzes

[1] Die Resultate der Modellierung werden nachfolgend ab 2020 dargestellt.

auf die verschiedenen Produkttypen und zur Verteilung des Stromverbrauchs auf die Nutzungssektoren und auf die Produkttypen. Die Studie trifft daher Annahmen:

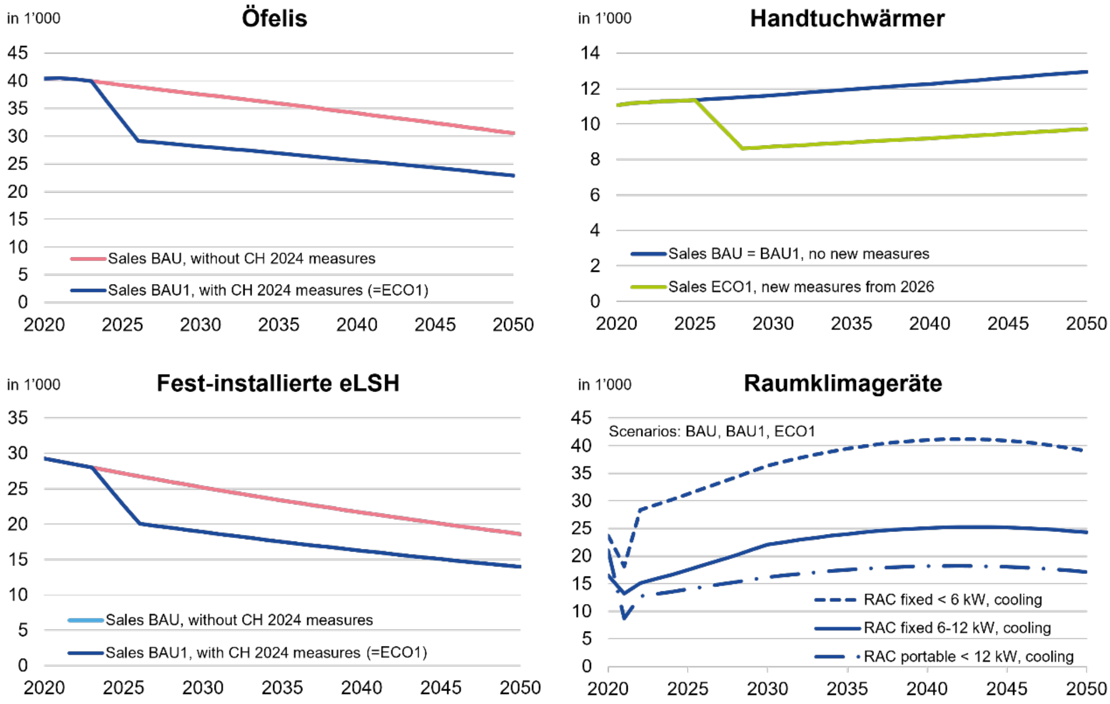
- Mangels präziser Verkaufszahlen für elektrische Einzelraumheizgeräte und Raumklimageräte wurden die Daten zum Energieverbrauch herangezogen, um Verkaufs- und Bestandszahlen iterativ abzuleiten. Dies erfolgte durch Anpassung der Modellparameter, wie durchschnittliche Lebensdauer, Effizienz und Heizlast der Geräte, bis die berechneten Energieverbrauchswerte den referenzierten Verbrauchsdaten entsprachen.
- In den Fällen, in denen keine spezifischen Daten für die Schweiz verfügbar sind (z.B. für Heizlast und Wirkungsgrad), wurden die EU-Zahlen aus den Berichten zur Ökodesign-Folgenabschätzung übernommen.
- Die Studie geht davon aus, dass die Lebensdauer von Geräten in der Schweiz höher ist als in der EU. Dies basiert auf spezifischen Marktbedingungen und Nutzergewohnheiten. Beispielsweise wird die Lebensdauer von tragbaren Einzelraumheizgeräten in der Schweiz auf 12 Jahre geschätzt, verglichen mit 9 Jahren in der EU, während fest-installierte Geräte teils doppelt so lange genutzt werden. Diese längeren Lebensdauern beeinflussen die Bestandsdaten und die durchschnittliche Effizienz der Geräte im Markt.
- Die Studie nimmt an, dass der Rückgang im Verkauf von eLSHs in der Schweiz nicht zu einer stärkeren Nachfrage nach RACs führt, sondern dass eLSHs eher durch Zentralheizungen ersetzt werden. Zentralheizungen liegen nicht im Untersuchungsrahmen. Diese Annahme basiert auf spezifischen Marktbedingungen und Nutzerpräferenzen in der Schweiz. Im Gegensatz dazu verfolgt die EU mit einem gemeinsamen Energielabel für eLSHs und RACs das Ziel, ineffiziente eLSHs durch effizientere RACs zu ersetzen, um den Gesamtenergieverbrauch zu senken.

1.7 Ergebnisse

Modellierung der Verkaufszahlen

Als erstes präsentieren wir die modellierte Entwicklung der Verkaufszahlen bis 2050.

Abbildung 1: Verkaufszahlen (in 1000)



Quelle: Modellierung VHK, eigene Darstellung

Im alten und neuen Status quo (BAU und BAU1) erwarten wir, dass die Zahl der mobilen (Öfelis) und fest-installierten eLSH zurückgeht. Mit den strengeren Schweizer Vorgaben für 2024 (BAU1) erwarten wir einen deutlich stärkeren Rückgang als im alten Status quo (BAU). Ein Nachvollzug der neuen EU-Anforderungen (ECO1) würde hier keinen einen Unterschied machen, da die Schweizer Vorgaben von 2024 bereits strenger sind als die neuen Anforderungen der EU.

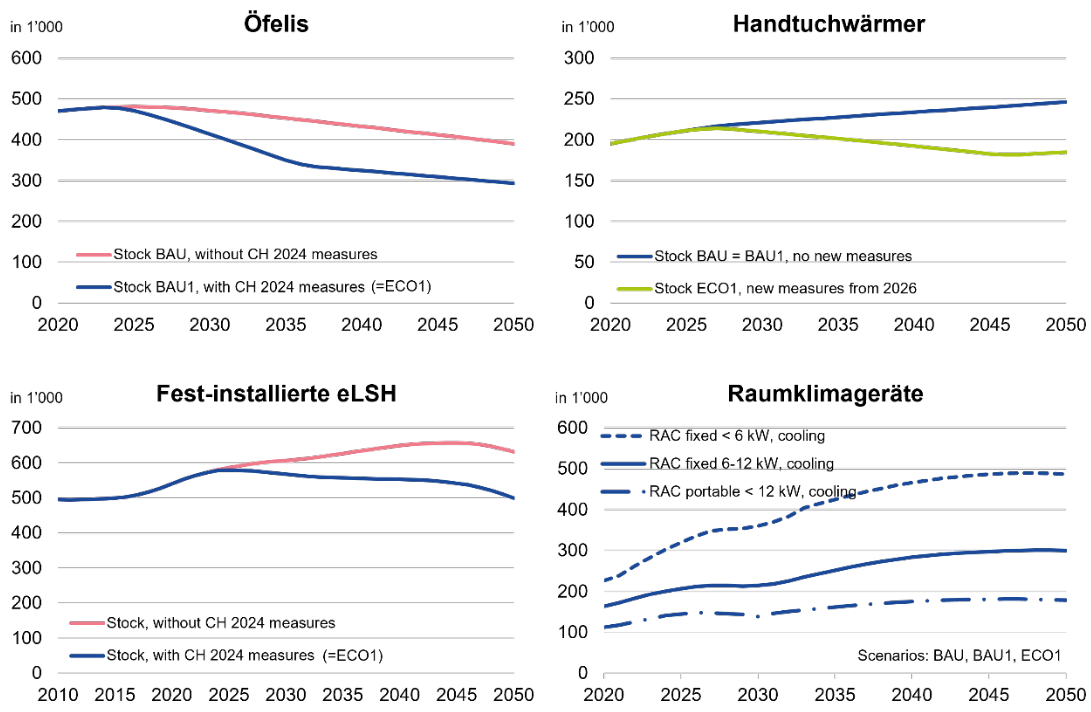
Der Nachvollzug der neuen EU-Anforderungen würde sich lediglich auf Handtuchwärmer auswirken, da Handtuchwärmer bislang nicht im Geltungsbereich der Schweizer Vorgaben von 2024 liegen. So erwarten wir, dass eine Übernahme der EU-Anforderungen (ECO1) zu einem deutlichen Rückgang der Verkaufszahlen für Handtuchwärmer führen würde. Verglichen mit den mobilen und fest-installierten elektrischen Einzelraumheizgeräten, ist die Zahl der verkauften Handtuchwärmer jedoch klein.

Für Klimageräte haben wir nur ein Szenario modelliert, den Status quo. Die Studie erwartet einen Anstieg der Verkäufe von Raumklimageräten (RACs), da klimatische Veränderungen und wärmere Sommer in der Schweiz zu einer steigenden Nachfrage nach Kühlgeräten führen. Zusätzlich wird davon ausgegangen, dass steigende Wohnstandards und die Verbreitung von energieeffizienteren RACs die Attraktivität dieser Geräte erhöhen. Allerdings nehmen wir an, dass der Rückgang bei eLSHs nicht direkt zu einer stärkeren Verbreitung von RACs führt. Wir nehmen an, dass eLSHs in der Schweiz vorrangig durch Zentralheizungen ersetzt werden.

Modellierung des Gerätebestands

Die folgende Abbildung zeigt, wie sich der Bestand im Modell entwickelt.

Abbildung 2: Bestand (in 1000)



Quelle: Modellierung VHK, eigene Darstellung

Die beschriebenen Vorgaben verändern das Kaufverhalten der Endkunden. Strengere Vorgaben führen dazu, dass effizientere Geräte gekauft werden. Da der Bestand der Geräte nicht von der Vorgabe betroffen ist, dauert es einige Jahre, bis der Bestand durch die neu regulierten Geräte ausgetauscht ist.[2]

Nicht berücksichtigt sind dabei allerdings, die kantonalen Vorschriften und Verbote für dezentrale Elektroheizungen, die dazu führen könnten, dass der Bestand noch schneller zurückgeht.

[2] Für tragbare Einzelraumheizgeräte nehmen wir eine Lebensdauer von 12 Jahren an, für installierte Einzelraumheizgeräte 25 bis 35 Jahre und 12 Jahre für fest-installierte Raumklimageräte und 10 Jahre für tragbare Raumklimageräte.

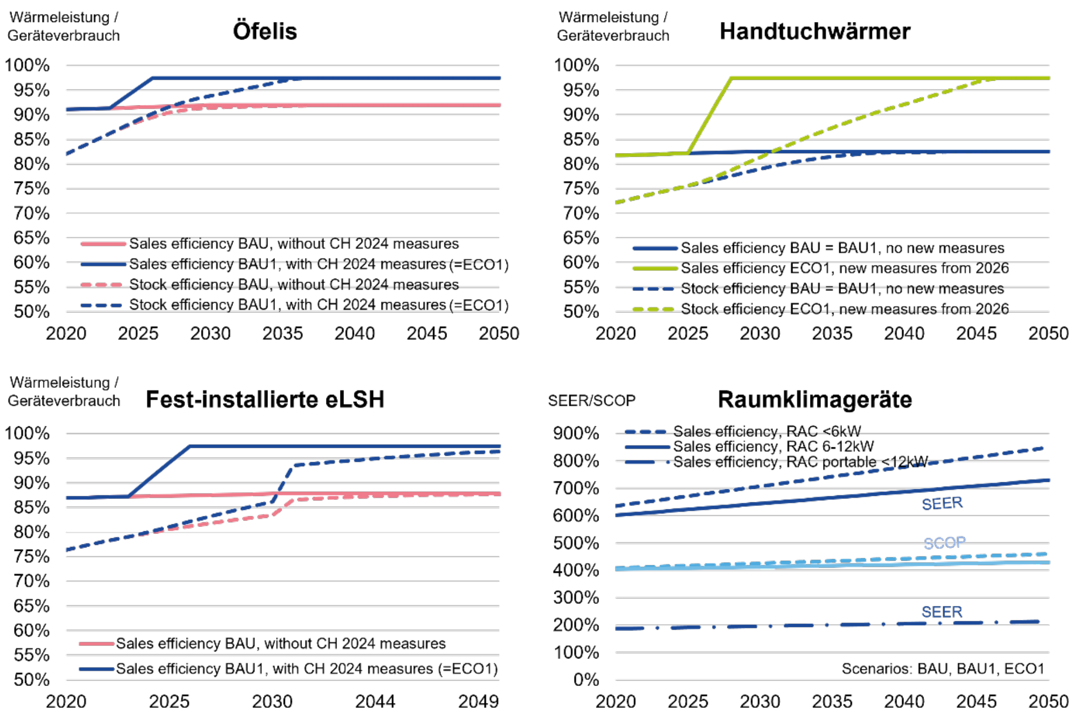
Wir erwarten, dass die strengeren Schweizer Vorgaben aus dem Jahr 2024 zu einem Rückgang des Bestandes von mobilen (Öfelis) und fest-installierten Einzelraumheizgeräten führen wird. Ohne diese Vorgabe wäre für die fest-installierten Einzelraumheizgeräte ein Anstieg bis 2045 zu erwarten. Allerdings sind dabei die bereits genannten kantonalen Vorgaben und Verbote nicht berücksichtigt, die zu einem schnelleren Rückgang führen dürften.

Ein Nachvollzug der EU-Vorgaben könnte zu einem Rückgang des Bestandes von Handtuchwärmern führen. Ohne Nachvollzug dürfte der Bestand kontinuierlich steigen.

Entwicklung der Energieeffizienz

Die folgende Abbildung zeigt, wie sich die veränderten Verkaufszahlen und die Verbreitung effizienterer Geräte auf die Effizienz der Verkäufe und des Bestandes auswirken.

Abbildung 3: Modellierte Entwicklung der Energieeffizienz



Quelle: Modellierung VHK, eigene Darstellung

Die Effizienz von eLSH wird daran gemessen, wie effizient sie elektrische Energie in Wärme umwandeln. Da diese Geräte keine Umgebungsenergie nutzen, liegt die maximal erreichbare Effizienz bei 100%. Dies bedeutet, dass sie 1 Watt an elektrischer Energie in 1 Watt Wärme umsetzen können. RACs hingegen nutzen Umgebungswärme und erzielen dadurch ein deutlich höheres Verhältnis zwischen

Wärmeleistung und Energieverbrauch. Ihre Effizienz wird über SEER (Seasonal Energy Efficiency Ratio) für Kühlleistungen oder SCOP (Seasonal Coefficient of Performance) für Heizleistungen angegeben. Beide Kennzahlen reflektieren die saisonale Energieeffizienz über ein gesamtes Kühl- oder Heizjahr.

Die Lenkungswirkung der Regulierung wirkt sich nur langsam auf den Bestand aus. Je nach Produkt und je angenommener Lebensdauer der Produkte, dauert es bis 2035 (Öfelis) bzw. bis 2050 (fest-installierte eLSH) bis die Effizienzwirkung vollständig im Bestand angekommen ist.

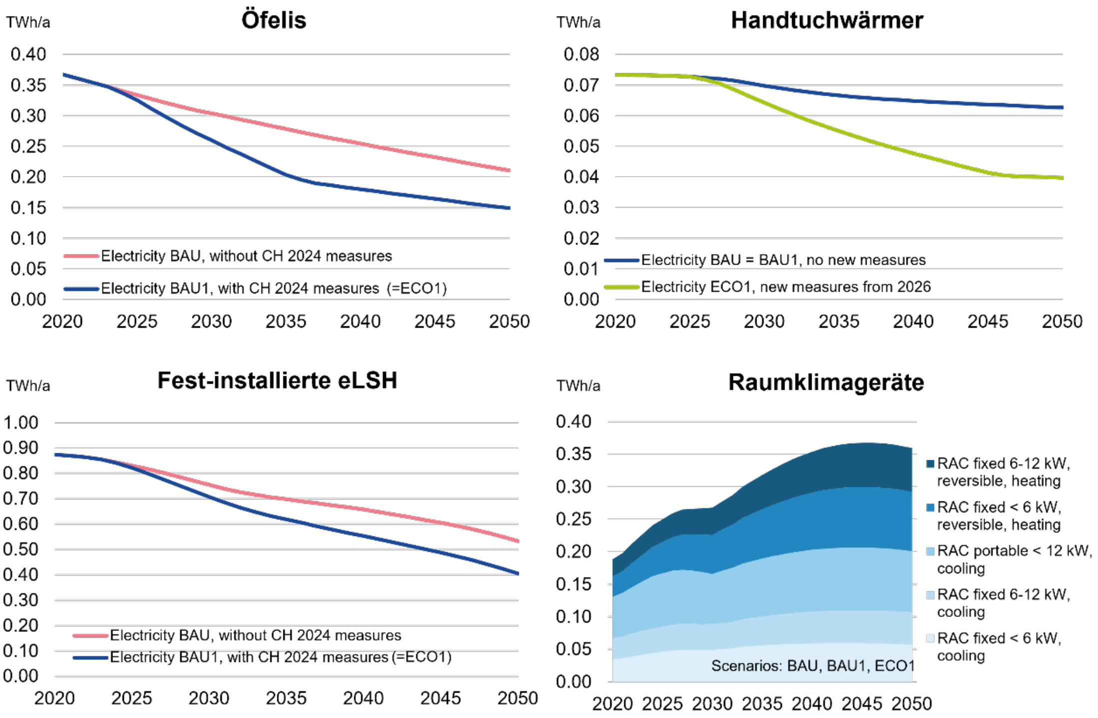
Nicht abgebildet im Modell sind die kantonalen Vorgaben und Verbote, die zu einer schnelleren Diffusion effizienterer Geräte führen können.

Im Vergleich zeigt sich auch, dass Raumklimageräte um ein Vielfaches effizienter sind – auch zum Heizen.

Modellierte Entwicklung der Energieverbräuche

Die Abnahme des Bestandes von Einzelraumheizgeräten (alle drei Kategorien) sowie die höhere Effizienz der Geräte führt zu geringeren Energieverbräuchen. Mit den Schweizer Vorgaben aus dem Jahr 2024 sowie einem Nachvollzug der EU-Anforderungen können die Energieverbräuche deutlich reduziert werden. Den grössten Effekt erwarten wir bei den fest-installierten Einzelraumheizgeräten. Auch hier haben wir nicht modelliert, dass kantonale Vorgaben und Verbote zu einer schnelleren Absenkung der Energieverbräuche führen könnten.

Abbildung 4: Entwicklung der Energieverbräuche



Quelle: Modellierung VHK, eigene Darstellung

Nicht in der Analyse berücksichtigt ist, dass Einzelraumheizgeräte durch andere Wärmeerzeuger ersetzt werden müssen. Diese Wärmeerzeuger benötigen ebenfalls Energie. Das ist hier nicht abgebildet.

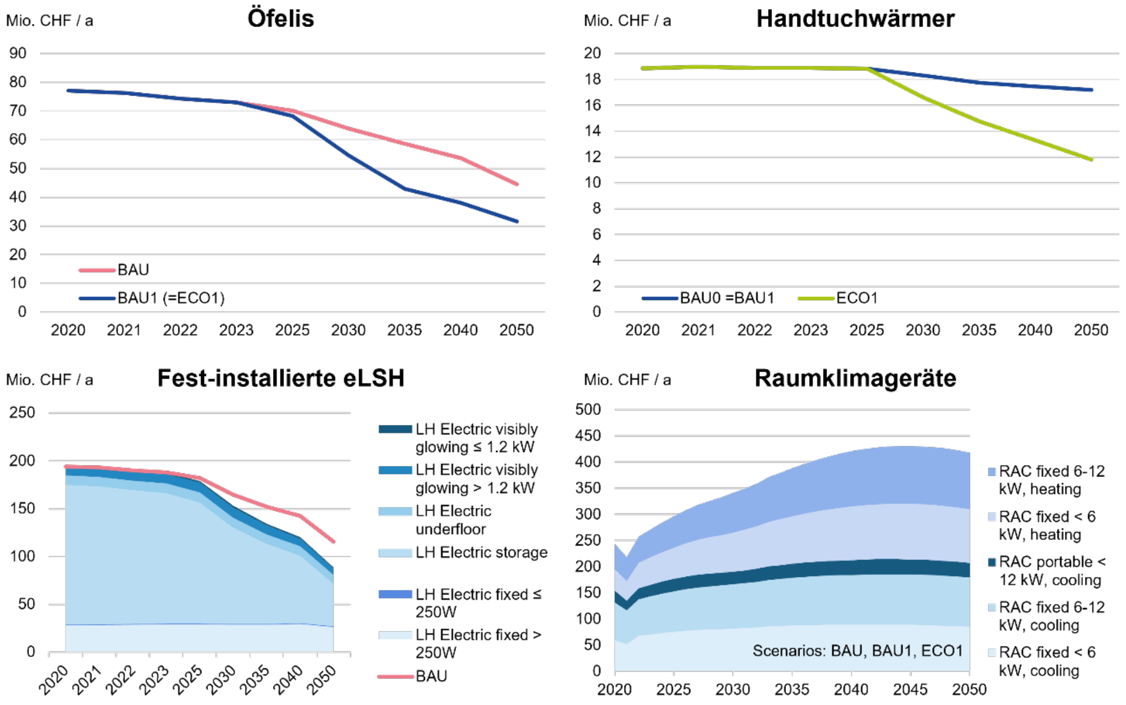
Für Klimageräte erwarten wir einen Anstieg der Energieverbräuche. Wie bereits erwähnt haben wir hier nur das Status quo-Szenario modelliert.

Grundsätzlich ist zu erwarten, dass strengere Vorgaben an die Energieeffizienz zu niedrigeren Energieverbräuchen führen. Spannend ist jedoch die Frage, wie sich diese Vorgaben auf die Kosten bei den Endnutzern auswirken.

Modellierte Auswirkungen auf die Lebenszykluskosten der Endnutzer

Die gesamten Lebenszykluskosten (Total Lifecycle Costs, TLC) setzen sich aus den Anschaffungskosten, den Betriebskosten und den Wartungskosten zusammen. Bei elektrischen Einzelraumheizgeräten (eLSH) beeinflussen die strengeren Schweizer Vorgaben ab 2024 sowie ein potenzieller Nachvollzug der EU-Regelungen diese Kosten in unterschiedlichem Ausmass. Die Auswirkungen der kantonalen Vorgaben und Verbote sind auch hier nicht berücksichtigt.

Abbildung 5: Entwicklung der Total Lifecycle Costs



Quelle: Modellierung VHK, eigene Darstellung

Einzelraumheizgeräte:

Die fest-installierten eLSH zeigen das grösste Einsparpotenzial bei den eLSH, da sie eine lange Lebensdauer haben und häufig im Dauerbetrieb eingesetzt werden. Die Schweizer Anforderungen von 2024 führen zwar zu höheren Anschaffungskosten, da effiziente Geräte mit modernster Technologie teurer sind, jedoch kompensiert der signifikant geringere Stromverbrauch die höheren Investitionen bereits nach einigen Jahren. Insbesondere der Rückgang der Betriebskosten durch den höheren Wirkungsgrad der Geräte sorgt langfristig für eine deutliche Senkung der Gesamtkosten.

Ein Nachvollzug der EU-Vorschriften hätte hingegen nur begrenzte zusätzliche Auswirkungen, da die Schweizer Mindestanforderungen von 2024 bereits strenger sind als die EU-Anforderungen und die Schweizer Anforderungen bei einem Nachvollzug beibehalten werden sollen. Einzig bei Handtuchwärmern, die bislang von den Schweizer Vorgaben ausgenommen sind, könnte ein Nachvollzug zu Einsparungen führen. Hier würden die neuen Regelungen zu effizienteren Modellen führen, was sowohl den Stromverbrauch als auch die Betriebskosten deutlich reduziert. Insgesamt sind die Einsparungen bei den TLC für tragbare Geräte wie Öfelis geringer, da sie eine kürzere Lebensdauer und einen niedrigeren Energieverbrauch aufweisen.

Raumklimageräte:

Bezüglich Raumklimageräte erwarten wir einen Anstieg der TLC, da die Nachfrage nach Raumklimageräte infolge klimatischer Veränderungen und wärmerer Sommer zunimmt. Die Anschaffungskosten sind bei Raumklimageräten in der Regel höher als bei Einzelraumheizgeräten, insbesondere für fest-installierte Geräte mit höherer Leistung.

Ein wesentlicher Treiber der TLC sind die Betriebskosten. Der Stromverbrauch steigt mit zunehmender Nutzung, insbesondere im Sommer, was die Betriebskosten massgeblich beeinflusst. Wartungskosten spielen ebenfalls eine Rolle, insbesondere bei fest-installierten Geräten, die regelmässig gewartet werden müssen, um die Effizienz und Funktionalität zu gewährleisten.

Zusammengefasst ist bei Raumklimageräte ein kontinuierlicher Anstieg der TLC zu erwarten, getrieben durch die wachsende Nachfrage und die intensive Nutzung. Effizientere Geräte könnten diese Kosten langfristig dämpfen, insbesondere durch Einsparungen beim Stromverbrauch, bleiben jedoch von den Markttrends und technologischen Entwicklungen abhängig.

Nicht modellierte Auswirkungen auf die Installation von Zentralheizungen:

Wie bereits erwähnt, nehmen wir an, dass der Rückgang der Einzelraumheizgeräte (eLSH) nicht zu einer verstärkten Nachfrage nach Raumklimageräten (RAC) führt, sondern dass Einzelraumheizgeräte durch Zentralheizungen, insbesondere Wärmepumpen, ersetzt werden. Dies kann jedoch erhebliche Auswirkungen auf die Kosten für die Endnutzer haben, welche nicht in unserer Modellierung abgebildet sind.

Die Anschaffung und Installation einer Zentralheizung, insbesondere einer Wärmepumpe, ist mit hohen Anfangsinvestitionen verbunden. Neben den Kosten für die Heizung selbst (bspw. eine Wärmepumpe) entstehen häufig zusätzliche Aufwände, da in vielen Gebäuden neue Rohrleitungen verlegt und Heizkörper installiert werden müssen. In manchen Fällen ist es erforderlich, Flächenheizungen wie Fussbodenheizungen nachzurüsten, was besonders bei älteren Gebäuden teuer und aufwendig ist. Diese zusätzlichen baulichen Massnahmen können die Kosten für die Endnutzer erheblich steigern.

Zusammengefasst könnten die Massnahmen zur Ersetzung von Einzelraumheizgeräten durch Zentralheizungen zu erheblichen einmaligen Investitionen führen, die je nach Gebäudebeschaffenheit und technischem Zustand stark variieren. Diese Kosten wurden in der vorliegenden Modellierung nicht berücksichtigt, sind jedoch ein zentraler Faktor für die Gesamtbewertung der wirtschaftlichen Auswirkungen.

Raumklimageräte können in einzelnen Fällen eine günstige Alternative zu Zentralheizungslösungen sein. Raumklimageräte können effizient als Heizung eingesetzt werden. Allerdings sind sie lauter als Wärmepumpen und ihr Einsatz als Wärmequelle ist nicht immer mit kantonalen Vorgaben kompatibel.

Auswirkungen auf die Unternehmen

Die Auswirkungen der strengeren Anforderungen an Einzelraumheizgeräte und der möglichen Übernahme der EU-Vorschriften auf die Wirtschaft sind vielfältig und betreffen unterschiedliche Akteure. Zwar wurde dies in der Studie nicht direkt modelliert, doch lassen sich einige mögliche Auswirkungen ableiten.

Für Hersteller von Einzelraumheizgeräten und Raumklimageräten könnten die strengeren Anforderungen zweischneidige Auswirkungen haben. Einerseits dürften sinkende Verkaufszahlen von Einzelraumheizungen zu einem Rückgang der Umsätze führen. Andererseits werden Einzelraumheizungen, durch Heizgeräte (bspw. Wärmepumpen oder Klimaanlagen) der gleichen Hersteller ersetzt. In der Schweiz selbst gibt es jedoch keine Hersteller von Einzelraumheizgeräten und Raumklimageräten, sodass diese Effekte primär Hersteller im Ausland betreffen.

Für Schweizer Unternehmen, die als Detailhändler oder Importeure von Heiz- und Klimageräten tätig sind, dürften sinkende Verkaufszahlen von Einzelraumheizgeräte ebenfalls Umsatzrückgänge bedeuten. Gleichzeitig könnten höhere Margen bei effizienteren Geräten diese Verluste teilweise kompensieren.

Auch Handwerksbetriebe, die (fest-installierte) Einzelraumheizgeräte einbauen, dürften betroffen sein. Diese müssten mit rückgehenden Einnahmen rechnen. Allerdings wird es kaum Unternehmen geben, die allein (fest-installierte) Einzelraumheizgeräte installieren und warten. Diese Unternehmen dürften gleichzeitig auch Raumklimageräte installieren und warten und in diesem Segment mit einem steigenden Umsatz rechnen.

Interessant ist, welche Auswirkungen der Wechsel von Einzelraumheizgeräten zu Zentralheizungen haben wird. Diese Entwicklung könnte für Schweizer Handwerksbetriebe neue Geschäftsmöglichkeiten schaffen. Der Einbau von Zentralheizungen ist technisch anspruchsvoll und erfordert oft umfangreiche bauliche Massnahmen. Davon könnten viele Handwerksbetriebe profitieren, insbesondere in der Gebäudetechnik und im Heizungsbau.

Zusammengefasst sind die wirtschaftlichen Auswirkungen komplex: Während Händler und Installateure von Einzelraumheizgeräten mit Umsatzrückgängen rechnen müssen, könnten Unternehmen im Bereich der Zentralheizungen, insbesondere Handwerksbetriebe, von einer steigenden Nachfrage profitieren und ihre Absatzchancen ausbauen.

1.8 Potenzial für weitere Vorgaben

Könnte die Schweiz analog zu den Vorgaben von 2024 weitere Vorgaben einführen, die über die neuen Vorgaben der EU hinausgehen?

Einzelraumheizgeräte

Die Analyse zeigt, dass die Anforderungen an Einzelraumheizgeräte in der Schweiz mit den ab 2024 geltenden Vorschriften bereits ein sehr hohes Niveau erreicht haben. Insbesondere die Mindestanforderung von 39% Effizienz entspricht nahezu dem technischen Maximum, das bei diesen Geräten erreichbar ist. Eine weitere Verschärfung der Anforderungen würde daher nur marginale Effizienzsteigerungen bewirken und könnte dazu führen, dass Hersteller technisch oder wirtschaftlich nicht in der Lage sind, entsprechende Produkte anzubieten. Dies würde die Auswahl für Endnutzer einschränken und die Anschaffungskosten unnötig erhöhen, ohne einen nennenswerten Beitrag zur Energieeinsparung zu leisten.

Ein sinnvoller Ansatz ist stattdessen, die Nutzer zu einem Wechsel hin zu effizienteren Alternativen wie Wärmepumpen oder Raumklimageräten (RAC) zu bewegen. Die Raumklimageräte, die wir in der vorliegenden Studie untersucht haben, insbesondere fest-installierte Modelle mit Heizfunktion, bieten eine höhere saisonale Energieeffizienz (SCOP) und können damit Wärmeenergie effizienter nutzen. Zentralheizungen, insbesondere Wärmepumpen, sind zudem eine langfristig nachhaltige Lösung, da sie durch den Einsatz erneuerbarer Energien nicht nur effizient sind, sondern auch die Treibhausgasemissionen senken.

Kühlung durch tragbare RACs

Für tragbare RACs zeigt die Analyse, dass strengere Anforderungen an die Energieeffizienzklassen (Energieetikette) keine signifikanten Verbesserungen des Marktes bewirken würden. Ein Verbot ineffizienter Geräte in Klasse F würde keinen nennenswerten Effekt haben, da solche Geräte bereits kaum am Markt vorhanden sind. Eine strengere Anforderung, z.B. Klasse E oder höher, wäre hingegen zu ambitioniert und würde die Marktstruktur überfordern. Daher wird von solchen Massnahmen abgeraten.

Kühlung durch fest-installierte RACs < 6 kW

Bei fest-installierten RACs mit einer Kühlleistung unter 6 kW wurde geprüft, welche Mindestanforderung an die Energieeffizienzklassen sinnvoll wäre. Eine Anforderung von mindestens Klasse C (SEER ≥ 6.1) würde von 91% der aktuell vermarkteten Modelle erfüllt und hätte daher kaum Einfluss auf den Markt. Ein höherer Standard wie Klasse B (SEER zwischen 8.5 und 11.6) würde hingegen eine deutliche Verschärfung bedeuten, da nur 23% der derzeitigen Geräte diese Klasse erreichen. Während eine Anhebung auf Klasse B potenziell positive Auswirkungen auf die Markteffizienz hätte, bedürfen die Kosten und Marktauswirkungen weiterer Studien, um die Umsetzbarkeit zu bewerten.

Kühlung durch fest-installierte RACs 6–12 kW

Auch in diesem Segment zeigt sich, dass bereits ein Grossteil der Geräte höhere Effizienzklassen erfüllt. Ein Verbot ineffizienter Geräte in Klassen D, E, F oder G hätte daher nur geringe Auswirkungen auf die Marktstruktur. 80% der Geräte sind bereits in Klasse C oder höher. Zusätzlich auch Klasse C zu verbieten ist schwierig, da nur 2.4% der Geräte auf dem Markt Klasse A oder B erfüllen.

Heizung durch fest-installierte RACs < 6 kW

Die Heizfunktion in diesem Segment ist weniger verbreitet, und viele Geräte erfüllen bereits höhere Effizienzklassen. Ein Verbot ineffizienter Heizgeräte würde daher nur geringe Marktveränderungen bewirken. Höhere Anforderungen über Klasse C hinaus könnten theoretisch Effizienzgewinne erzielen, aber auch hier wäre eine detailliertere Analyse erforderlich.

Heizung durch fest-installierte RACs 6–12 kW

Die Situation ist ähnlich wie bei RACs mit geringerer Leistung. Effizientere Geräte dominieren den Markt, und die Heizfunktion ist nur begrenzt verbreitet. Ein Verbot ineffizienter Geräte hätte daher ebenfalls nur geringe Auswirkungen, während strengere Anforderungen wie Klasse B eingehender geprüft werden müssten.

1.9 Fazit

Die Analyse zeigt, dass strengere Energieeffizienzvorschriften für Einzelraumheizgeräte und Raumklimageräte erhebliche Energieeinsparungen und langfristige Kostenvorteile für Endnutzer ermöglichen können. Insbesondere die Schweizer Vorgaben ab 2024 haben das Potenzial, den Stromverbrauch deutlich zu senken und effizientere Technologien am Markt zu etablieren. Dies tun sie, indem sie erstens dafür sorgen, dass besonders ineffiziente Einzelraumheizgeräte aus dem Markt verdrängt werden.

Zweitens fördern die Vorgaben einen Umstieg von ineffizienten Einzelraumheizgeräten zu anderen Technologien. Wir nehmen an, dass dies vor allem Zentralheizungen sind, die bestenfalls mit einer energieeffizienten Wärmepumpe angetrieben werden. Aber auch ein Wechsel hin zu Raumklimageräten als Wärmeerzeuger würde sich positiv auf den Energieverbrauch auswirken, da diese ebenfalls deutlich effizienter sind als Einzelraumheizgeräte.

Es ist jedoch zu betonen, dass die Ergebnisse der Studie mit erheblichen Unsicherheiten behaftet sind. Diese resultieren aus den begrenzten Datenverfügbarkeiten (insbesondere von Verkaufszahlen), notwendigen Annahmen zur Lebensdauer und Nutzung der Geräte sowie der Modellierung zukünftiger Markttrends. Auch sei erwähnt, dass die diversen kantonalen Vorgaben und Verbote zu Einzelraumheizgeräten nicht in der Modellierung berücksichtigt wurden. Dennoch zeigt die Analyse, dass sich die Einführung und Weiterentwicklung strengerer Energievorschriften ökologisch und wirtschaftlich lohnt.

2 Résumé

Le présent document est un résumé non technique. L'étude complète, rédigée en anglais, se trouve en annexe.

2.1 Situation de départ

Depuis 2013 ou 2015, des exigences minimales en matière d'efficacité énergétique sont en vigueur dans l'Union européenne (UE) pour les appareils de climatisation et de chauffage individuel. Cela signifie que les appareils concernés ne peuvent être mis sur le marché que s'ils satisfont à ces exigences minimales. La Suisse a reproduit ces exigences en grande partie à l'identique dans le droit suisse. Seuls les appareils de chauffage décentralisés sont soumis à des exigences plus strictes en Suisse depuis janvier 2024. Ces exigences sont régies par l'ordonnance sur l'efficacité énergétique (EnEV ; RS 730.02).

Parallèlement, certains cantons ont introduit des interdictions d'installer ou de remplacer des appareils de chauffage décentralisés, mais ces interdictions ne sont pas au cœur de la présente étude.

Dans l'UE, une révision des exigences est désormais à l'ordre du jour. Ainsi, la question se pose de savoir si la Suisse doit suivre ces exigences et, le cas échéant, si elle doit édicter des exigences plus strictes. Dans cette optique, l'Office fédéral de l'énergie (OFEN) a chargé les bureaux de conseil BSS Volkswirtschaftliche Beratung à Bâle et van Holsteijn en Kemna VHK aux Pays-Bas de réaliser une étude.

2.2 Objectifs

Au moyen de la modélisation, l'étude vérifie

1. comment l'adoption des nouvelles exigences européennes en matière d'efficacité et
2. comment des règles plus strictes, allant au-delà de celles de l'UE, pourraient avoir un impact,

sur les utilisateurs finaux (économies d'énergie, coût total du cycle de vie) et les fabricants (limitation de l'offre et des acteurs du marché, chiffres de vente) en Suisse.

2.3 Scénarios d'enquête

Les trois scénarios étudiés sont

1. Ancien statu quo (BAU) : image de la réglementation actuelle jusqu'à fin 2023, basée sur les prescriptions existantes de l'UE (règlement 2015/1188), sans exigences supplémentaires en Suisse.
2. Nouveau statu quo (BAU1) : Comprend, en plus des prescriptions BAU, les exigences suisses plus strictes qui s'appliqueront à partir de janvier 2024 et qui imposent une efficacité énergétique minimale de 39% pour les appareils de chauffage électrique individuels (eLSH) (à l'exception des chauffe-serviettes).
3. Scénario de suivi : Reprise des nouvelles dispositions de l'UE (règlement 2024/1103) dans la réglementation suisse. Il est toutefois prévu de conserver les prescriptions suisses plus strictes pour les appareils de chauffage individuels. Cela n'entraîne pas de grands changements par rapport à BAU1,

si ce n'est que les chauffe-serviettes seront réglementés pour la première fois et devront être plus efficaces.

En outre, l'étude examine si et dans quelle mesure il existe un potentiel pour la Suisse d'édicter des directives plus strictes que celles de l'UE.

2.4 Cadre de l'enquête

L'étude se concentre sur les appareils de chauffage électrique décentralisés (eLSH) et les climatiseurs individuels (RAC) en Suisse et couvre la période de 1990 à 2050[3] . L'analyse tient compte à la fois des évolutions historiques et des tendances prévues, en utilisant des données et des hypothèses provenant de sources européennes et suisses.

L'accent est mis sur différents types d'appareils, dont les eLSH portables et fixes (y compris les chauffe-serviettes), ainsi que les RAC portables et fixes d'une capacité inférieure à 12 kilowatts (kW).

Les LSH fonctionnant au gaz ou avec des combustibles liquides sont inclus dans les calculs, mais ne sont pas explicitement mentionnés en raison de leur faible influence. Les LSH fonctionnant avec des combustibles solides (bois, pellets, charbon) ont été exclues de l'analyse.

2.5 Méthodologie

Le Ecodesign-Impact-Accounting-Model de la société VHK, utilisé dans l'UE pour mesurer l'impact dans le contexte de la réglementation européenne en matière d'écoconception, sert de base à la modélisation. Dans le cadre de l'étude, nous avons adapté ce modèle à la Suisse. Pour ce faire, nous avons effectué une analyse approfondie des documents et des données, mené trois entretiens techniques avec des parties prenantes et des experts et organisé un atelier de validation avec cinq experts et parties prenantes.

2.6 Incertitudes

Pour les inputs centraux du modèle, les informations disponibles pour la Suisse sont limitées, par exemple en ce qui concerne la puissance de chauffage, l'efficacité énergétique et la durée de vie moyenne des appareils, la répartition des ventes entre les différents types de produits et la répartition de la consommation d'électricité entre les secteurs d'utilisation et entre les types de produits. L'étude repose donc sur des présomptions:

– En l'absence de chiffres de vente précis pour les appareils de chauffage décentralisés et les climatiseurs, les données relatives à la consommation d'énergie ont été utilisées pour déduire de manière

[3] Les résultats de la modélisation sont présentés ci-dessous à partir de 2020.

itérative les chiffres de vente et de stock. Pour ce faire, les paramètres du modèle, tels que la durée de vie moyenne, l'efficacité et le taux de charge des appareils, ont été ajustés jusqu'à ce que les valeurs de consommation d'énergie calculées correspondent aux données de consommation référencées.

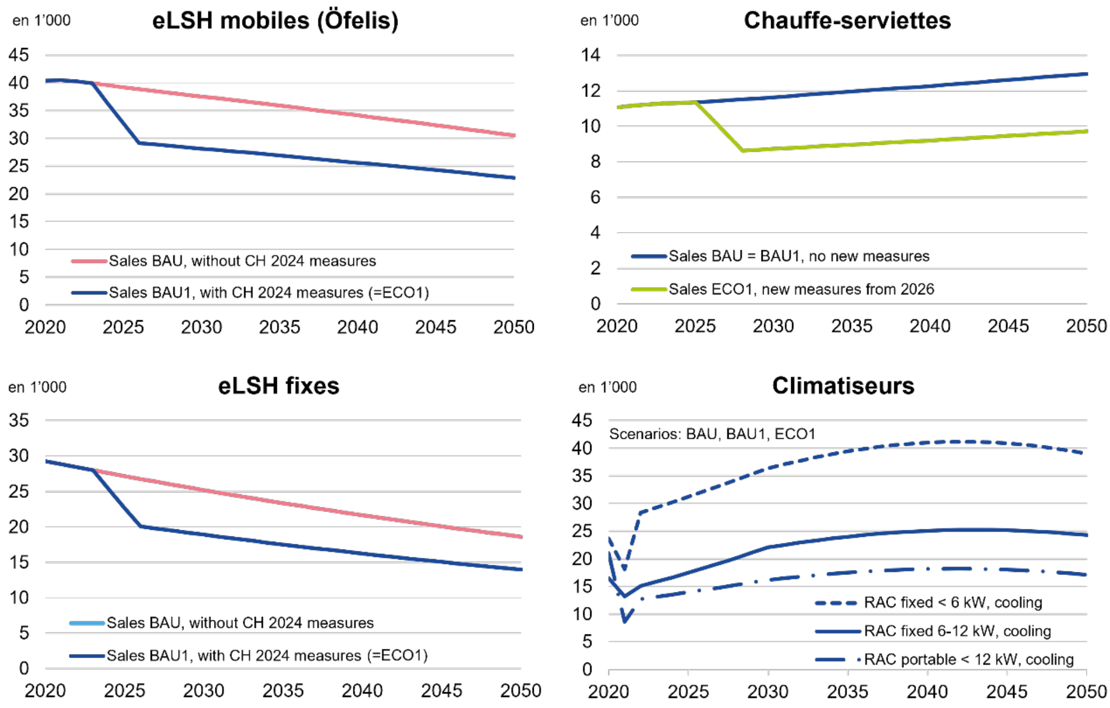
- Dans les cas où des données spécifiques à la Suisse ne sont pas disponibles (par exemple pour le taux de charge et le rendement), les chiffres de l'UE ont été repris des rapports d'analyse d'impact de l'écoconception.
- L'étude part du principe que la durée de vie des appareils est plus longue en Suisse que dans l'UE. Cela repose sur des conditions de marché et des habitudes d'utilisation spécifiques. Par exemple, la durée de vie des appareils de chauffage individuels portables est estimée à 12 ans en Suisse, contre 9 ans dans l'UE, alors que les appareils fixes sont utilisés parfois deux fois plus longtemps. Ces durées de vie plus longues influencent les données d'inventaire et l'efficacité moyenne des appareils sur le marché.
- L'étude suppose que la baisse des ventes d'eLSH en Suisse n'entraînera pas une augmentation de la demande de RAC, mais que les eLSH seront plutôt remplacés par des chauffages centraux. Les chauffages centraux ne font pas partie du cadre de l'étude. Cette hypothèse est basée sur des conditions de marché et des préférences des utilisateurs spécifiques à la Suisse. En revanche, avec un label énergétique commun pour les eLSH et les RAC, l'UE a pour objectif de remplacer les eLSH inefficaces par des RAC plus efficaces afin de réduire la consommation énergétique globale.

2.7 Résultats

Modélisation des ventes

Nous présentons tout d'abord l'évolution modélisée des chiffres de vente jusqu'en 2050.

Illustration 1: Chiffres de vente (en milliers)



Source : modélisation VHK, représentation propre

Dans l'ancien et le nouveau statu quo (BAU et BAU1), nous nous attendons à ce que le nombre d'eLSH mobiles (Öfelis) et fixes diminue. Avec les exigences suisses plus strictes pour 2024 (BAU1), nous nous attendons à un déclin nettement plus important que dans l'ancien statu quo (BAU). La mise en œuvre des nouvelles exigences de l'UE (ECO1) ne ferait pas de différence, car les exigences suisses de 2024 sont déjà plus strictes que les nouvelles exigences de l'UE.

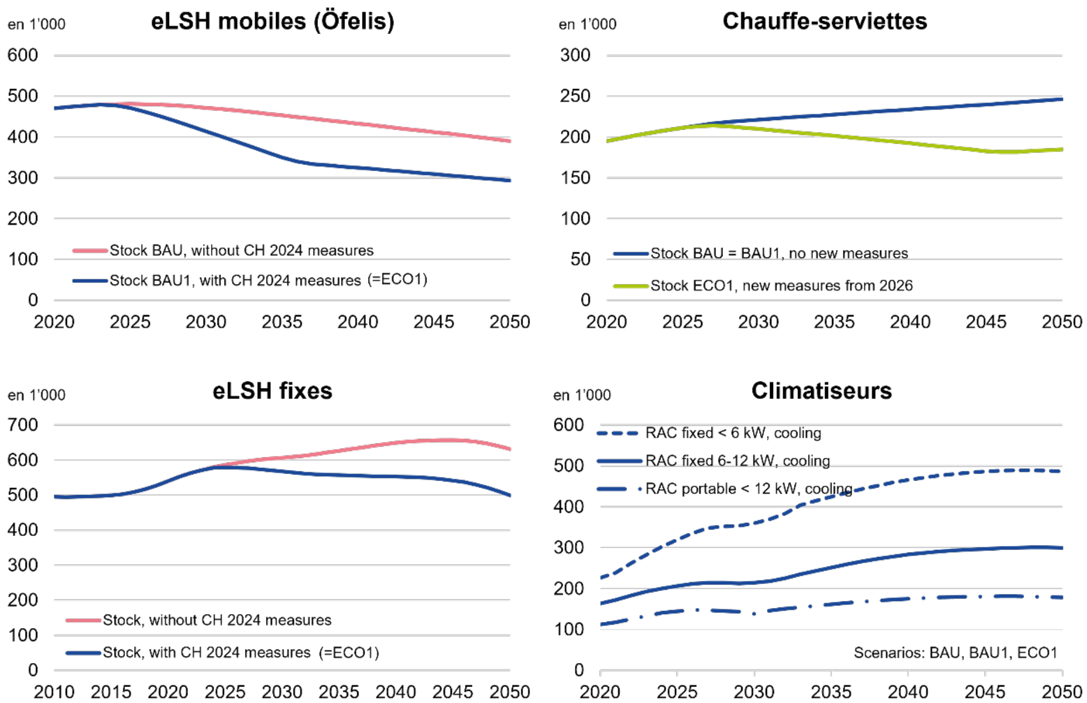
La mise en œuvre des nouvelles exigences de l'UE n'aurait d'impact que sur les chauffe-serviettes, étant donné que ces derniers n'entrent pas encore dans le champ d'application des exigences suisses de 2024. Nous nous attendons donc à ce que l'adoption des exigences de l'UE (ECO1) entraîne un net déclin des ventes de sèche-serviettes. Toutefois, le nombre de chauffe-serviettes vendus est faible comparé à celui des appareils de chauffage décentralisés mobiles et fixes.

Pour les climatiseurs, nous n'avons modélisé qu'un seul scénario, le statu quo. L'étude prévoit une augmentation des ventes de climatiseurs ambiants (RAC), car les changements climatiques et les étés plus chauds en Suisse entraînent une hausse de la demande en appareils de refroidissement. En outre, l'augmentation des normes d'habitation et la diffusion de RAC plus efficaces sur le plan énergétique devraient rendre ces appareils plus attrayants. Cependant, nous supposons que la baisse des eLSH n'entraînera pas directement une plus grande diffusion des RAC. Nous supposons qu'en Suisse, les eLSH seront remplacés en priorité par des systèmes de chauffage centralisés.

Modélisation du stock d'appareils

Le graphique suivant montre comment le stock évolue dans le modèle.

Illustration 2: Effectif (en milliers)



Source : modélisation VHK, représentation propre

Les directives décrites modifient le comportement d'achat des clients finaux. Des directives plus strictes conduisent à l'achat d'appareils plus efficaces. Comme le stock d'appareils n'est pas concerné par les prescriptions, il faut quelques années pour que le stock soit remplacé par les appareils nouvellement réglementés. [4]

Ce chiffre ne tient toutefois pas compte des prescriptions cantonales et des interdictions relatives aux chauffages électriques décentralisés, qui pourraient entraîner un déclin encore plus rapide du stock.

[4] Nous supposons une durée de vie de 12 ans pour les appareils de chauffage individuels portables, de 25 à 35 ans pour les appareils de chauffage individuels installés et de 12 ans pour les climatiseurs fixes et de 10 ans pour les climatiseurs portables.

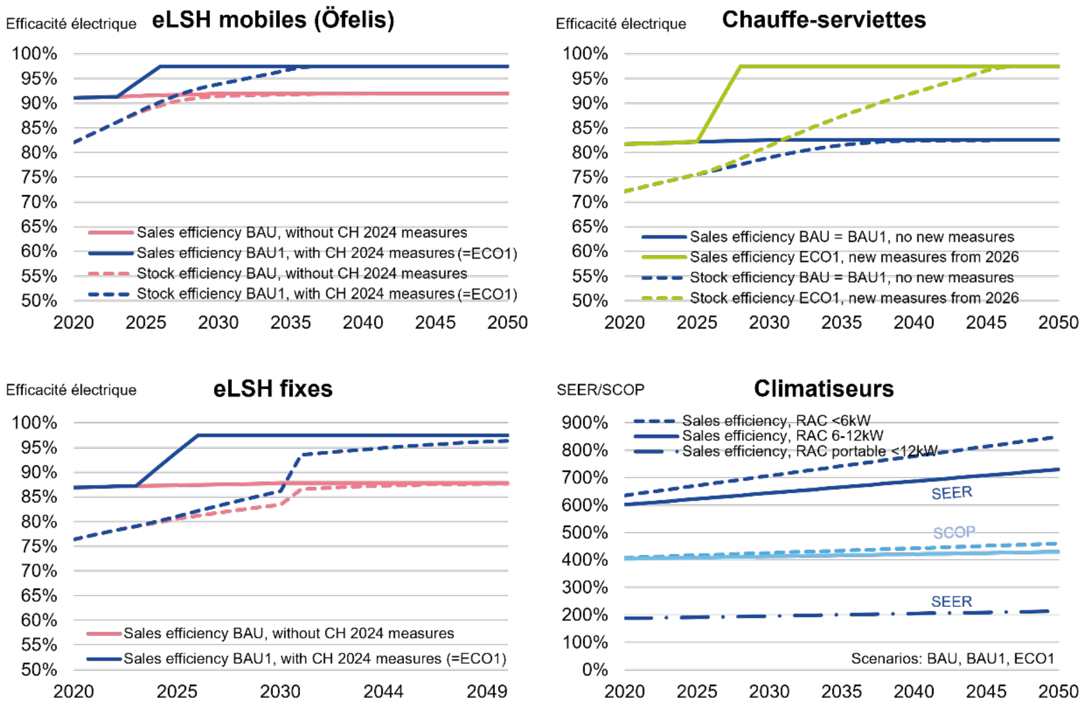
Nous nous attendons à ce que les exigences suisses plus strictes de 2024 entraînent une baisse du nombre de chauffages individuels mobiles (Öfelis) et fixes. Sans, on pourrait s'attendre à une augmentation du nombre d'appareils de chauffage individuels fixes d'ici 2045. Toutefois, ce chiffre ne tient pas compte des prescriptions et interdictions cantonales déjà mentionnées, qui devraient entraîner un recul plus rapide.

La mise en œuvre des directives européennes pourrait entraîner une diminution du nombre de chauffe-serviettes. En l'absence de mise en œuvre, le stock devrait continuer à augmenter.

Développement de l'efficacité énergétique

Le graphique suivant montre l'impact de l'évolution des ventes et de la diffusion d'appareils plus efficaces sur l'efficacité des ventes et du stock.

Illustration 3: Evolution modélisée de l'efficacité énergétique



Source : modélisation VHK, représentation propre

L'efficacité des eLSH se mesure à l'efficacité avec laquelle ils transforment l'énergie électrique en chaleur. Comme ces appareils n'utilisent pas d'énergie ambiante, l'efficacité maximale qu'ils peuvent atteindre est de 100 %. Cela signifie qu'ils peuvent convertir 1 watt d'énergie électrique en 1 watt de chaleur. Les RAC, en revanche, utilisent la chaleur ambiante et obtiennent ainsi un rapport nettement plus élevé entre la puissance thermique et la consommation d'énergie. Leur efficacité est indiquée par le SEER (Seasonal Energy Efficiency Ratio) pour les puissances de refroidissement ou le SCOP (Seasonal Coefficient of Performance) pour les puissances de chauffage. Ces deux indices reflètent l'efficacité énergétique saisonnière sur l'ensemble d'une année de refroidissement ou de chauffage.

L'effet incitatif de la réglementation ne se répercute que lentement sur le stock. Selon le produit et la durée de vie supposée des produits, il faut attendre 2035 (Öfelis) ou 2050 (eLSH fixes) pour que l'effet d'efficacité se répercute entièrement sur le stock.

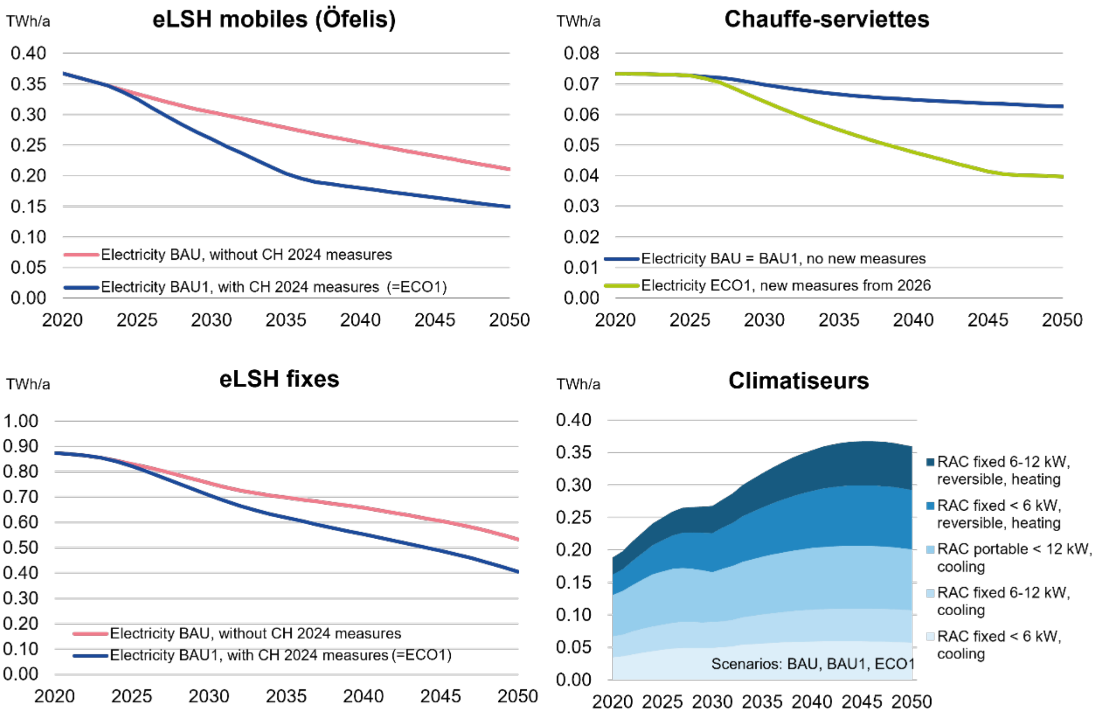
Les directives et interdictions cantonales, qui peuvent conduire à une diffusion plus rapide d'appareils plus efficaces, ne sont pas représentées dans le modèle.

La comparaison montre également que les climatiseurs sont plusieurs fois plus efficaces, y compris pour le chauffage.

Évolution des consommations d'énergie

La diminution du stock d'appareils de chauffage individuels (les trois catégories) ainsi que l'efficacité accrue des appareils entraînent une baisse des consommations d'énergie. Les prescriptions suisses de 2024 ainsi qu'une mise en application des exigences de l'UE permettent de réduire sensiblement les consommations d'énergie. Nous attendons l'effet le plus important pour les appareils de chauffage individuels fixes. Il est également important de mentionner, que nous n'avons pas modélisé le fait que des prescriptions cantonales et des interdictions pourraient entraîner une réduction plus rapide des consommations d'énergie.

Illustration 4: Évolution des consommations d'énergie



Source : modélisation VHK, représentation propre

L'analyse ne tient pas compte du fait que les appareils de chauffage individuels doivent être remplacés par d'autres générateurs de chaleur. Ces générateurs de chaleur nécessitent également de l'énergie pour leur fonctionnement. Cet impact n'est pas pris en compte dans le présent modèle.

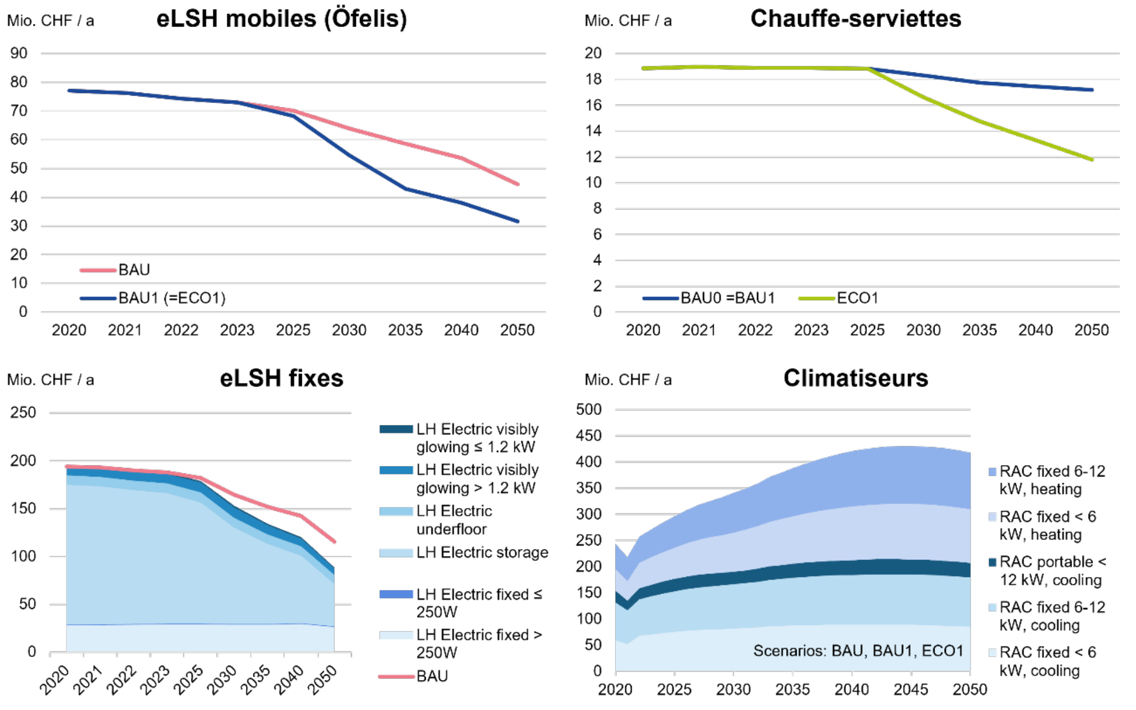
Pour les climatiseurs, nous nous attendons à une augmentation de la consommation d'énergie. Comme nous l'avons déjà mentionné, nous n'avons modélisé ici que le scénario de statu quo.

En principe, on peut s'attendre à ce que des exigences plus strictes en matière d'efficacité énergétique entraînent une baisse de la consommation d'énergie. Il est toutefois intéressant de se demander comment ces exigences se répercutent sur les coûts pour les utilisateurs finaux.

Impact modélisé sur les coûts du cycle de vie des utilisateurs finaux

Les coûts totaux du cycle de vie (Total Lifecycle Costs, TLC) se composent des coûts d'acquisition, des coûts d'exploitation et des coûts de maintenance. Pour les appareils de chauffage décentralisés (eLSH), les directives suisses plus strictes à partir de 2024 ainsi qu'une potentielle mise en conformité avec les réglementations de l'UE influencent ces coûts dans des proportions variables. L'impact des directives et des interdictions cantonales n'est pas non plus pris en compte ici.

Illustration 5: Évolution du coût total du cycle de vie



Source : modélisation VHK, représentation propre

Appareils de chauffage individuels :

Les eLSH fixes présentent le plus grand potentiel d'économies parmi les eLSH, car ils ont une longue durée de vie et sont souvent utilisés en continu. Les exigences suisses de 2024 entraînent certes des coûts d'acquisition plus élevés, car les appareils efficaces dotés de la technologie la plus moderne sont plus chers, mais la consommation d'électricité plus faible compense déjà l'investissement plus élevé après quelques années. En particulier, la baisse des coûts d'exploitation due à l'efficacité accrue des appareils assure une réduction significative des coûts totaux à long terme.

En revanche, une mise en conformité avec les règles de l'UE n'aurait qu'un impact supplémentaire limité, étant donné que les exigences minimales suisses de 2024 sont déjà plus strictes que les exigences européennes et que les exigences suisses devraient être maintenues en cas de mise en conformité. Seuls les chauffe-serviettes, jusqu'à présent exemptés des exigences suisses, pourraient faire l'objet d'économies. Dans ce cas, les nouvelles réglementations conduiraient à des modèles plus efficaces, ce qui réduirait considérablement la consommation d'électricité ainsi que les coûts d'exploitation. Dans l'ensemble, les économies de TLC sont moins importantes pour les appareils portables tels que les Öfeli, car leur durée de vie est plus courte et leur consommation d'énergie plus faible.

Climatiseurs :

En ce qui concerne les climatiseurs, nous prévoyons une augmentation de la TLC, car la demande de climatiseurs augmente en raison des changements climatiques et des étés plus chauds. Les coûts d'acquisition des climatiseurs sont généralement plus élevés que ceux des appareils de chauffage individuels, en particulier pour les appareils fixes d'une puissance plus élevée.

Les coûts d'exploitation sont un moteur essentiel de la TLC. La consommation d'électricité augmente avec l'utilisation, en particulier en été, ce qui exerce une influence considérable sur les coûts d'exploitation. Les coûts de maintenance jouent également un rôle, en particulier pour les appareils fixes qui doivent être entretenus régulièrement afin de garantir leur efficacité et leur fonctionnalité.

En résumé, on peut s'attendre à une augmentation continue des TLC pour les climatiseurs, sous l'effet d'une demande croissante et d'une utilisation intensive. Des appareils plus efficaces pourraient atténuer ces coûts à long terme, notamment grâce à des économies sur la consommation d'électricité, mais ils restent tributaires des tendances du marché et des évolutions technologiques.

Effets non modélisés sur l'installation du chauffage centralisé :

Comme nous l'avons déjà mentionné, nous supposons que le déclin des appareils de chauffage individuels (eLSH) n'entraînera pas une augmentation de la demande de climatiseurs (RAC), mais que les appareils de chauffage individuels seront remplacés par des systèmes de chauffage centralisé, notamment des pompes à chaleur. Cela peut toutefois entraîner des conséquences importantes sur les coûts pour les utilisateurs finaux, qui ne sont pas représentés dans notre modélisation.

L'achat et l'installation d'un chauffage centralisé, en particulier d'une pompe à chaleur, impliquent un investissement initial important. Outre le coût du chauffage lui-même (par exemple, une pompe à chaleur), des dépenses supplémentaires sont souvent nécessaires par l'installation d'un système de distribution de chaleur (par radiateurs ou chauffage au sol) dans de nombreux bâtiments. Dans certains cas, il est nécessaire d'ajouter des systèmes de chauffage de surface tels que des chauffages au sol, ce qui est particulièrement coûteux et compliqué dans les bâtiments anciens. Ces mesures de construction supplémentaires peuvent augmenter considérablement les coûts pour les utilisateurs finaux.

En résumé, les mesures visant à remplacer les appareils de chauffage individuel par des systèmes de chauffage centralisé pourraient entraîner des investissements uniques considérables, qui varient fortement en fonction des caractéristiques du bâtiment et de son état technique. Ces coûts n'ont pas été pris en compte dans la présente modélisation, mais ils constituent un facteur essentiel pour l'évaluation globale de l'impact économique.

Les climatiseurs peuvent, dans certains cas, constituer une alternative avantageuse aux solutions de chauffage centralisé. Les climatiseurs peuvent être utilisés efficacement comme chauffage. Cependant, ils sont plus bruyants que les pompes à chaleur et leur utilisation comme source de chaleur n'est pas toujours compatible avec les directives cantonales.

Impact sur les entreprises

L'impact sur l'économie des exigences plus strictes pour les appareils de chauffage individuels et de l'adoption éventuelle des règles de l'UE est multiple et concerne différents acteurs. Bien que cela n'ait pas été directement modélisé dans l'étude, il est possible d'en déduire certains effets potentiels.

Pour les fabricants de chauffages individuels et de climatiseurs, les exigences plus strictes pourraient entraîner des conséquences à double tranchant. D'une part, la baisse des ventes de chauffages individuels pourrait entraîner une diminution du chiffre d'affaires. D'autre part, les chauffages individuels seront remplacés par des appareils de chauffage (par exemple des pompes à chaleur ou des climatiseurs) du même fabricant. En Suisse, il n'y a cependant pas de fabricants d'appareils de chauffage individuel et de climatiseurs, de sorte que ces effets concernent en premier lieu les fabricants à l'étranger.

Pour les entreprises suisses actives en tant que détaillants ou importateurs d'appareils de chauffage et de climatisation, la baisse des ventes d'appareils de chauffage individuels devrait également signifier une diminution du chiffre d'affaires. En même temps, des marges plus élevées sur des appareils plus efficaces pourraient compenser en partie ces pertes.

Les entreprises artisanales qui installent des appareils de chauffage individuels (fixes) devraient également être concernées. Elles devraient s'attendre à une baisse de leurs revenus. Toutefois, il est peu probable que les entreprises installent et entretiennent uniquement des appareils de chauffage individuels (fixes). Ces entreprises devraient également installer et entretenir des climatiseurs et s'attendre à une augmentation de leur chiffre d'affaires dans ce segment.

Il est intéressant de voir quel sera l'impact du passage des appareils de chauffage individuel au chauffage centralisé. Cette évolution pourrait créer de nouvelles opportunités commerciales pour les entreprises artisanales suisses. L'installation de chauffages centraux est techniquement exigeante et nécessite souvent d'importantes mesures de construction. De nombreuses entreprises artisanales pourraient en profiter, notamment dans le domaine de la technique du bâtiment et de la construction de chauffages.

En résumé, les conséquences économiques sont complexes : alors que les distributeurs et les installateurs d'appareils de chauffage individuels doivent s'attendre à une baisse de leur chiffre d'affaires, les entreprises du secteur CVC, notamment les entreprises artisanales, pourraient bénéficier d'une augmentation de la demande et développer leurs opportunités de vente.

2.8 Potentiel pour d'autres directives

La Suisse pourrait-elle introduire, par analogie avec les objectifs de 2024, d'autres objectifs allant audelà des nouveaux objectifs de l'UE ?

Appareils de chauffage individuels

L'analyse montre que les exigences relatives aux appareils de chauffage individuels en Suisse ont déjà atteint un niveau très élevé avec les prescriptions applicables à partir de 2024. En particulier, l'exigence minimale de 39% d'efficacité correspond presque au maximum technique pouvant être atteint par ces appareils. Un nouveau renforcement des exigences n'entraînerait donc que des améliorations marginales de l'efficacité et pourrait conduire à ce que les fabricants ne soient pas en mesure, techniquement ou économiquement, de proposer les produits correspondants. Cela limiterait le choix pour les utilisateurs finaux et augmenterait inutilement les coûts d'acquisition, sans contribuer de manière significative aux économies d'énergie.

Une approche raisonnable consiste plutôt à inciter les utilisateurs à se tourner vers des alternatives plus efficaces, telles que les pompes à chaleur ou les climatiseurs individuels (RAC). Les climatiseurs que nous avons examinés dans cette étude, en particulier les modèles fixes avec fonction de chauffage, offrent une meilleure efficacité énergétique saisonnière (SCOP) et peuvent donc utiliser l'énergie thermique plus efficacement. Les systèmes de chauffage centralisé, notamment les pompes à chaleur, constituent en outre une solution durable à long terme, car ils sont non seulement efficaces grâce à l'utilisation d'énergies renouvelables, mais permettent également de réduire les émissions de gaz à effet de serre.

Refroidissement par des RAC portables

Pour les RAC portables, l'analyse montre que des exigences plus strictes en matière de classes d'efficacité énergétique (étiquette énergie) n'entraîneraient pas d'amélioration significative du marché. Une interdiction des appareils inefficaces de classe F n'aurait pas d'effet significatif, car ces appareils sont déjà peu présents sur le marché. En revanche, une exigence plus stricte, par exemple la classe E ou supérieure, serait trop ambitieuse et surchargerait la structure du marché. C'est pourquoi de telles mesures sont déconseillées.

Refroidissement par des RAC fixes < 6 kW

Pour les RAC fixes d'une puissance frigorifique inférieure à 6 kW, nous avons examiné quelle serait l'exigence minimale raisonnable en matière de classe d'efficacité énergétique. Une exigence d'au moins la classe C (SEER ≥ 6.1) serait remplie par 91% des modèles actuellement commercialisés et n'aurait donc guère d'influence sur le marché. En revanche, une norme plus élevée telle que la classe B (SEER compris entre 8,5 et 11,6) représenterait un net durcissement, puisque seuls 23% des appareils actuels atteignent cette classe. Alors qu'un relèvement à la classe B aurait potentiellement un impact positif sur l'efficacité du marché, les coûts et l'impact sur le marché nécessitent des études supplémentaires afin d'évaluer la faisabilité de la mise en œuvre.

Refroidissement par des RAC fixes de 6 à 12 kW

Dans ce segment également, on constate qu'une grande partie des appareils répondent déjà à des classes d'efficacité supérieures. Une interdiction des appareils inefficaces de classe D, E, F ou G n'aurait donc que peu d'impact sur la structure du marché. 80% des appareils sont déjà de classe C ou supérieure. Il est difficile d'interdire également la classe C, étant donné que seuls 2,4% des appareils sur le marché sont conformes à la classe A ou à la classe B.

Chauffage par des RAC fixes < 6 kW

La fonction de chauffage est moins répandue dans ce segment et de nombreux appareils répondent déjà à des classes d'efficacité supérieures. Une interdiction des appareils de chauffage inefficaces n'entraînerait donc que des changements mineurs sur le marché. Des exigences plus élevées, au-delà de la classe C, pourraient théoriquement permettre des gains d'efficacité, mais là encore, une analyse plus détaillée serait nécessaire.

Chauffage par des RAC fixes de 6 à 12 kW

La situation est similaire à celle des RAC de faible puissance. Les appareils plus efficaces dominent le marché et la fonction de chauffage n'est que peu répandue. Par conséquent, l'interdiction des appareils inefficaces n'aurait également qu'un impact limité, tandis que les exigences plus strictes, telles que la classe B, devraient faire l'objet d'un examen plus approfondi.

2.9 Conclusion

L'analyse montre que des règles plus strictes en matière d'efficacité énergétique pour les appareils de chauffage individuels et les climatiseurs peuvent permettre de réaliser des économies d'énergie considérables et des avantages financiers à long terme pour les utilisateurs finaux. Les prescriptions suisses à partir de 2024, en particulier, ont le potentiel de réduire considérablement la consommation d'électricité et d'introduire des technologies plus efficaces sur le marché. Pour ce faire, elles veillent tout d'abord à ce que les appareils de chauffage individuels particulièrement inefficaces soient évincés du marché.

Deuxièmement, les objectifs encouragent le passage d'appareils de chauffage individuels inefficaces à d'autres technologies. Nous supposons qu'il s'agit principalement de chauffages centralisés, alimentés au mieux par une pompe à chaleur efficace sur le plan énergétique. Mais le passage à des climatiseurs en tant que générateurs de chaleur aurait également un effet positif sur la consommation d'énergie, car ceux-ci sont également beaucoup plus efficaces que les appareils de chauffage individuels.

Il convient toutefois de souligner que les résultats de l'étude sont entachés d'importantes incertitudes. Celles-ci résultent de la disponibilité limitée des données (notamment des chiffres de vente), des hypothèses nécessaires concernant la durée de vie et l'utilisation des appareils ainsi que de la modélisation des futures tendances du marché. Il convient également de mentionner que les diverses directives et interdictions cantonales relatives aux appareils de chauffage individuels n'ont pas été prises en compte dans la modélisation. Néanmoins, l'analyse montre que l'introduction et le développement de prescriptions énergétiques plus strictes sont rentables d'un point de vue écologique et économique.

3 Sintesi

Questo documento è una sintesi non tecnica. L'intero studio, scritto in inglese, si trova in appendice.

3.1 Situazione iniziale

Dal 2013 e dal 2015, l'Unione Europea (UE) ha stabilito dei requisiti minimi per l'efficienza energetica degli apparecchi di climatizzazione e di riscaldamento individuale. Ciò significa che gli apparecchi in questione possono essere immessi sul mercato solo se soddisfano tali requisiti minimi. La Svizzera ha recepito questi requisiti in modo sostanzialmente identico nella legislazione elvetica. Solo i riscaldatori elettrici a camera singola saranno soggetti a requisiti più severi in Svizzera a partire da gennaio 2024. Ciò è regolato dall'Ordinanza sull'efficienza energetica (EnEV; RS 730.02).

Allo stesso tempo, alcuni cantoni hanno introdotto divieti sull'installazione o la sostituzione di apparecchi elettrici per il riscaldamento a camera singola, ma questi non sono oggetto di questo studio.

Nell'UE è in corso una revisione dei requisiti. Ciò solleva la questione se la Svizzera debba seguire questi requisiti e se debba imporre requisiti più severi, se necessario. Alla luce di ciò, l'Ufficio federale dell'energia (UFE) ha commissionato uno studio alle società di consulenza BSS Volkswirtschaftliche Beratung di Basilea e van Holsteijn en Kemna VHK dei Paesi Bassi.

3.2 Obiettivi

Lo studio utilizza la modellazione per verificare questo aspetto,

1. come l'adozione dei nuovi requisiti di efficienza dell'Unione Europea e
2. regolamenti più severi che vanno oltre quelli dell'UE,

sugli utenti finali (risparmio energetico, costi totali del ciclo di vita) e sui produttori (restrizione dell'offerta e attori del mercato, cifre di vendita) in Svizzera.

3.3 Scenari d'esame

I tre scenari analizzati sono

1. Vecchio status quo (BAU): illustrazione dell'attuale regolamento fino alla fine del 2023, sulla base dei requisiti UE esistenti (Regolamento 2015/1188), senza requisiti aggiuntivi in Svizzera.
2. Nuovo status quo (BAU1): Oltre alle specifiche BAU, include i requisiti svizzeri più severi che si applicheranno a partire da gennaio 2024 e prevedono un'efficienza energetica minima del 39% per i riscaldatori elettrici locali (eLSH) (ad eccezione degli scaldasalviette).

3. Scenario successivo: adozione delle nuove norme UE (Regolamento 2024/1103) nella normativa svizzera. Tuttavia, i requisiti svizzeri più severi per gli apparecchi di riscaldamento a camera singola devono essere mantenuti. Ciò non comporta cambiamenti sostanziali rispetto allo scenario BAU1, ad eccezione del fatto che gli scaldasalviette sono regolamentati per la prima volta e devono diventare più efficienti.

Lo studio esamina inoltre se e in che misura la Svizzera possa adottare requisiti più severi rispetto a quelli dell'UE.

3.4 Quadro d'indagine

[5]Lo studio si concentra sui riscaldatori elettrici locali (eLSH) e sui condizionatori d'aria per ambienti (RAC) in Svizzera e copre il periodo dal 1990 al 2050. L'analisi prende in considerazione sia gli sviluppi storici che le tendenze previste, utilizzando dati e ipotesi provenienti da fonti europee e svizzere.

L'attenzione si concentra su diversi tipi di apparecchi, tra cui gli eLSH portatili e a installazione fissa (compresi gli scaldasalviette), nonché i RAC portatili e a installazione fissa con una capacità inferiore a 12 kilowatt (kW).

Gli impianti di riscaldamento a combustione interna alimentati a gas o a combustibili liquidi sono inclusi nei calcoli, ma non sono elencati esplicitamente a causa della loro influenza minore. Gli impianti di riscaldamento a combustione interna alimentati con combustibili solidi (legno, pellet, carbone) sono stati esclusi dall'analisi.

3.5 Metodologia

Il Ecodesign-Impatto-Contabilità-Modello della società VHK, utilizzato nell'UE per la misurazione dell'impatto nel contesto della normativa europea sulla progettazione ecocompatibile, serve come base per la modellazione. Nell'ambito dello studio, abbiamo adattato questo modello alla Svizzera. A tal fine, abbiamo condotto un'analisi completa dei documenti e dei dati, abbiamo tenuto tre discussioni tecniche con stakeholder ed esperti e abbiamo organizzato un workshop di validazione con cinque esperti e stakeholder.

3.6 Incertezze

Per la Svizzera sono disponibili solo informazioni limitate per gli input chiave del modello, ad esempio sulla potenza termica, l'efficienza energetica e la durata media degli apparecchi, la distribuzione delle

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[5] I risultati della modellizzazione sono presentati di seguito a partire dal 2020.

vendite tra i vari tipi di prodotto e la distribuzione del consumo di elettricità tra i settori di utilizzo e i tipi di prodotto. Lo studio fa quindi delle ipotesi:

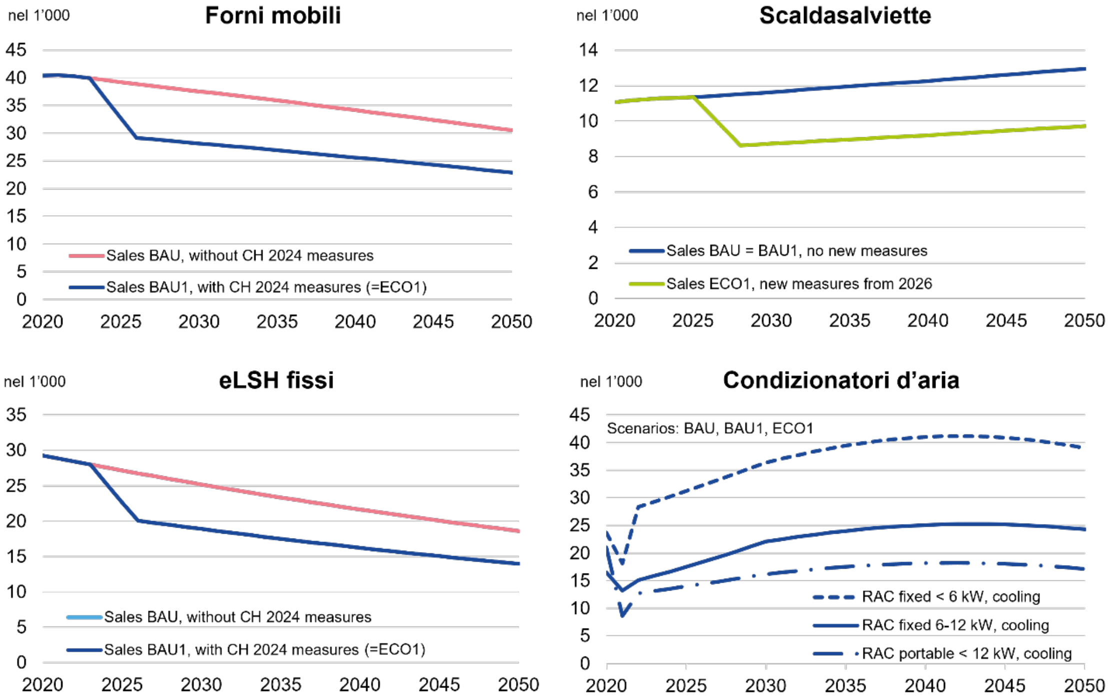
- In assenza di dati precisi sulle vendite di riscaldatori elettrici individuali e condizionatori d'aria, i dati sul consumo energetico sono stati utilizzati per ricavare in modo iterativo i dati sulle vendite e sulle scorte. Questo è stato fatto regolando i parametri del modello, come la vita media, l'efficienza e il carico di riscaldamento degli apparecchi, fino a quando i valori di consumo energetico calcolati corrispondevano ai dati di consumo di riferimento.
- Nei casi in cui non sono disponibili dati specifici per la Svizzera (ad esempio per il carico termico e l'efficienza), i dati dell'UE sono stati ricavati dai rapporti di valutazione d'impatto della progettazione ecocompatibile.
- Lo studio parte dal presupposto che la vita utile degli apparecchi in Svizzera sia più lunga rispetto a quella dell'UE. Ciò si basa sulle specifiche condizioni di mercato e sulle abitudini degli utenti. Ad esempio, la durata di vita delle stufe portatili a camera singola in Svizzera è stimata in 12 anni, rispetto ai 9 anni dell'UE, mentre gli apparecchi installati in modo permanente vengono utilizzati in alcuni casi per il doppio del tempo. Questi tempi di vita più lunghi influenzano i dati di inventario e l'efficienza media degli apparecchi presenti sul mercato.
- Lo studio parte dal presupposto che il calo delle vendite di eLSH in Svizzera non porterà a un aumento della domanda di RAC, ma piuttosto che gli eLSH saranno sostituiti da sistemi di riscaldamento centrale. I sistemi di riscaldamento centrale non rientrano nell'ambito dello studio. Questa ipotesi si basa sulle specifiche condizioni di mercato e sulle preferenze degli utenti in Svizzera. Al contrario, con un'etichetta energetica comune per le eLSH e i RAC, l'UE persegue l'obiettivo di sostituire le eLSH inefficienti con i RAC più efficienti, al fine di ridurre il consumo energetico complessivo.

3.7 Risultati

Modellazione dei dati di vendita

In primo luogo, presentiamo lo sviluppo modellato dei dati di vendita fino al 2050.

Illustrazione 1: Dati di vendita (in 1000)



Fonte: modellazione VHK, illustrazione propria

Nel vecchio e nel nuovo status quo (BAU e BAU1), ci aspettiamo che il numero di eLSH mobili (Öfelis) e permanenti diminuisca. Con i requisiti svizzeri più severi per il 2024 (BAU1), ci aspettiamo un calo molto più netto rispetto al vecchio status quo (BAU). L'implementazione dei nuovi requisiti UE (ECO1) non cambierebbe nulla in questo caso, poiché i requisiti svizzeri per il 2024 sono già più severi dei nuovi requisiti UE.

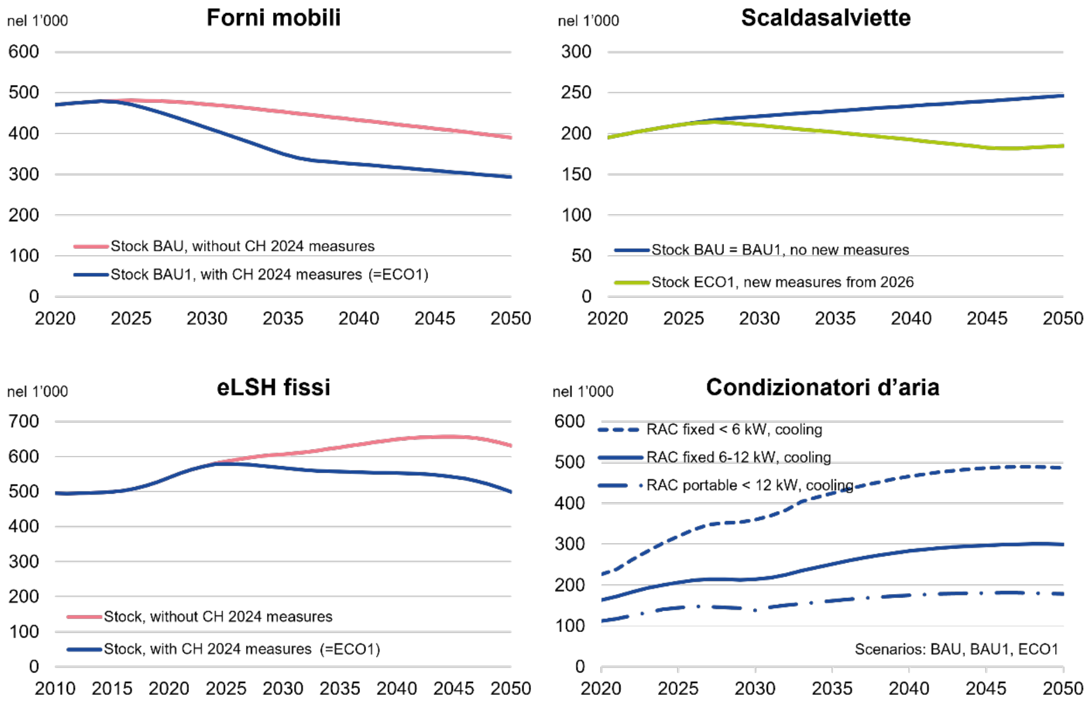
L'implementazione dei nuovi requisiti UE riguarderebbe solo gli scaldasalviette, in quanto questi ultimi non rientrano ancora nell'ambito di applicazione dei requisiti svizzeri del 2024. Prevediamo quindi che l'adozione dei requisiti UE (ECO1) porterebbe a un calo significativo delle vendite di scaldasalviette. Tuttavia, rispetto ai riscaldatori elettrici mobili e a quelli installati in modo permanente, il numero di scaldasalviette venduti è esiguo.

Abbiamo modellato solo uno scenario per gli apparecchi di climatizzazione, lo status quo. Lo studio prevede un aumento delle vendite di condizionatori d'aria per ambienti (RAC), poiché i cambiamenti climatici e le estati più calde in Svizzera portano a un aumento della domanda di apparecchi di raffreddamento. Inoltre, si presume che l'aumento del tenore di vita e la diffusione di condizionatori d'aria più efficienti dal punto di vista energetico aumenteranno l'appeal di questi apparecchi. Tuttavia, si ipotizza che il calo degli eLSH non porti direttamente a una maggiore diffusione dei RAC. Si ipotizza che in Svizzera le eLSH saranno sostituite principalmente da sistemi di riscaldamento centralizzati.

Modellazione dell'inventario dei dispositivi

La figura seguente mostra l'andamento dello stock nel modello.

Illustrazione 2: Inventario (nel 1'000)



Fonte: modellazione VHK, illustrazione propria

I requisiti sopra descritti stanno modificando il comportamento di acquisto dei clienti finali. I requisiti più severi portano all'acquisto di apparecchi più efficienti.[6] Poiché le apparecchiature esistenti non sono interessate dalle normative, ci vorranno alcuni anni prima che il parco macchine venga sostituito dalle nuove apparecchiature regolamentate.

Tuttavia, questo non tiene conto delle normative cantonali e dei divieti sugli impianti di riscaldamento elettrico decentralizzati, che potrebbero portare a un calo ancora più rapido dello stock.

Prevediamo che i requisiti svizzeri più severi a partire dal 2024 porteranno a una diminuzione del numero di apparecchi di riscaldamento mobili (alimentati a gasolio) e di quelli installati in modo permanente in un unico locale. Senza questo requisito, si prevede un aumento degli apparecchi di riscaldamento a

[6] Si ipotizza una vita utile di 12 anni per i riscaldatori portatili, di 25-35 anni per i riscaldatori installati, di 12 anni per i condizionatori installati in modo permanente e di 10 anni per i condizionatori portatili.

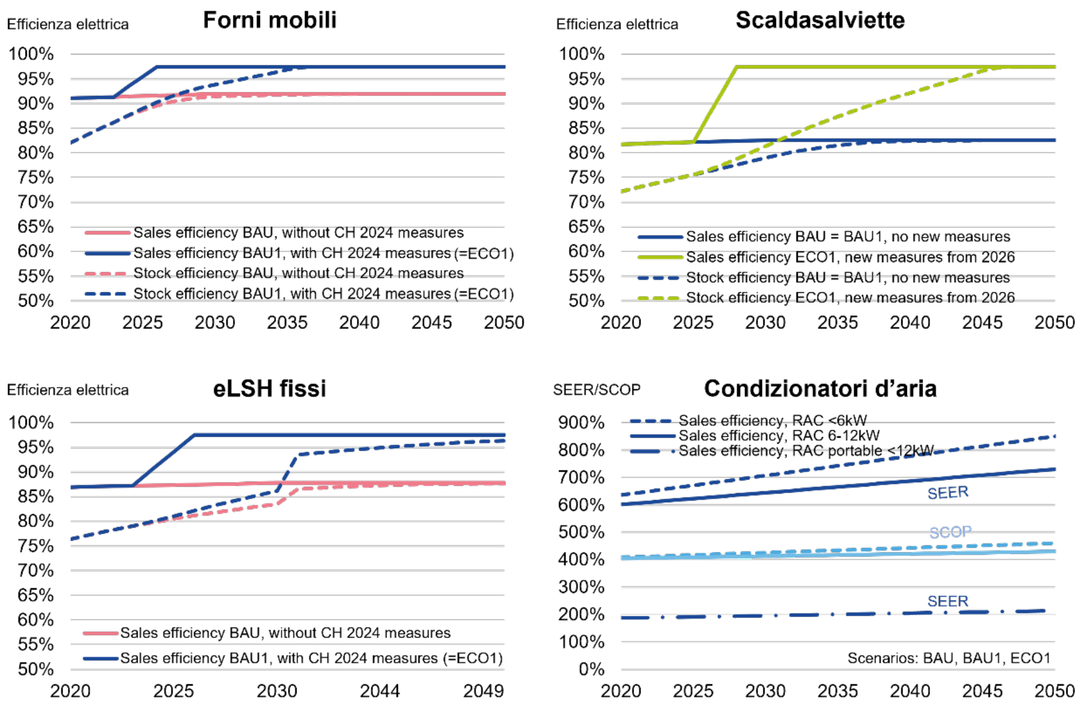
camera singola installati in modo permanente entro il 2045. Tuttavia, ciò non tiene conto dei requisiti e dei divieti cantonali già menzionati, che probabilmente porteranno a un calo più rapido.

L'attuazione dei requisiti UE potrebbe portare a una diminuzione del numero di scaldasalviette. Senza l'applicazione dei requisiti, è probabile che la popolazione aumenti continuamente.

Sviluppo dell'efficienza energetica

La figura seguente mostra come la variazione dei dati di vendita e la diffusione di apparecchi più efficienti influiscano sull'efficienza delle vendite e del magazzino.

Illustrazione 3: Sviluppo modellato dell'efficienza energetica



Fonte: modellazione VHK, illustrazione propria

L'efficienza degli eLSH si misura in base all'efficienza con cui convertono l'energia elettrica in calore. Poiché questi dispositivi non utilizzano energia ambientale, l'efficienza massima raggiungibile è del 100%. Ciò significa che possono convertire 1 watt di energia elettrica in 1 watt di calore. I RAC, invece, utilizzano il calore dell'ambiente e quindi raggiungono un rapporto significativamente più alto tra produzione di calore e consumo di energia. La loro efficienza è specificata tramite SEER (Seasonal Energy Efficiency Ratio) per le capacità di raffreddamento o SCOP (Seasonal Coefficient of Performance) per le capacità di riscaldamento. Entrambe le cifre chiave riflettono l'efficienza energetica stagionale nell'arco di un intero anno di raffreddamento o riscaldamento.

L'effetto di guida del regolamento ha solo un impatto lento sullo stock. A seconda del prodotto e della durata di vita ipotizzata, ci vorrà fino al 2035 (apparecchi a olio combustibile) o fino al 2050 (eLSH installati in modo permanente) perché l'effetto di efficienza raggiunga completamente lo stock esistente.

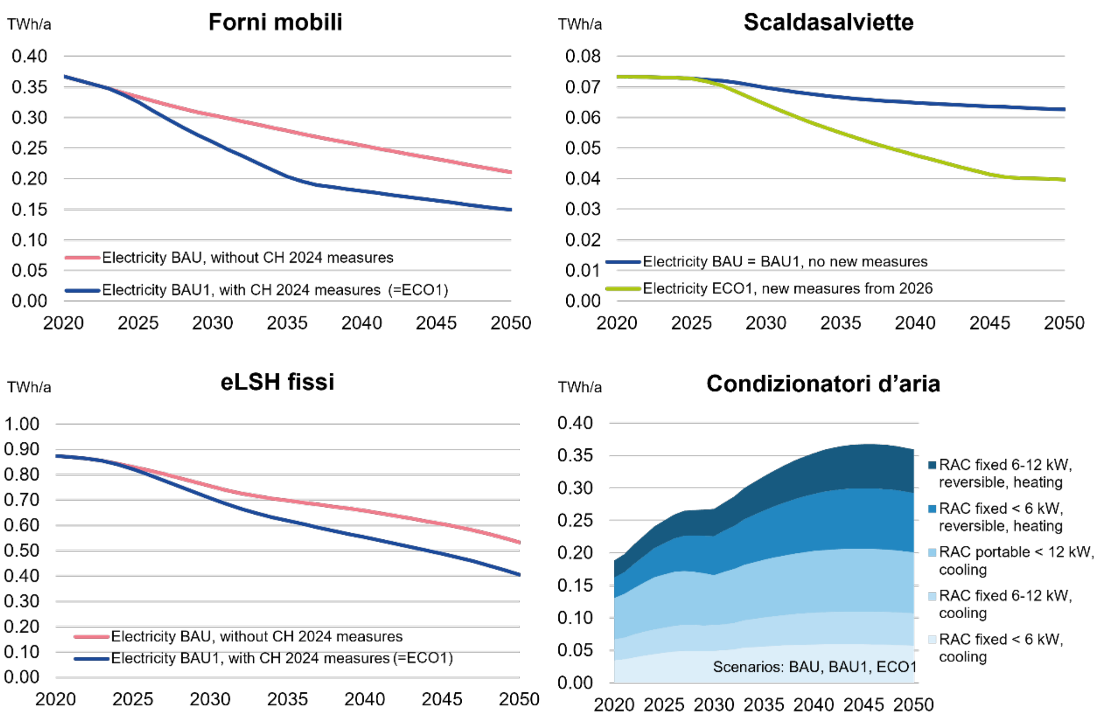
Il modello non include i regolamenti e i divieti cantonali, che possono portare a una più rapida diffusione di apparecchi più efficienti.

Un confronto mostra anche che i condizionatori d'aria per ambienti sono molto più efficienti, anche per il riscaldamento.

Sviluppo modellato del consumo energetico

La riduzione del numero di apparecchi di riscaldamento a camera singola (in tutte e tre le categorie) e la maggiore efficienza degli apparecchi porteranno a una riduzione del consumo energetico. Il consumo energetico può essere ridotto in modo significativo con i requisiti svizzeri a partire dal 2024 e seguendo i requisiti dell'UE. L'effetto maggiore è previsto per gli apparecchi di riscaldamento a camera singola installati in modo permanente. Anche in questo caso, non abbiamo calcolato che i requisiti e i divieti cantonali potrebbero portare a una riduzione più rapida dei consumi energetici.

Illustrazione 4: Sviluppo del consumo energetico



Fonte: modellazione VHK, illustrazione propria

L'analisi non tiene conto del fatto che i singoli riscaldatori di ambienti devono essere sostituiti da altri generatori di calore. Anche questi generatori di calore richiedono energia. Questo aspetto non viene mostrato.

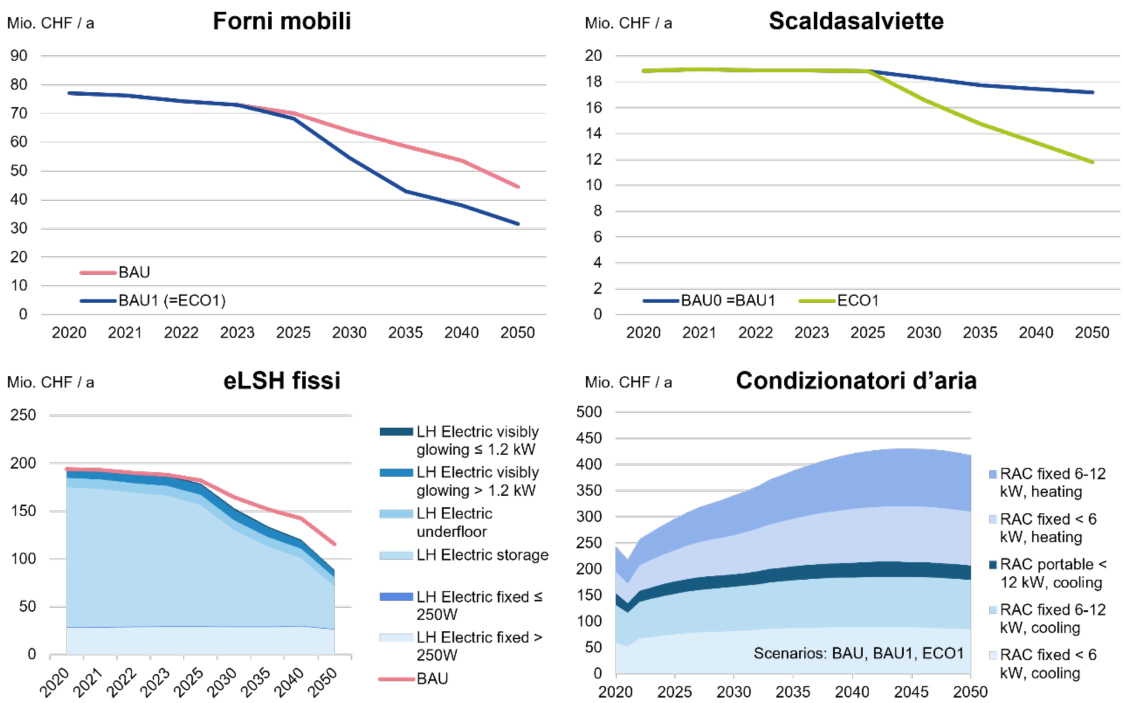
Ci aspettiamo un aumento del consumo di energia per gli apparecchi di condizionamento. Come già detto, abbiamo modellato solo lo scenario di status quo.

In linea di principio, è prevedibile che requisiti di efficienza energetica più severi portino a una riduzione dei consumi energetici. Tuttavia, la questione di come questi requisiti influiranno sui costi per gli utenti finali è interessante.

Impatto modellato sui costi del ciclo di vita degli utenti finali

I costi totali del ciclo di vita (TLC) sono costituiti dai costi di acquisto, di esercizio e di manutenzione. Nel caso dei riscaldatori elettrici locali (eLSH), i requisiti svizzeri più severi a partire dal 2024 e la potenziale attuazione delle normative UE influenzeranno questi costi in misura diversa. Anche gli effetti delle normative e dei divieti cantonali non sono presi in considerazione.

Illustrazione 5: Sviluppo dei costi totali del ciclo di vita



Fonte: modellazione VHK, illustrazione propria

Riscaldatori individuali per ambienti:

Le eLSH installate in modo permanente mostrano il maggior potenziale di risparmio per le eLSH, poiché hanno una lunga durata di vita e sono spesso utilizzate in modo continuo. Sebbene i requisiti svizzeri del 2024 comportino costi di acquisto più elevati, in quanto gli apparecchi efficienti con la tecnologia più recente sono più costosi, il consumo di elettricità significativamente inferiore compensa l'investimento più elevato già dopo pochi anni. In particolare, la riduzione dei costi operativi dovuta alla maggiore efficienza degli apparecchi garantisce una significativa riduzione dei costi complessivi a lungo termine.

Tuttavia, l'attuazione dei regolamenti UE avrebbe solo un impatto aggiuntivo limitato, poiché i requisiti minimi svizzeri a partire dal 2024 sono già più severi dei requisiti UE e i requisiti svizzeri dovrebbero essere mantenuti in caso di attuazione. Solo nel caso degli scaldasalviette, che finora sono stati esentati dai requisiti svizzeri, l'applicazione potrebbe portare a dei risparmi. In questo caso, le nuove norme porterebbero a modelli più efficienti, che ridurrebbero in modo significativo sia il consumo di elettricità che i costi operativi. Complessivamente, i risparmi nelle TLC per gli apparecchi portatili, come le lampade a olio, sono inferiori, in quanto hanno una vita utile più breve e un consumo energetico più basso.

Condizionatori d'aria per ambienti:

Per quanto riguarda i condizionatori d'aria per ambienti, prevediamo un aumento delle TLC in quanto la domanda di condizionatori d'aria per ambienti aumenta a causa dei cambiamenti climatici e delle estati più calde. I costi di acquisizione dei condizionatori d'aria per ambienti sono generalmente più elevati di quelli dei singoli riscaldatori per ambienti, soprattutto per gli apparecchi installati in modo permanente con una potenza maggiore.

I costi operativi sono un fattore chiave delle TLC. Il consumo di energia aumenta con l'aumentare dell'utilizzo, soprattutto in estate, con un impatto significativo sui costi operativi. Anche i costi di manutenzione giocano un ruolo importante, soprattutto per i dispositivi installati in modo permanente che richiedono una manutenzione regolare per garantire l'efficienza e la funzionalità.

In sintesi, si prevede un continuo aumento del TLC per i condizionatori d'aria per ambienti, a causa della crescente domanda e dell'uso intensivo. Apparecchi più efficienti potrebbero ridurre questi costi a lungo termine, in particolare grazie al risparmio sul consumo di elettricità, ma dipendono dalle tendenze del mercato e dagli sviluppi tecnologici.

Effetti non modellati sull'installazione di sistemi di riscaldamento centrale:

Come già detto, ipotizziamo che il declino dei riscaldatori individuali per ambienti (eLSH) non porterà a un aumento della domanda di condizionatori d'aria per ambienti (RAC), ma che i riscaldatori individuali per ambienti saranno sostituiti da sistemi di riscaldamento centrale, in particolare da pompe di calore. Tuttavia, ciò può avere un impatto significativo sui costi per gli utenti finali, che non si riflette nella nostra modellizzazione.

L'acquisto e l'installazione di un sistema di riscaldamento centrale, in particolare di una pompa di calore, comporta un investimento iniziale elevato. Oltre ai costi dell'impianto di riscaldamento in sé (ad esempio, una pompa di calore), spesso si aggiungono costi aggiuntivi per la posa di nuove tubature e l'installazione di radiatori in molti edifici. In alcuni casi, è necessario riadattare i sistemi di riscaldamento a pannelli, come il riscaldamento a pavimento, che è particolarmente costoso e richiede tempo negli edifici più vecchi. Queste misure strutturali aggiuntive possono aumentare significativamente i costi per gli utenti finali.

In sintesi, le misure di sostituzione dei singoli apparecchi di riscaldamento degli ambienti con sistemi di riscaldamento centralizzati potrebbero comportare investimenti significativi una tantum, che variano notevolmente a seconda delle condizioni dell'edificio e del suo stato tecnico. Questi costi non sono stati presi in considerazione nella presente modellizzazione, ma sono un fattore chiave nella valutazione complessiva dell'impatto economico.

In alcuni casi, i condizionatori d'aria per ambienti possono essere una valida alternativa alle soluzioni di riscaldamento centralizzato. I condizionatori d'aria per ambienti possono essere utilizzati in modo efficiente come riscaldamento. Tuttavia, sono più rumorosi delle pompe di calore e il loro utilizzo come fonte di calore non è sempre compatibile con le normative cantonali.

Effetti sulle aziende

Gli effetti dei requisiti più severi per i riscaldatori di ambienti locali e l'eventuale adozione di regolamenti UE sull'economia sono diversi e riguardano diverse parti interessate. Anche se questo aspetto non è stato modellato direttamente nello studio, si possono dedurre alcuni possibili effetti.

I requisiti più severi potrebbero avere effetti a doppio taglio per i produttori di riscaldatori individuali per ambienti e unità di condizionamento. Da un lato, il calo delle vendite di stufe individuali potrebbe portare a una diminuzione del fatturato. Dall'altro lato, le stufe individuali saranno sostituite da apparecchi di riscaldamento (ad esempio, pompe di calore o sistemi di condizionamento) degli stessi produttori. Tuttavia, in Svizzera non ci sono produttori di stufe e condizionatori individuali, per cui questi effetti si ripercuotono principalmente sui produttori esteri.

Per le aziende svizzere che operano come rivenditori o importatori di apparecchi per il riscaldamento e il condizionamento dell'aria, il calo delle vendite di singoli riscaldatori per ambienti potrebbe comportare una diminuzione del fatturato. Allo stesso tempo, i margini più elevati degli apparecchi più efficienti potrebbero compensare in parte queste perdite.

Anche le imprese commerciali che installano apparecchi di riscaldamento a camera singola (in modo permanente) potrebbero essere colpite. Dovranno fare i conti con un calo delle entrate. Tuttavia, difficilmente ci saranno aziende che si limitano a installare e manutenere (in modo permanente) singoli apparecchi di riscaldamento per ambienti. È probabile che queste aziende installino e maneggino anche i condizionatori d'aria e si aspettino un aumento del fatturato in questo segmento.

Sarà interessante vedere quale sarà l'impatto del passaggio dai singoli apparecchi per il riscaldamento degli ambienti ai sistemi di riscaldamento centralizzati. Questo sviluppo potrebbe creare nuove opportunità commerciali per le imprese commerciali svizzere. L'installazione di sistemi di riscaldamento centralizzati è tecnicamente impegnativa e spesso richiede ampie misure strutturali. Molte aziende del settore potrebbero trarre vantaggio da questa evoluzione, in particolare nel campo della tecnologia edilizia e della costruzione di impianti di riscaldamento.

In sintesi, gli effetti economici sono complessi: mentre i rivenditori e gli installatori di apparecchi per il riscaldamento dei singoli ambienti devono aspettarsi un calo delle vendite, le aziende del settore del riscaldamento centrale, in particolare i commercianti, potrebbero beneficiare dell'aumento della domanda e ampliare le loro opportunità di vendita.

3.8 Potenziale per ulteriori specifiche

La Svizzera potrebbe introdurre ulteriori requisiti che vadano oltre i nuovi requisiti dell'UE, analoghi a quelli del 2024?

Riscaldatori individuali per ambienti

L'analisi mostra che i requisiti per gli apparecchi di riscaldamento a camera singola in Svizzera hanno già raggiunto un livello molto elevato con le normative che si applicheranno a partire dal 2024. In particolare, il requisito minimo del 39% di efficienza corrisponde quasi al massimo tecnico raggiungibile con questi apparecchi. Un ulteriore inasprimento dei requisiti porterebbe quindi solo ad aumenti marginali dell'efficienza e potrebbe portare i produttori a non essere in grado di offrire prodotti corrispondenti dal punto di vista tecnico o economico. Ciò limiterebbe la scelta degli utenti finali e aumenterebbe inutilmente i costi di acquisto senza contribuire in modo significativo al risparmio energetico.

Un approccio ragionevole è invece quello di incoraggiare gli utenti a passare ad alternative più efficienti, come le pompe di calore o i condizionatori d'aria per ambienti (RAC). I RAC analizzati in questo studio, in particolare i modelli fissi con funzione di riscaldamento, offrono una maggiore efficienza energetica stagionale (SCOP) e possono quindi utilizzare l'energia termica in modo più efficiente. I sistemi di riscaldamento centralizzato, in particolare le pompe di calore, sono anche una soluzione sostenibile a lungo termine, in quanto non solo sono efficienti grazie all'uso di energia rinnovabile, ma riducono anche le emissioni di gas serra.

Raffreddamento tramite RAC portatili

Per i RAC portatili, l'analisi mostra che requisiti più severi per le classi di efficienza energetica (etichetta energetica) non porterebbero alcun miglioramento significativo nel mercato. Il divieto di utilizzare apparecchi inefficienti in classe F non avrebbe alcun effetto significativo, poiché tali apparecchi sono già poco presenti sul mercato. Un requisito più severo, ad esempio la classe E o superiore, d'altra parte, sarebbe troppo ambizioso e comporterebbe uno stress eccessivo per la struttura del mercato. Tali misure non sono quindi raccomandate.

Raffreddamento tramite RAC installati permanentemente < 6 kW

Per i RAC installati in modo permanente con una capacità di raffreddamento inferiore a 6 kW, è stato esaminato il requisito minimo per le classi di efficienza energetica. Un requisito di almeno classe C (SEER ≥ 6,1) sarebbe soddisfatto dal 91% dei modelli attualmente in commercio e avrebbe quindi un impatto minimo sul mercato. Uno standard più elevato, come la classe B (SEER compreso tra 8,5 e 11,6), invece, comporterebbe un notevole inasprimento, dato che solo il 23% degli apparecchi attuali raggiunge questa classe. Sebbene un aumento alla classe B avrebbe potenzialmente un impatto positivo sull'efficienza del mercato, i costi e l'impatto sul mercato richiedono ulteriori studi per valutarne la fattibilità.

Raffreddamento tramite RAC installati in modo permanente 6-12 kW

Questo segmento mostra anche che la maggior parte degli apparecchi soddisfa già classi di efficienza più elevate. Un divieto sugli apparecchi inefficienti delle classi D, E, F o G avrebbe quindi un impatto minimo sulla struttura del mercato. L'80% degli apparecchi è già in classe C o superiore. Sarebbe difficile vietare anche la classe C, dato che solo il 2,4% degli apparecchi presenti sul mercato soddisfa le classi A o B.

Riscaldamento tramite RAC installati in modo permanente < 6 kW

La funzione di riscaldamento in questo segmento è meno diffusa e molti apparecchi soddisfano già classi di efficienza più elevate. Il divieto di utilizzare apparecchi di riscaldamento inefficienti comporterebbe quindi solo piccoli cambiamenti nel mercato. Requisiti più elevati, al di sopra della classe C, potrebbero teoricamente portare a un aumento dell'efficienza, ma anche in questo caso sarebbe necessaria un'analisi più dettagliata.

Riscaldamento tramite RAC installati in modo permanente 6-12 kW

La situazione è simile a quella dei RAC con potenza inferiore. Gli apparecchi più efficienti dominano il mercato e la funzione di riscaldamento è utilizzata solo in misura limitata. Un divieto sugli apparecchi inefficienti avrebbe quindi un impatto limitato, mentre i requisiti più severi, come la classe B, dovrebbero essere esaminati più da vicino.

3.9 Conclusione

L'analisi dimostra che norme più severe in materia di efficienza energetica per i singoli riscaldatori e condizionatori d'aria possono consentire un significativo risparmio energetico e vantaggi economici a lungo termine per gli utenti finali. In particolare, le norme svizzere che entreranno in vigore nel 2024 hanno il potenziale per ridurre significativamente il consumo di elettricità e per introdurre sul mercato tecnologie più efficienti. Ciò avverrà in primo luogo garantendo che gli apparecchi di riscaldamento individuali particolarmente inefficienti vengano eliminati dal mercato.

In secondo luogo, i requisiti incoraggiano il passaggio da apparecchi di riscaldamento individuali inefficienti ad altre tecnologie. Si presume che si tratti principalmente di sistemi di riscaldamento centralizzati, che nella migliore delle ipotesi sono alimentati da una pompa di calore ad alta efficienza energetica. Tuttavia, anche il passaggio alle unità di condizionamento dell'aria come generatori di calore avrebbe un effetto positivo sul consumo energetico, in quanto anche queste sono significativamente più efficienti dei singoli riscaldatori per ambienti.

Va tuttavia sottolineato che i risultati dello studio sono soggetti a notevoli incertezze. Esse derivano dalla limitata disponibilità di dati (soprattutto quelli relativi alle vendite), dalle necessarie ipotesi sulla durata e sull'utilizzo degli apparecchi e dalla modellizzazione delle future tendenze del mercato. Va inoltre ricordato che nella modellizzazione non sono stati presi in considerazione i vari regolamenti e divieti cantonali relativi agli apparecchi di riscaldamento a camera singola. Ciononostante, l'analisi dimostra che l'introduzione e l'ulteriore sviluppo di norme energetiche più severe è utile sia dal punto di vista ecologico che economico.

4 Technischer Bericht (englisch)

Local Space Heaters (LSH) and Room Air Conditioners (RAC),

Scenario modelling for Switzerland

Van Holsteijn en Kemna (VHK), Leo Wierda
Delft (NL), 05.12.2024

Disclaimer:

The study was faced with scarce data availability, and consequently assumptions had to be made, e.g. on unit heat outputs, energy efficiencies, average product lifetimes, the distribution of sales over the various product types, and the distribution of the electricity consumption over the usage sectors and over the product types. Annual sales data have been derived iteratively, such that the target electricity consumption was met, in some cases with disputable results. Hence the results are uncertain.

The data in this report have been retrieved and elaborated to the best of the author's ability and knowledge. However, neither the contractor VHK nor the author personally assume any liability for damages, material or immaterial, that may arise from the use of this document and the data therein.

Contents

1 Introduction

This study regards electric Local Space Heaters (eLSHs) and Room Air Conditioners (RACs) in Switzerland. It presents a Business-as-Usual (BaU) scenario and various ECO scenarios, for discussion with stakeholders.

The BaU scenario includes the effects of currently active regulations [1], but it is presented without (BaU) and with (BaU1) the (assumed) impacts of the increase in Swiss energy efficiency requirements for electric LSHs from 1 January 2024.

The ECO scenarios show the potential impacts in Switzerland of adopting upcoming EU Ecodesign and Energy Labelling regulations for eLSHs and RACs.

LSHs operating on gaseous or liquid fuels were considered in the study but they have a low impact, and no details are reported in this document. The focus is on electric LSHs (eLSHs) and RACs.

LSHs operating on solid fuels (wood, pellets, coal) were excluded from the study.

Initially, the BaU-scenario was developed based on EU27 data for LSHs and RACs, taken from the Ecodesign Impact Accounting (EIA) [2] [3] [4] [5], scaling the data to the Swiss reality. The result was commented by the Swiss Bundesamt für Energie (BFE) [6], showing that the scaling exercise did not lead to realistic results for Switzerland.

Information on sales and stock of eLSHs and RACs in Switzerland is limited. The table below shows retail market data from the FEA [7], but these data do not seem

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[1] Energieeffizienzverordnung, EnEV 730.02, Verordnung über die Anforderungen an die Energieeffizienz serienmässig hergestellter Anlagen, Fahrzeuge und Geräte (November 2017).
„Anhang 1.18 Anforderungen an die Energieeffizienz und an das Inverkehrbringen und Abgeben von Einzelraumheizgeräten" copies the requirements and definitions of EU Regulation 2015/1188, but increases the minimum required seasonal energy efficiency for electric LSHs to 39% from 01.01.2024
„Anhang 1.13 Anforderungen an die Energieeffizienz und an das Inverkehrbringen und Abgeben netzbetriebener Raumklimageräte und Komfortventilatoren" copies the requirements and definitions of EU Regulation 206/2012.

[2] Local Space Heaters (LSH) and Room Air Conditioners (RAC), Proposal for a BaU scenario for Switzerland, Van Holsteijn en Kemna (VHK), Leo Wierda, Delft (NL), 27.07.2023

[3] European Commission, Directorate-General for Energy, Ecodesign impact accounting annual report 2021: overview and status report, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2833/38763

[4] European Commission, Directorate-General for Energy, Ecodesign impact accounting annual report 2023: overview report, status report, and materials and environmental impacts report, October 2023, https://circabc.europa.eu/ui/group/418195ae-4919-45fa-a959-3b695c9aab28/library/c2c3ef00-75a1-46d0-8bce-ad4116236e0a

[5] European Commission, Directorate-General for Energy, Ecodesign impact accounting annual report 2024: overview report, status report, and materials and environmental impacts report, October 2024, to be published

[6] Mail of 31.08.2023 from Paul Stadler (BFE) to Niclas Meyer (BSS)

[7] Fachverband Elektroapparate für Haushalt und Gewerbe Schweiz (FEA) https://fea.ch/marktentwicklung/

to be complete: contributions from some larger wholesalers are not included. In addition, it is not clear to which types of devices the sales refer. For RACs the sales would be expected to mainly refer to portable RACs [8]. For LSHs, the subdivision of the sales over local SHs and central SHs, and over portable and fixed devices is not specified.

Table 1 Sales data for Switzerland reported by FEA

	2015	2016	2017	2018	2019	2020	2021	2022	2023
RAC	10512	11766	11985	12253	18060	22178	18827	7544	10399
LSH	93249	77757	85651	75066	58470	54645 [9]	37561		

Considering that these sales data do not provide a solid basis for scenario analysis, this document attempts to estimate sales and stock from Swiss information on buildings and dwellings using electric resistance heating (ERH), the corresponding heated surfaces, and the electricity consumption for heating and cooling, mainly from the following sources:

[1] Der Energieverbrauch der Privaten Haushalte 2000–2022, Ex-Post-Analyse nach Verwendungszwecken und Ursachen der Veränderungen, Prognos für BFE, November 2023, Bericht 11576, and associated Excel 2024-01 11577-PHH_Webtabellen_2022.xlsx
[2] BfE 11532 - Daten Widerstandsheizungen
[3] BfE 11536 - Analyse des schweizerischen Energieverbrauchs 2000–2022 nach Verwendungszwecken, Infras, TEP, Prognos für BFE, Oktober 2023
[4] Der Bestand an Elektroheizungen in den Kantonen, 1990, 2000 und 2008, Schlussbericht 22. Dezember 2008, Prognos für BFE.
[5] Beschleunigung des Ersatzes von Elektroheizungen, Eine technisch-ökonomische Analyse, Lemon Consult AG für BFE, Bericht vom 31. Januar 2022
[6] Bâtiments selon le système de chauffage et la source d'énergie du chauffage, 26.09.2023
[7] Ersatz von dezentralen Elektroheizungen, Bachelorarbeit von Merlin Hürlimann, 12. Januar 2023, Umweltingenieurswesen, ZÜRCHER HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN
[8] Ersatz der Elektroheizungen: Gewinn für Umwelt, Wirtschaft und Gesellschaft. Greenpeace Schweiz, 2009
[9] Beschleunigung des Ersatzes von Elektroheizungen in der Schweiz, Bericht zu Handen des Bundesrats, BFE, 8 Februar 2022

The sources differ in:

- Years for which data are provided
- Inclusion / exclusion of secondary / holiday dwellings
- Inclusion / exclusion of empty dwellings
- Split or not between mountain-areas and non-mountain areas.
- Buildings (Gebäude) versus dwellings (Wohnungen)
- Split or not between one-, two- and more-family houses.
- Data for all electric resistance heaters or only for electric storage heaters (Speicherheizung)
- All electricity consumption for heating versus electricity consumption by electric resistance heating only.

[8] Fixed RACs are mainly supplied directly by installers, through wholesale channels.
[9] In FEA documentation there are two different values for year 2020: 34637 and 54645.

- Electricity consumption for all electric resistance heaters or split between local heaters and central heaters.
- Inclusion / exclusion of portable electric LSHs (Öfelis)
- Reporting of electricity consumption for real weather or weather corrected.
- Electricity consumption for all sectors, split per usage sector, or only for households.
- Buildings / dwellings using only electric resistance heating versus those using ERH as 2nd or 3rd heater.
- Inclusion / exclusion of auxiliary electricity (Hilfsenergieverbrauch)

Where specific data for Switzerland were not available (e.g. for heating loads and efficiencies), the EU27 data for eLSHs and RACs, as reported in the Ecodesign Impact Accounting reports, have been used as a reference.

Considering in detail all available data, and after several trial calculations, it was decided to develop the BaU scenario by trying to match the reported electricity consumption for electric local space heaters (Table 2): the sales quantities in the analysis model were iteratively adapted until the target electricity consumption was obtained.

Data on the number of buildings / dwellings using electric resistance heating, and their heated surfaces (EBF Energiebezugsfläche) (Table 2) were used as an ex-post check on sales and stock quantities. As signaled in some of the reference documents, the building-related data might be less accurate especially for the non-storage heaters (Direktheizungen). Most likely, portable electric heaters and towel heaters are also not included in the dwelling data.

Table 2 Number of households in Switzerland, number of dwellings using electric local space heaters, dwelling areas with heating covered by eLSHs, and reference electricity consumption by eLSHs.

	1990	2000	2005	2010	2015	2020	2021	2022
Number of households (millions)	2.48	2.85	3.05	3.31	3.58	3.81	3.87	3.92
Number of dwellings using eLSH (thousands) [10]								
Permanently occupied	38.1	43.4	44.2	46.4	51.1	55.7	55.6	55.6
Partially occupied or empty	17.6	25.7	27.2	25.3	18.4	11.4	11.4	11.4
Using eLSH as 2nd or 3rd heater	40.2	35.5	29.2	24.6	22.3	20.1	20.1	20.1
Total, dwellings using eLSH	95.9	104.6	100.6	96.3	91.8	87.2	87.1	87.1
Dwelling areas heated by eLSHs (Mio m2) [11]								
Permanently occupied	5.7	6.2	6.4	6.5	6.5	6.5	6.5	6.5
Secondary / holiday houses	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3

[10] Based on references [4] and [5]. This might reflect mainly the use of local electric storage heaters, and not the use of other fixed electric heaters, portable heaters and towel heaters.

[11] Energiebezugsfläche (EBF), based on references [1], [2], [3]. This might reflect mainly the use of local electric storage heaters, and not the use of other fixed electric heaters, portable heaters and towel heaters. The number of dwellings and the areas do not seem to match, i.e. for permanently occupied dwellings, dividing areas by number of dwellings, the area per dwelling would decrease from 140 m2 in 2010 to 117 m2 in 2020. For secondary / empty dwellings it would increase from 71.3 m2 in 2010 to 159 m2 in 2020. For all dwellings it increases from 86 m2 in 2010 to 96 m2 in 2020.

	1990	2000	2005	2010	2015	2020	2021	2022
Empty dwelling areas	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total, dwelling areas using eLSH	7.3	7.9	8.2	8.3	8.2	8.3	8.3	8.3
Electricity consumption by eLSH (TWh/year)								
Portable eLSHs (mobile, Öfelis), in households [12]		0.46	0.42	0.38	0.36	0.34	0.33	0.32
Fixed eLSH in households (except towel heaters) [13]	0.65	0.81	0.81	0.79	0.75	0.73	0.72	0.72
Fixed eLSH in other sectors (except towel heaters) [14]	0.13	0.17	0.17	0.16	0.15	0.15	0.15	0.15
Fixed eLSH, total in all sectors (except towel heaters)	0.79	0.98	0.98	0.95	0.91	0.87	0.87	0.87
Reference electricity consumption for towel heaters [15]	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Electricity consumption by RACs (TWh/year)								
RACs in private households, real weather [16]		0.01	0.04	0.06	0.08	0.13	0.08	0.23
RACs in private households, weather corrected [17]		0.01	0.04	0.06	0.08	0.13	0.12	0.15

The analysis model calculates the electricity consumption as stock [18] times annual heat output per LSH divided by average stock efficiency. On their turn, stock quantities are derived from sales quantities using the average lifetime of the products [19]. The following assumptions have been made for lifetimes, efficiencies and heating loads (further details in chapter 2):

- Following comments by BFE, average product <u>lifetimes</u> for eLSHs have been increased compared to those used in EU analyses.

- The average <u>efficiency</u> of eLSHs sold in a given year has been kept identical to the values used in EU analyses. However, due to using longer lifetimes, the average efficiency of the stock is slightly lower than in the EU analysis.

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[12] Based on reference [2]. No distinction made in the source between 'real weather' and 'weather corrected'.
[13] Based on reference [2], weather corrected, assuming that 25% (ref.[2], year 2000) of the reported electricity consumption for electric resistance heaters in households is consumed by local space heaters (and not by central electric resistance heaters). In addition, approximately 7% has been subtracted for electric towel heaters.
[14] Assuming that 83% (ref.[3]) of the total electricity consumption for local electric resistance heaters is consumed in households, and thus 17% in other sectors.
[15] Estimated as 7% of the electricity consumption of eLSHs (except portables) in households (7% derives from original proposal for CH BaU scenario).
[16] Based on reference [1] table 8 and reference [3] table 51, for real weather (not weather corrected). For services sector and industry, reported electricity consumption in [3] includes mainly central air conditioning, and is thus not reported here.
[17] Values for real weather corrected by the ratio between the real CH cooling-degree days from "Analyse des schweizerischen Energieverbrauchs 2000–2021 nach Verwendungszwecken, Infras, TEP, Prognos, Oktober 2022", Tabelle 11 & Bundesamt für Energie BFE, Ex-Post-Analyse des Energieverbrauchs der schweizerischen Haushalte 2000 bis 2017 nach Bestimmungsfaktoren und Verwendungszwecken tabelle 7,
and the average trend in cooling-degree-days from
"EP2050+_Ergebnissynthese_2020-2060_WWB_KKW50_aktuelleRahmenbedingungen_2022-04-12.xlsx", Tabelle 01-06
[18] The term 'stock' in this document indicates the quantity of devices that is in use / operating in Switzerland.
[19] but the same stock can be obtained from different sales distributions in previous years

- The average unit heat output (unit load) for eLSHs and the average cooling demand for RACs have been derived from EU loads, scaling them for differences between CH and EU in dwelling size, heating-degree-days and cooling-degree-days.

- Information on the distribution of Swiss eLSH sales over the product types is limited but the distribution differs from the one used in EU analyses. In the EU distribution, fixed eLSH > 250 W (without storage) are dominant, while in Switzerland storage heaters are (or were) dominant.

- BFE indicated that RACs are a niche market in Switzerland, with fixed RACs hardly being used in households, where portable RACs are dominant. Consequently, for RACs the EU sales distribution over fixed < 6 kW, fixed 6-12 kW and portable RACs < 12 kW has been changed for Switzerland. In addition, the household usage share of fixed RACs has been reduced.

- As regards the impact of the Swiss 2024 measures on eLSHs, it has preliminarily been assumed that the required increase in efficiency leads to a decrease of 25% in the sales of eLSHs (towel heaters excepted) over the period 2024 – 2026. As indicated by BFE, these sales are NOT assumed to shift to RACs, but to central heating solutions (which are outside the scope of the analysis).
  The results are reported separately for the BaU scenario without the Swiss 2024 measures, and the BaU1 scenario with the Swiss 2024 measures. The difference between the two scenarios indicates the additional heat load to be covered by central heating solutions [20].

The developed BaU scenario matches the electricity consumption for eLSHs and RACs reported in the Swiss reference documents. However, the underlying estimated sales and stock remain uncertain. The discussion with stakeholders aims at improving and consolidating these data for Switzerland.

The ECO-scenarios reflect the change in impacts compared to the BaU or BaU1 scenario, for the following measures (see chapter 9):

- ECO1: Application of the 2024 Swiss energy efficiency requirements also to towel heaters (currently they are exempted).

- ECO2: Substitution of the 2024 Swiss energy efficiency requirements for eLSHs by a minimum energy label class requirement, according to the currently proposed revised EU labelling classification.

- ECO3: Application of a more severe minimum energy label class requirement for RACs, especially for portable RACs.

[20] at the moment this is not further used in this study

2 Sales, Stock and Electricity consumption

This chapter presents the model assumptions and results for the BaU and BaU1 scenarios for sales, stock, lifetimes, efficiencies, heating and cooling loads, and electricity consumption. The presentation is subdivided in:

- Portable electric local space heaters (Öfelis)
- Electric towel heaters
- Fixed electric local space heaters (except towel heaters)
- Room Air Conditioners
- Combinations

2.1 Portable electric local space heaters (Öfelis)

Separate electricity consumption data are available in ref. [2] for portable eLSHs, see Table 2. The derivation of sales and stock for these portables has therefore been separated from those for the other eLSHs.
Main assumptions:

- Average lifetime in CH is 12 years, compared to 9 years in the EU27.

- The share of portables sold to households in CH is 90%, compared to 66% in the EU27.

- The average annual heat output per device, initially scaled up from EU values, has been further increased by a factor 2.5, to reduce stock quantities [21] (Figure 3).

- Heating efficiencies for portable eLSHs have been copied from the EU analysis. It is assumed that due to the Swiss 01.01.2024 measures (required increase to 97.5% electric efficiency) the sales quantities of portables decrease by 25% over the period 2024-2026.

The figures below present model results for sales, stock, heat output, efficiency and electricity consumption.

[21] The annual heat output for portable eLSHs in Switzerland is now 630 kWh in 2022, while in the EU analysis it is 229 kWh. The EU value is based on an average capacity of 1 kW and a load factor of 0.5, i.e. EU users are expected to use the portable eLSH on average at half capacity. The device is then in use for 458 hours per year. Assuming the same powers in Switzerland, devices would be in use for 1260 hours per year.

Figure 1 Sales quantities (thousands) for portable electric local space heaters in Switzerland.

In 2022, sales are approximately 10 units per 1000 CH households [22].

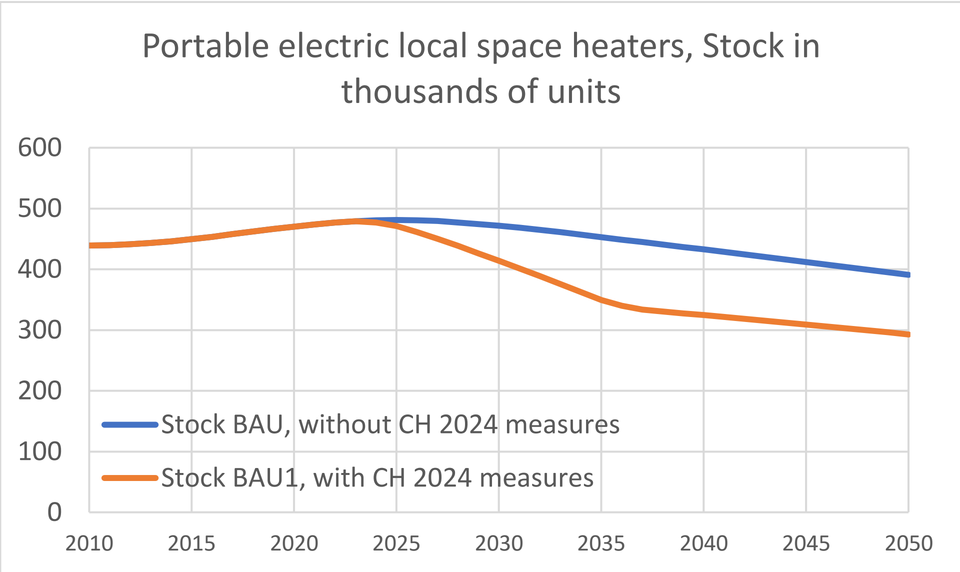

Figure 2 Stock quantities (thousands) for portable electric local space heaters in Switzerland.

In 2022, the stock is approximately 120 units per 1000 CH households [23].

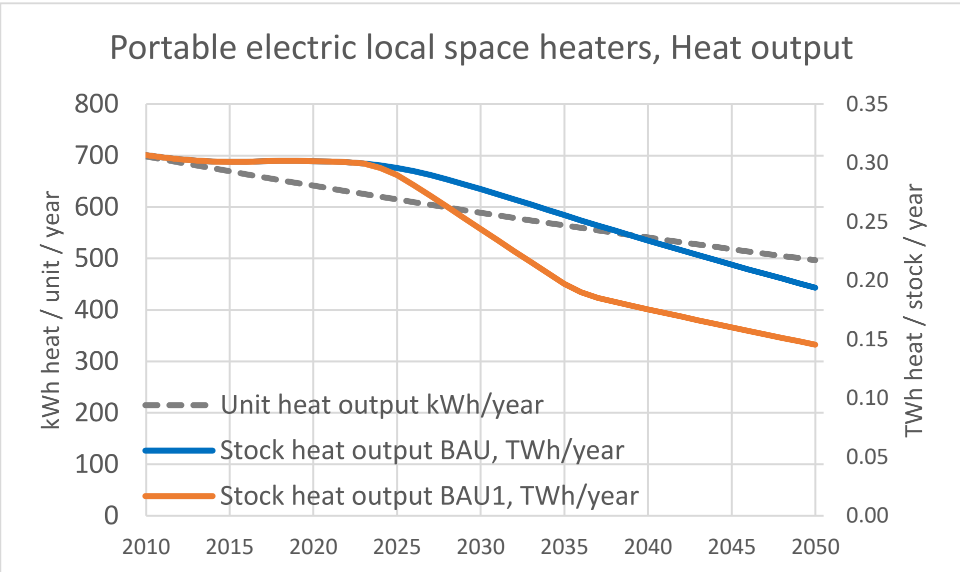

Figure 3 Annual heat output for portable electric local space heaters in Switzerland, per unit in kWh/year and for the stock in TWh / year.

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[22] In 2021, the sales quantities are close to the 38 thousand reported by FEA (Table 1), but in 2015 they are much lower than FEA's 93 thousand. However, FEA's sales seem to be incomplete while they probably cover also eLSHs other than portables.

[23] The stock is much smaller than the 'Rund 1,5 Mio. mobile Elektroöfen' in 2009 mentioned by Greenpeace in reference [8]. They also have a higher electricity consumption (0.6 TWh in 2009, compared to 0.43 TWh here). If stakeholders find the proposed stock of nearly 500 thousand units in 2020 too low, the annual heat output per unit can be reduced to increase sales and stock.

The annual heat output per device decreases over time (grey dashed curve), due to decreasing heating-degree-days and increasing degree of dwelling insulation. The blue and orange curve show the heat output of the stock of portable eLSHs. The difference between the two curves is the heat load no longer covered by portable eLSHs due to the Swiss 1.1.2024 measures (under the assumptions made). In 2035, the reduction in heat output is 0.06 TWh (0.22 PJ).

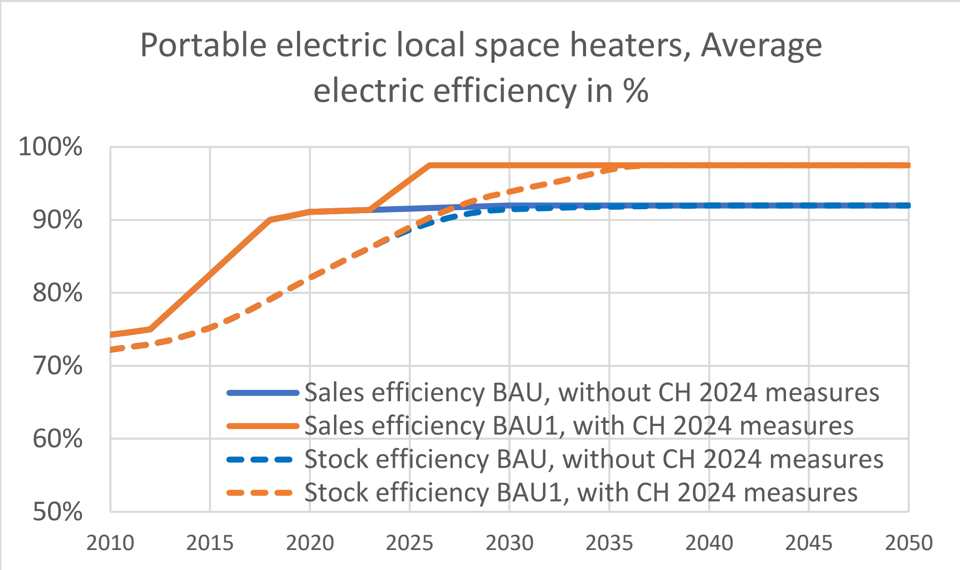
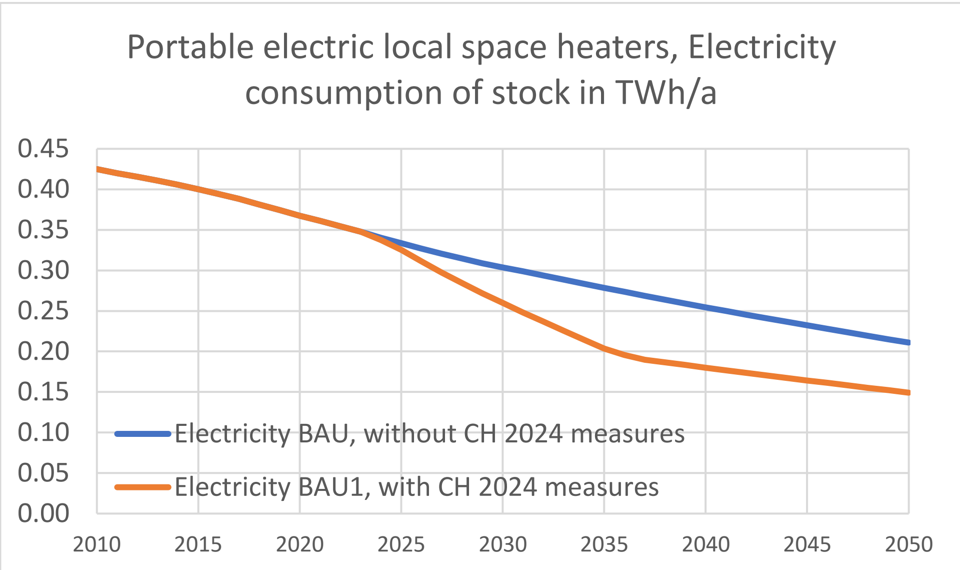


Figure 4 Electric efficiency of portable electric local space heaters in Switzerland, average for unit sold in year (solid curve) and for units in stock in year (dashed curve).

The increase in average sales-efficiency (heat output divided by electricity input) after 2012 is due to existing EU Ecodesign regulation, adopted also by Switzerland. The further increase to 97.5% around 2024 (in the orange curve) is due to the Swiss 1.1.2024 measures. Changes in the average efficiency of the stock (which is a mix of devices sold in previous years) are slower than for the sales average.



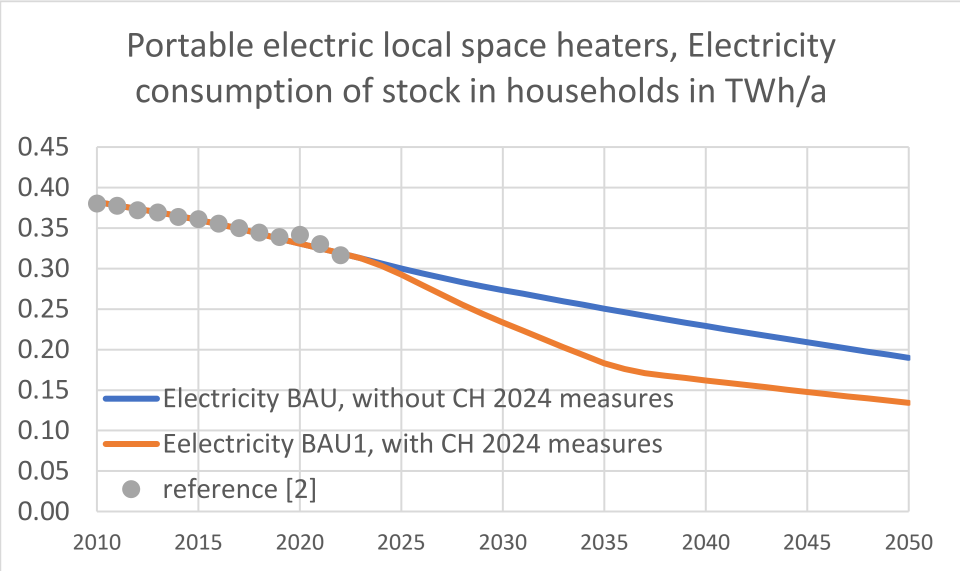


Figure 5 Annual electricity consumption (TWh/year) of the stock of portable electric local space heaters in Switzerland, for all usage sectors (top) and for households (bottom)

The electricity consumption by portable eLSHs in households (Figure 5, bottom graph) closely matches the consumption reported in ref. [2] (grey dots in the graph). In 2035, the reduction in electricity consumption due to Swiss 01.01.2024 measures is 0.07 TWh (0.25 PJ) [24].

[24] However, part of the heat load no longer covered by portable eLSHs will have to be covered in another way, e.g. by central heating systems, and will lead to additional energy consumption there.

2.2 Electric towel heaters

Towel heaters are a somewhat special type of eLSH. In the former EU regulation 2015/1188 on LSHs it was not completely clear if towel heaters were in scope or not, but the revised EU regulation 2024/1103 clearly puts them in scope, with their own specific requirements.

According to BFE, the 1.1.2024 Swiss measures do not apply to towel heaters. Consequently, the BaU1 scenario (which applies those measures) is not applicable for towel heaters.
The analysis for the ECO1 scenario assumes that the minimum electric efficiency of 97.5% will apply also to towel heaters, starting from 2026, and that this will lead to a 25% decrease in towel heater sales over the period 2026-2028 (see further in section 9.2).

Sales and stock for towel heaters have been estimated separately from the other fixed eLSHs. No reference electricity consumption is available specifically for towel heaters. It has been (roughly) estimated that towel heaters consume 7% of the total consumption for fixed eLSHs (0.87 TWh in 2020 in ref. [2] => 0.06 TWh for towel heaters, see Table 2) [25].

Main assumptions:

- Average lifetime is 20 years in CH, compared to 15 years in the EU27.
- 98% of the towel heaters is sold to households.
- The average annual heat output per device is close to the one used in the last EU27 analysis (270 kWh heat in 2020) [26].
- Heating efficiencies for towel heaters have been copied from the EU analysis (Figure 8).

[25] It is uncertain if the electricity consumption in ref. [2] also includes towel heaters, but it has been assumed that this is the case.
[26] For towel heaters it seems reasonable to assume that CH and EU unit heat load are similar: the influence of differences in heating-degree-days and degree of building insulation is smaller than for other types of eLSHs.

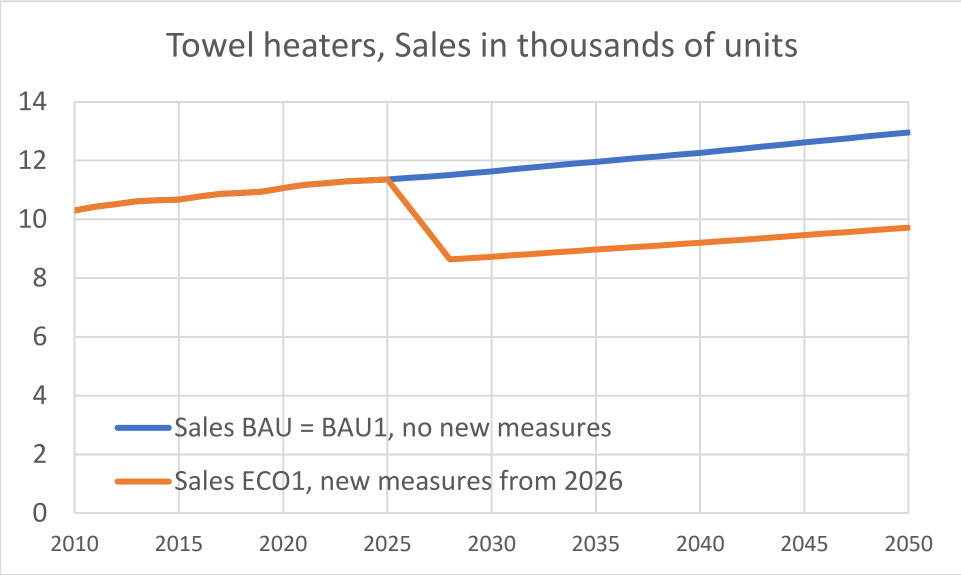


Figure 6 Sales quantities (thousands) for electric towel heaters in Switzerland, for the BaU scenario without new measures (blue curve) and for the ECO1 scenario with new minimum efficiency requirements from 2026 (orange curve).

In 2022, sales are approximately 3 units per 1000 households.

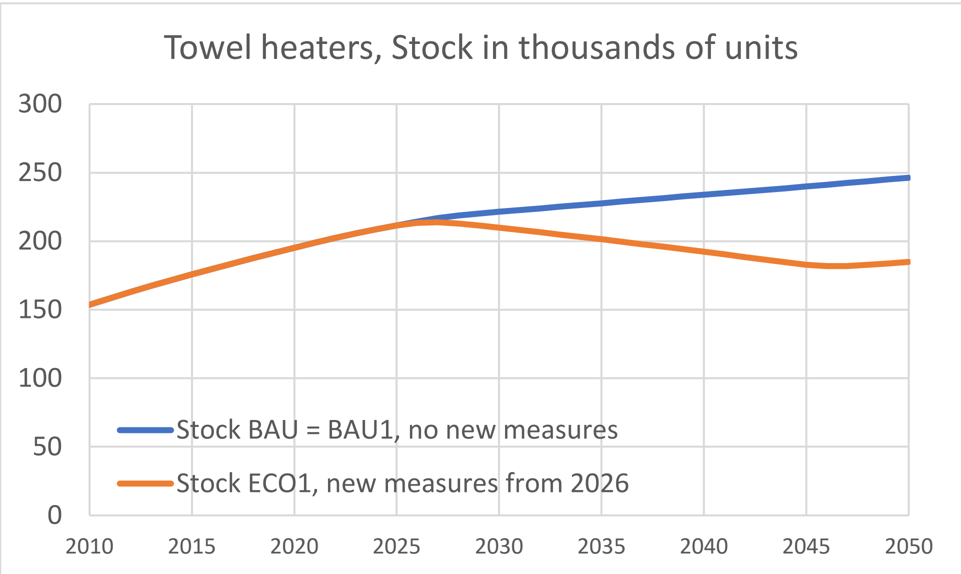


Figure 7 Stock quantities (thousands) for electric towel heaters in Switzerland, for the BaU scenario without new measures (blue curve) and for the ECO1 scenario with new minimum efficiency requirements from 2026 (orange curve).

In 2022, the stock is approximately 50 units per 1000 households.

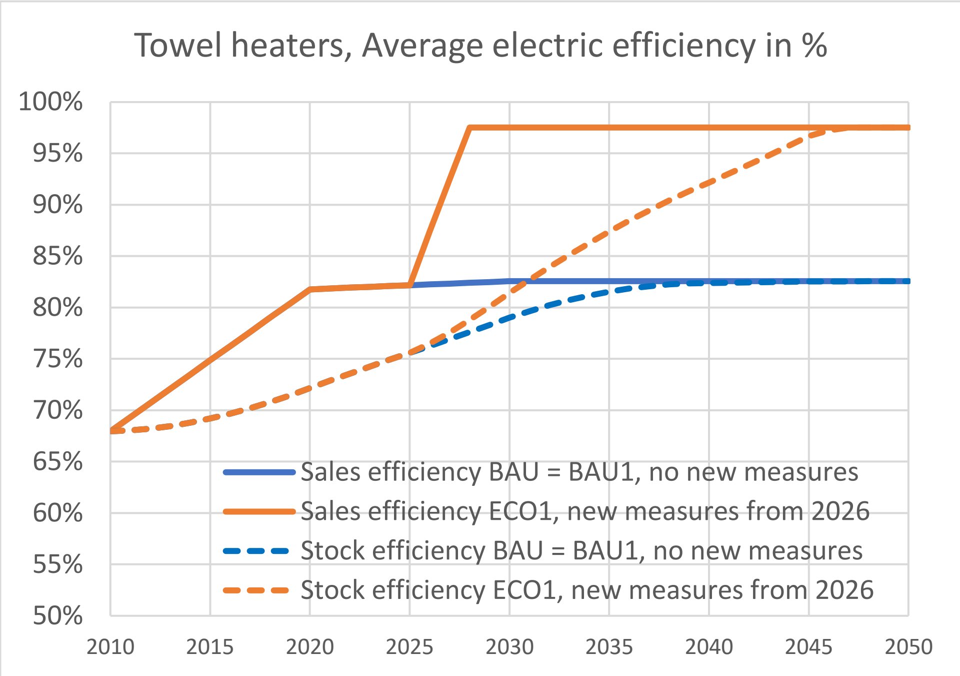


Figure 8 Electric efficiency of electric towel heaters in Switzerland, average for unit sold in year (solid curves) and for units in stock in year (dashed curves), for the BaU scenario without new measures (blue curves) and for the ECO1 scenario with new minimum efficiency requirements from 2026 (orange curves).

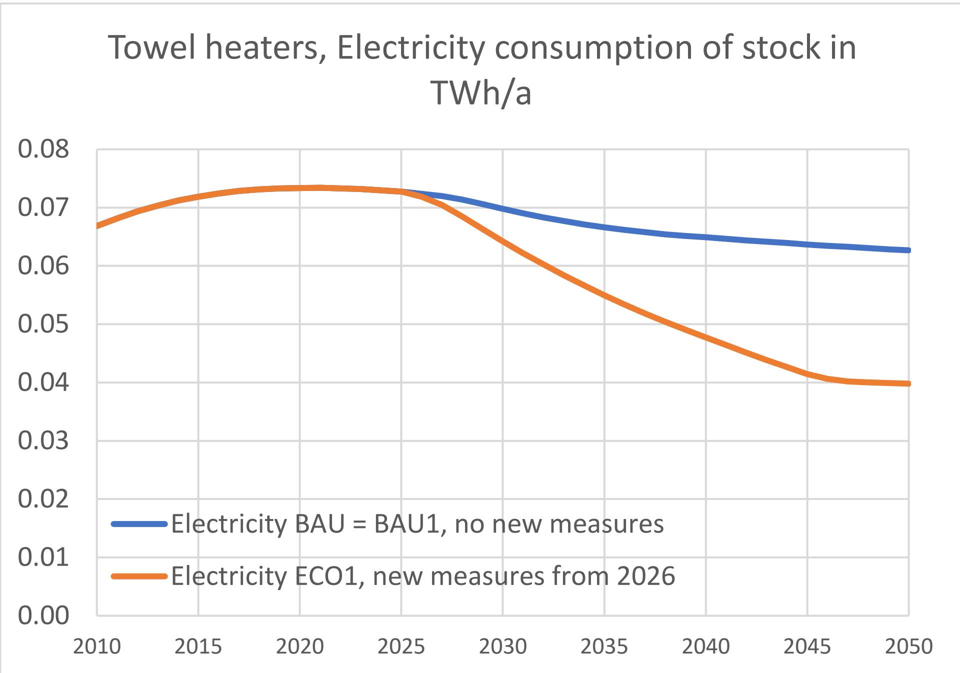


Figure 9 Annual electricity consumption (TWh/year) of the stock of electric towel heaters in Switzerland, for the BaU scenario without new measures (blue curve) and for the ECO1 scenario with new minimum efficiency requirements from 2026 (orange curve).

2.3 Fixed electric local space heaters (except towel heaters)

According to ref. [2], the electricity consumption by electric resistance heaters used in households in 2020 is 11.5 PJ or 3.6 TWh (weather corrected). Considering several references, approximately 25% of this is for fixed local electric heaters in households (0.8 TWh). Subtracting 0.07 TWh for the towel heaters and considering that the consumption in households is 83% of the total consumption over all sectors, the 2020 electricity consumption for fixed eLSH except towel heaters is 0.87 TWh for all usage sectors (Table 2).

Comparison with the initial analysis:

- Average lifetimes are shown in the table below. As indicated by BFE, for most product types the lifetime is higher in Switzerland than in the EU27 analyses:

Average lifetime in years	CH	EU27
LH Electric fixed > 250W	30	15
LH Electric fixed ≤ 250W	25	15
LH Electric storage	30	15
LH Electric underfloor	35	35
LH Electric visibly glowing > 1.2 kW	15	10
LH Electric visibly glowing ≤ 1.2 kW	15	10

- 83% of the fixed eLSHs is sold to households.

- The average annual heat output per device (see table below) has been set 10% higher than the EU27 value of the 2024 Ecodesign Impact Accounting [5], to reflect differences in degree of building insulation and heating-degree-days between Switzerland and the EU27.
  The heat load decreases over time, reflecting trends in building insulation and heating-degree-days.
  The average annual heat output for storage heaters is higher than for the other types. This has consequences when reducing the share of storage heaters in the sales (see below): one storage heater has to be replaced by more than one other eLSH to maintain the same heat output (and electricity consumption).

Annual Heat Output per unit (kWh/unit/a)	2010	2015	2020	2025	2030
LH Electric fixed > 250W	904	882	857	831	802
LH Electric fixed ≤ 250W	226	220	214	208	201
LH Electric storage	1658	1617	1572	1523	1471
LH Electric underfloor	537	524	509	493	476
LH Electric visibly glowing > 1.2 kW	1074	1047	1018	987	953
LH Electric visibly glowing ≤ 1.2 kW	537	524	509	493	476

- The sales-average efficiencies of fixed eLSHs have been copied from the EU27 values in the Ecodesign Impact Accounting [3]. Stock-average efficiencies for the CH analysis are lower than those for the EU27 due to the longer product lifetimes.

Sales-average efficiency (%)	**2010**	**2015**	**2020**	**2025**	**2030**
LH Electric fixed > 250W	78%	83%	91%	92%	92%
LH Electric fixed ≤ 250W	73%	78%	85%	85%	86%
LH Electric storage	74%	86%	96%	97%	97%
LH Electric underfloor	74%	77%	80%	80%	80%
LH Electric visibly glowing > 1.2 kW	76%	81%	89%	89%	90%
LH Electric visibly glowing ≤ 1.2 kW	69%	74%	81%	81%	82%

- In the EU distribution of sales over the fixed eLSH types, fixed eLSH > 250 W are dominant. This is not representative for Switzerland, where storage heaters were dominant. The sales distribution used for Switzerland is shown in the table below.
  In 2010 and before, the 60% sales share for storage heaters is an estimate, considering that the majority of eLSHs in Switzerland were of the storage type (speicherheizung). An exact share could not be determined from the available data. The approximately 8% for underfloor heating comes from reference [5] abbildung 51. Other percentages in 2010 are estimates inspired on the EU distribution.
  As indicated by BFE, after 2010 the share of storage heaters in the sales goes down. The decreasing percentages in the table are an assumption (no data available). The shares for the non-storage heaters were increased in parallel to maintain a total of 100%.

Shares in annual sales (%)	**2010**	**2015**	**2020**	**2025**	**2030**
LH Electric fixed > 250W	18%	23%	27%	29%	32%
LH Electric fixed ≤ 250W	2%	3%	3%	3%	4%
LH Electric storage	60%	50%	40%	35%	30%
LH Electric underfloor	8%	10%	12%	13%	14%
LH Electric visibly glowing > 1.2 kW	9%	11%	14%	15%	16%
LH Electric visibly glowing ≤ 1.2 kW	3%	4%	5%	5%	5%

- It is assumed that due to the Swiss 01.01.2024 measures (required increase to 97.5% electric efficiency) the sales quantities for all types of fixed eLSH (except towel heaters) decrease by 25% over the period 2024-2026 (BaU1 scenario, see further in section 9.3).

Figure 10 shows the sales for fixed eLSH over the period 1990-2050. For the period 1990-2022 the sales have been determined iteratively, trying to match the electricity consumption. Although many attempts have been made, the sales distribution over the years remains disputable. The initial increase in the period

1990 to 2000 corresponds to the increase in electricity consumption (Figure 13). After 2000, the electricity consumption first stabilizes and then decreases. This is mainly due to the decrease in heat load and the increase in efficiency over the years. The implication is that the stock must remain stable, and this means that the sales in the period following 2000 are replacement sales for the heaters sold after 1970 that reach their end-of-life after 2000 [27]. As those sales are relatively low, after 2000 the sales quantities drop.
After 2010, the decrease in electricity consumption is smaller than the combined effect of decreasing heat loads and increasing efficiencies. This means that the stock must increase to match the electricity consumption, and this requires additional sales after 2010. In addition, increasing quantities of products sold over the period 1980-1990 reach their end-of-life in the period 2010-2020, leading to an increase in replacement sales. A third but smaller effect is, that starting from 2010, the share of storage heaters in the sales has been reduced, and the share of the other fixed eLSHs correspondingly increased. As storage heaters have a higher unit heat load than the other fixed eLSHs, the total sales have to increase to maintain the total heat output level that leads to the target electricity consumption.
After 2022, where there is no target electricity consumption to match, sales in the BaU scenario have been assumed to decrease by 1.5% per year.

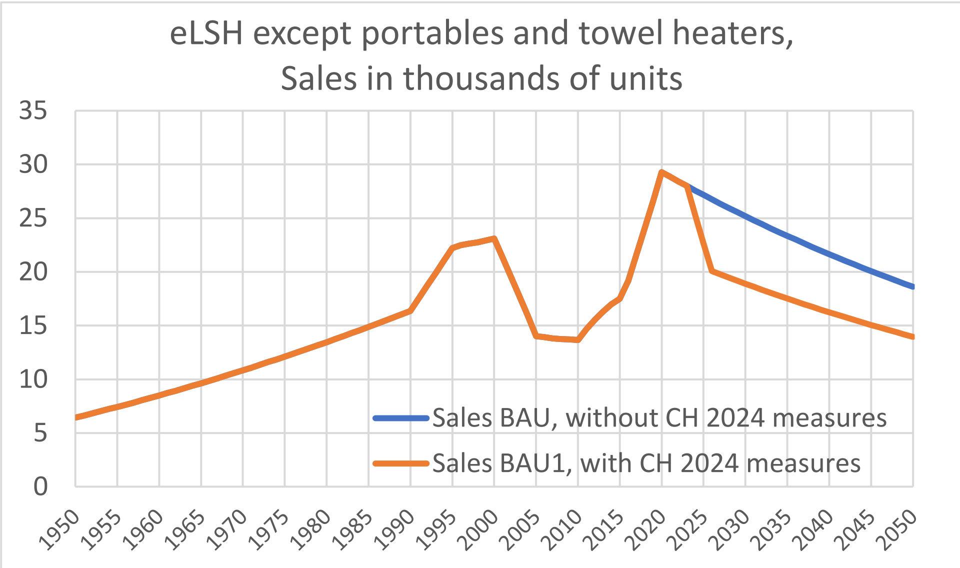


Figure 10 Sales quantities (thousands) for fixed electric local space heaters in Switzerland.

In 2022, sales are approximately 7 fixed eLSHs (except towel heaters) per 1000 households.

[27] The most important heater types for the electricity consumption have a lifetime of 30 years, and thus those sold around 1970 disappear from the stock around 2000.

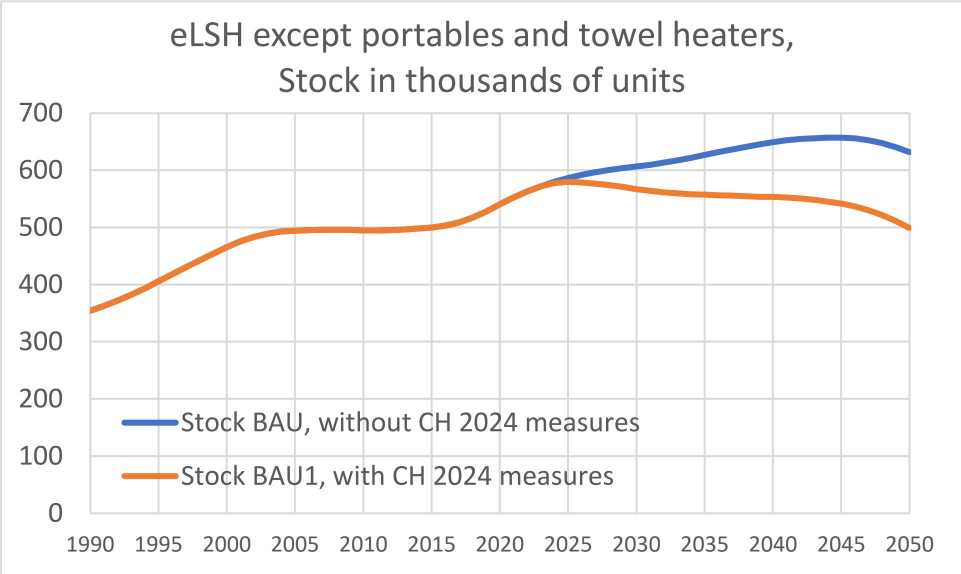


Figure 11 Stock quantities (thousands) for fixed electric local space heaters in Switzerland.

In 2022, the stock of 563 thousand fixed eLSH except towel heaters implies:

- 144 units per 1000 households.
- 10 units per permanently occupied dwelling using only local electric resistance heating.
- 6 units per dwelling using local electric resistance heating (including also empty dwellings, secondary and holiday houses, and dwellings using electric as 2^{nd} or 3^{rd} heater).
- 11.6 m2 per device when counting only the area of permanently occupied dwellings using only local electric resistance heating.
- 14.8 m2 per device when counting the entire area of dwellings using local electric resistance heating (including also empty dwellings, secondary and holiday houses, and dwellings using electric as 2^{nd} or 3^{rd} heater).

In the above, the number of eLSHs per dwelling seems rather high while the areas covered per single device seem small. This could be due to Swiss dwelling and area statistics covering only storage heaters and not all fixed eLSHs.

When counting only the stock of local electric storage heaters (319 thousand in 2022), the following numbers result:

- 6 units per permanently occupied dwelling using only local electric resistance heating.
- 4 units per dwelling using local electric resistance heating (including also empty dwellings, secondary and holiday houses, and dwellings using electric as 2nd or 3rd heater)
- 20 m2 per device when counting only the area of permanently occupied dwelling using only local electric resistance heating.
- 26 m2 per device when counting the entire area of dwellings using local electric resistance heating (including also empty dwellings, secondary and holiday houses, and dwellings using electric as 2^{nd} or 3^{rd} heater).

The latter numbers seem more reasonable.

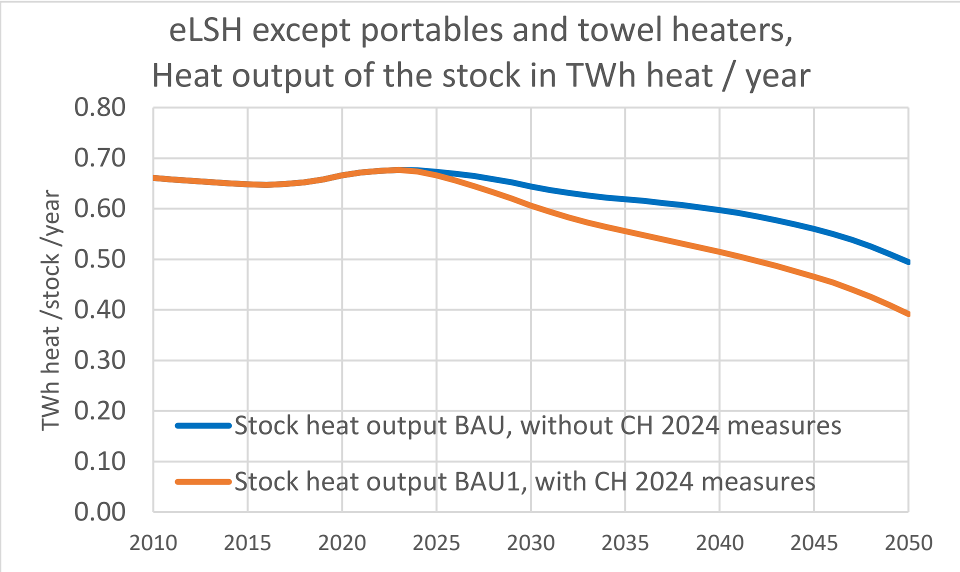


Figure 12 Annual heat output of the stock of fixed electric local space heaters (except towel heaters) in Switzerland, in TWh / year.

Due to climate changes and building insulation improvements, the annual heat output per fixed eLSH decrease over the years (table above). For local electric storage heaters in 2022 the annual heat output per device is 1553 kWh. In reference [5] table 5, the average heating energy [28] need for a house in Switzerland is estimated between 16000 and 20000 kWh and would thus need 10-13 local storage heaters. However, the values in [5] are an average of central heated (majority) and local heated (minority) dwellings. For dwellings that use only local heaters, the real average heat load would be expected to be smaller. The 6 units per permanently occupied dwelling derived above multiplied by 1553 kWh heat per storage heater give 9300 kWh heat per year, which seems reasonable.

The blue and orange curve in the above graph show the heat output of the stock. The difference between the curves shows the heat load no longer covered by fixed eLSHs (except towel heaters) due to the Swiss 1.1.2024 measures. In 2040, the reduction in heat output is 0.09 TWh (0.32 PJ).

[28] The data are interpreted as heating energy, not electric energy, and they seem to be without warm water production, but some uncertainty remains.

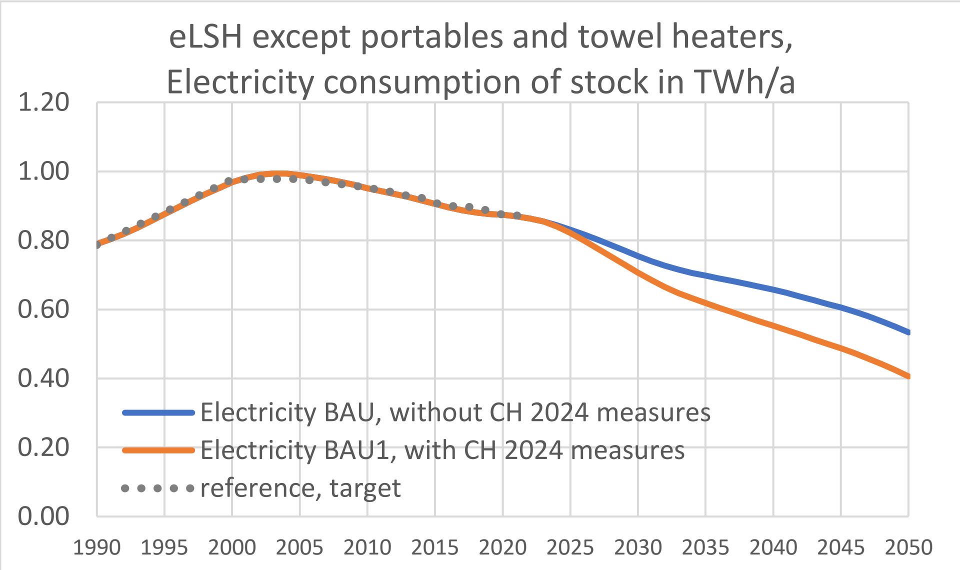


Figure 13 Annual electricity consumption (TWh/year) of the stock of fixed electric local space heaters (except towel heaters) in Switzerland.

The electricity consumption by fixed eLSHs except towel heaters closely matches the consumption reported in ref. [2] (grey dots in the graph, see Table 2). In 2040, the reduction in electricity consumption due to Swiss 1.1.2024 measures is 0.11 TWh (0.40 PJ) [29].

2.4 Room Air Conditioners

According to ref. [1], table 8, the household electricity consumption for space cooling (not including ventilation and humidification) is 0.01 TWh in 2000, 0.08 TWh in 2016, 0.13 TWh in 2020, and 0.23 TWh in 2022 (Table 2). These values are for real weather and therefore variable over the years [30]. The weather-corrected values (also reported in Table 2) have been used as a reference for the cooling electricity consumption by RACs in households.
Ref. [3] table 51 gives the same values for households, and additional values for space cooling in the services sector and industry. However, the largest part of the latter is consumed by central air conditioners, and therefore not useful as a target for electricity consumption by RACs.

Main assumptions:

- Average lifetimes are 12 years for fixed RACs and 10 years for portable RACs. This is the same as in the EU27 analyses.

- RACs are sold both for residential and non-residential use. Following comments from BFE, the share of RACs that is sold to and used in the CH residential sector has been changed compared to the EU27 average:

[29] However, part of the heat load no longer covered by fixed eLSHs will have to be covered in another way, e.g. by central heating systems, and will lead to additional energy consumption there.
[30] For example, 2021 was cooler than average, with an electricity consumption for cooling of only 0.08 TWh, but 2022 was very warm, with a consumption of 0.23 TWh.

Residential share of RAC sales	CH	EU27
RAC fixed < 6 kW	33%	71%
RAC fixed 6-12 kW	20%	46%
RAC portable < 12 kW	90%	79%

- The distribution of sales in Switzerland over fixed RAC < 6 kW, fixed RAC 6-12 kW and portable RACs (overall and in households) is shown in the table, for all sectors together and for the residential sector alone. EU27 shares are shown for comparison. In Switzerland, the sales share of fixed RACs < 6 kW is smaller, and the shares for fixed RACs 6-12 kW and portable RACs is higher.

Share of RAC sales per type ALL SECTORS	2010	2015	2020	2025	2030		EU 2010	EU 2020
RAC fixed < 6 kW	39%	44%	39%	50%	49%		70%	59%
RAC fixed 6-12 kW	32%	34%	27%	28%	30%		17%	20%
RAC portable < 12 kW	30%	23%	34%	22%	22%		13%	21%
Share of RAC sales per type RESIDENTIAL	**2010**	**2015**	**2020**	**2025**	**2030**			
RAC fixed < 6 kW	28%	35%	26%	39%	39%			
RAC fixed 6-12 kW	14%	16%	11%	13%	14%			
RAC portable < 12 kW	58%	49%	63%	48%	47%			

- All RACs are used for cooling. The share of fixed RACs that is also being used for heating is indicated in the table below. Heating by portable RACs is not considered.

Share of RACs also being used for heating	2010	2015	2020	2025	2030
RAC fixed < 12 kW	38%	48%	60%	70%	80%

- The average annual cooling load per RAC in CH has been set (much) higher than in EU27 analyses. On average, cooling-degree-days in CH are a factor 1.89 higher than in the EU27, but CH cooling loads for fixed RACs have been set a factor 2.25 higher than in the EU27, and for portable RACs a factor 3.2, to get a lower stock. The CH cooling load increases with the years, to reflect climate change trends.

Unit annual cooling load kWh cool /unit /a	2010	2015	2020	2025	2030		EU all years
RAC fixed < 6 kW	2713	2734	2756	2778	2801		1225
RAC fixed 6-12 kW	5503	5547	5591	5636	5681		2485
RAC portable < 12 kW	1151	1161	1170	1179	1189		365

- The average annual heating load per fixed RAC in CH has been set 10% higher than in recent EU27 analyses [31], to reflect differences in heating-degree-days and average dwelling size. The CH cooling load decreases with the years, to reflect climate change trends. Heating by portable RACs is not considered.

Unit annual heating load kWh cool /unit /a	**2010**	**2015**	**2020**	**2025**	**2030**		**EU 2020**
RAC fixed < 6 kW	3594	3444	3300	3162	3030		3000
RAC fixed 6-12 kW	6709	6429	6160	5903	5656		5600
RAC portable < 12 kW	0	0	0	0	0		0

- Cooling and heating efficiencies for RACs have been copied from the EU27 sales-average values, as reported in the Ecodesign Impact Accounting [5].

Sales-average efficiency	**unit**	**2010**	**2015**	**2020**	**2025**	**2030**
RAC fixed < 6 kW, cooling	SEER	4.81	6.00	6.36	6.71	7.07
RAC fixed 6-12 kW, cooling	SEER	4.58	5.80	6.01	6.23	6.44
RAC portable < 12 kW, cooling	SEER	1.65	1.83	1.87	1.91	1.96
RAC fixed < 6 kW, heating	SCOP	3.34	4.00	4.09	4.17	4.26
RAC fixed 6-12 kW, heating	SCOP	3.26	4.00	4.04	4.09	4.13
RAC portable < 12 kW, heating						

- According to the European product database EPREL, only 0.06% of the RAC models for cooling are fixed double duct. For models also used for heating the share of fixed double duct is 0.17%. Consequently, it is not worthwhile to separately include fixed double duct models in the scenario analysis.

- Single-duct models are assumed to be all portable RACs and used only for cooling. Hence, they are covered by the portable RACs in the scenario analysis.

- Ducted-splits models (where ducted refers to the distribution of cold air within the dwelling, and not to the exchange with the outside air) are considered by the Ecodesign Impact Accounting as central air conditioners, subject to EU regulation 2016/2281. However, according to recent data from BRG, 90% of the sales of ducted-splits is below 12 kW and these would be subject to EU regulation 206/2012 for room air conditioners [32]. Sales of ducted-splits in EU are 3-4% of the sales for (other) RACs. For the scenario analysis made here, it is assumed that ducted-splits sales are included in the sales for fixed RACs.

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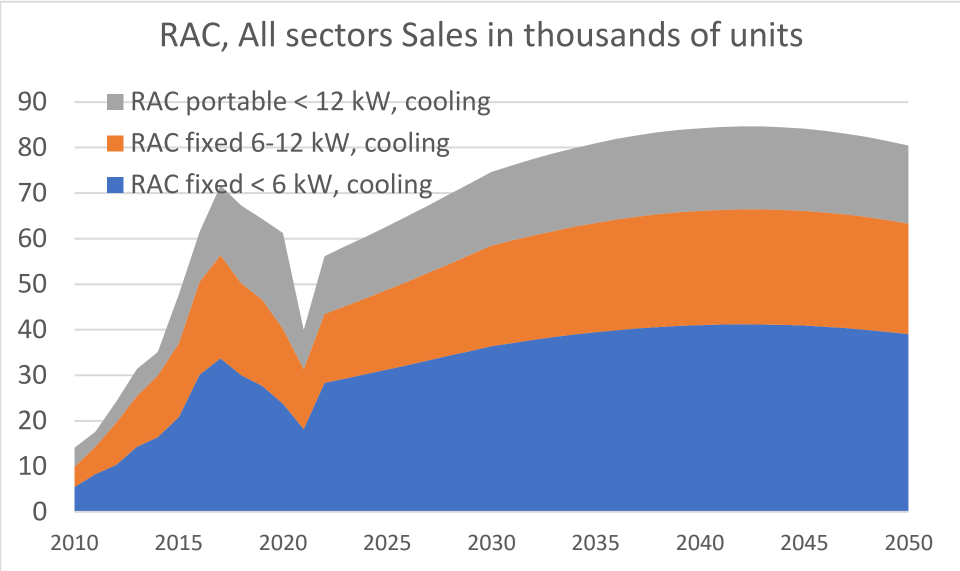
[31] The EU27 values from the ongoing review study on RACs have been used, because they are more recent than the (higher) values in the Ecodesign Impact Accounting.

[32] The EIA is currently verifying if a part of ACs registered under central ACs should be shifted to RACs, or if ducted-splits below 12 kW are counted twice, as central ACs and as RACs.

- Following indications from BFE, it is assumed that the Swiss 01.01.2024 measures for eLSHs (required increase to 97.5% electric efficiency) do NOT lead to an increase in RAC sales.



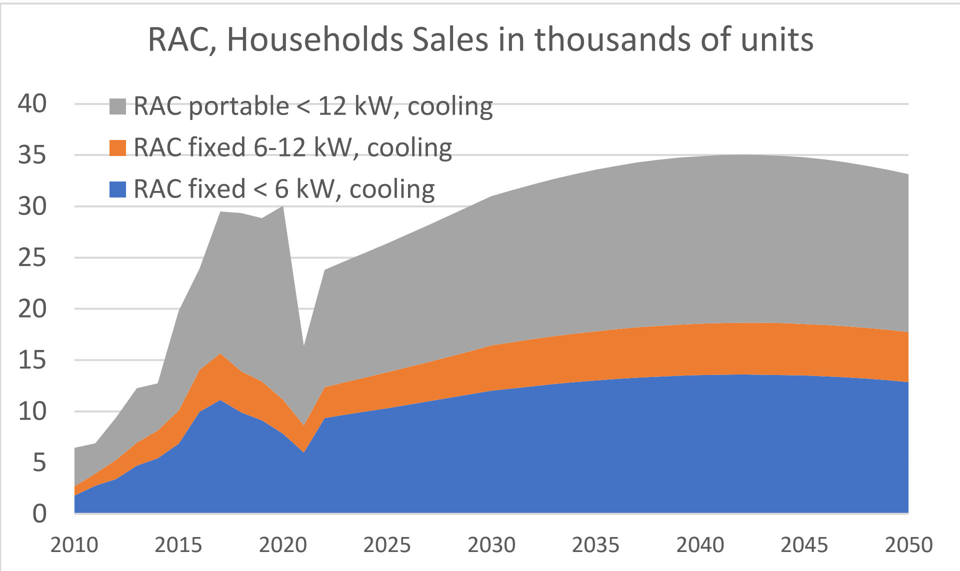


Figure 14 Sales quantities (thousands) for room air conditioners in Switzerland, for all sectors (top) and for households only (bottom).

In 2022, sales are approximately 6 units per 1000 households, of which 48% are portable RACs (counting only the share sold to households). In 2020 this was 8 units per 1000 households, of which 48% portable.

The FEA retail sales presented in Table 1 are close to the sales of portable RACs in the modelling (Figure 15).

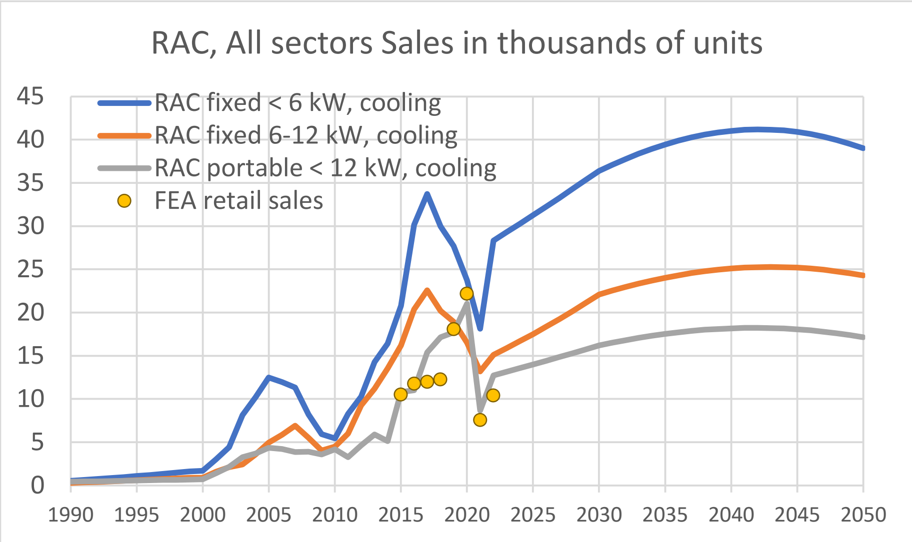
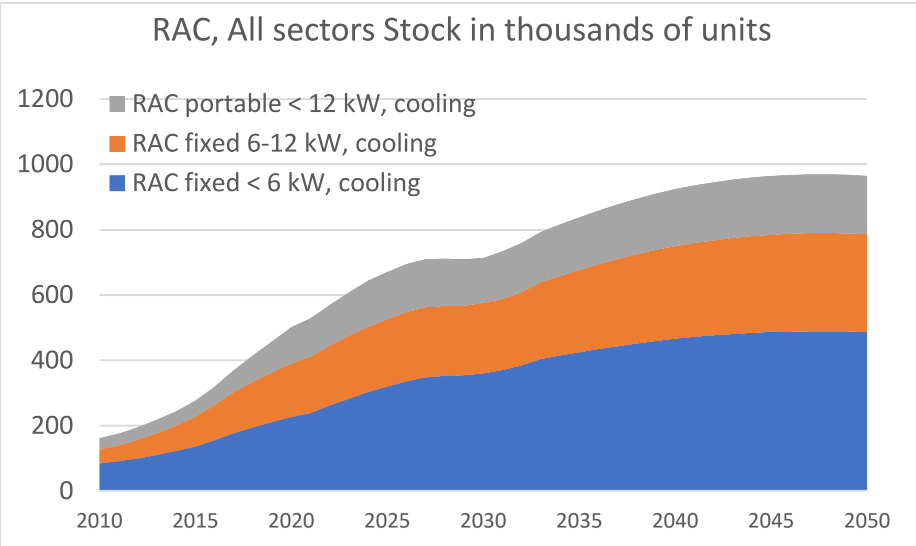


Figure 15 Sales quantities (thousands) for room air conditioners in Switzerland, for all sectors (top) per type. Yellow dots indicate retail sales according to FEA (Table 1).



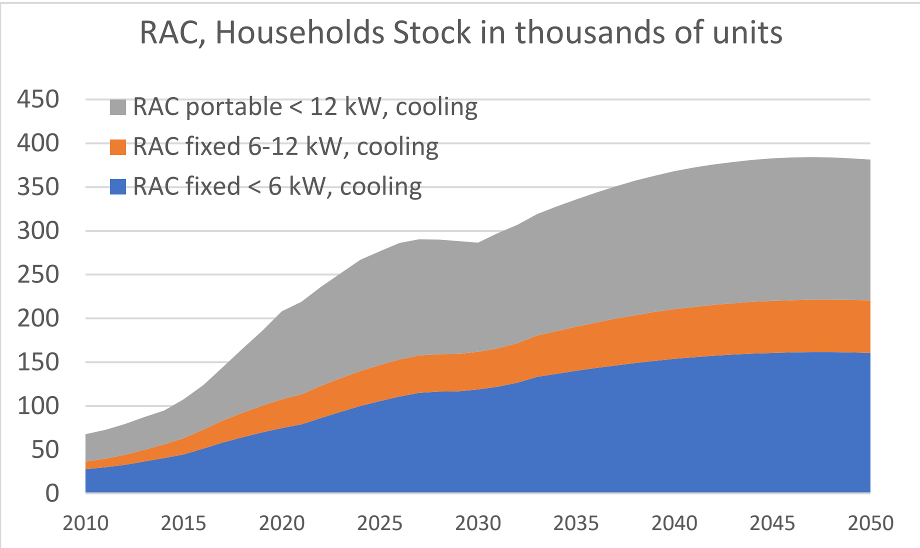


Figure 16 Stock quantities (thousands) for room air conditioners in Switzerland, for all sectors (top) and for households only (bottom).

In 2022, the stock is approximately 60 units per 1000 households, of which 48% are portable RACs (counting only the share sold to households).

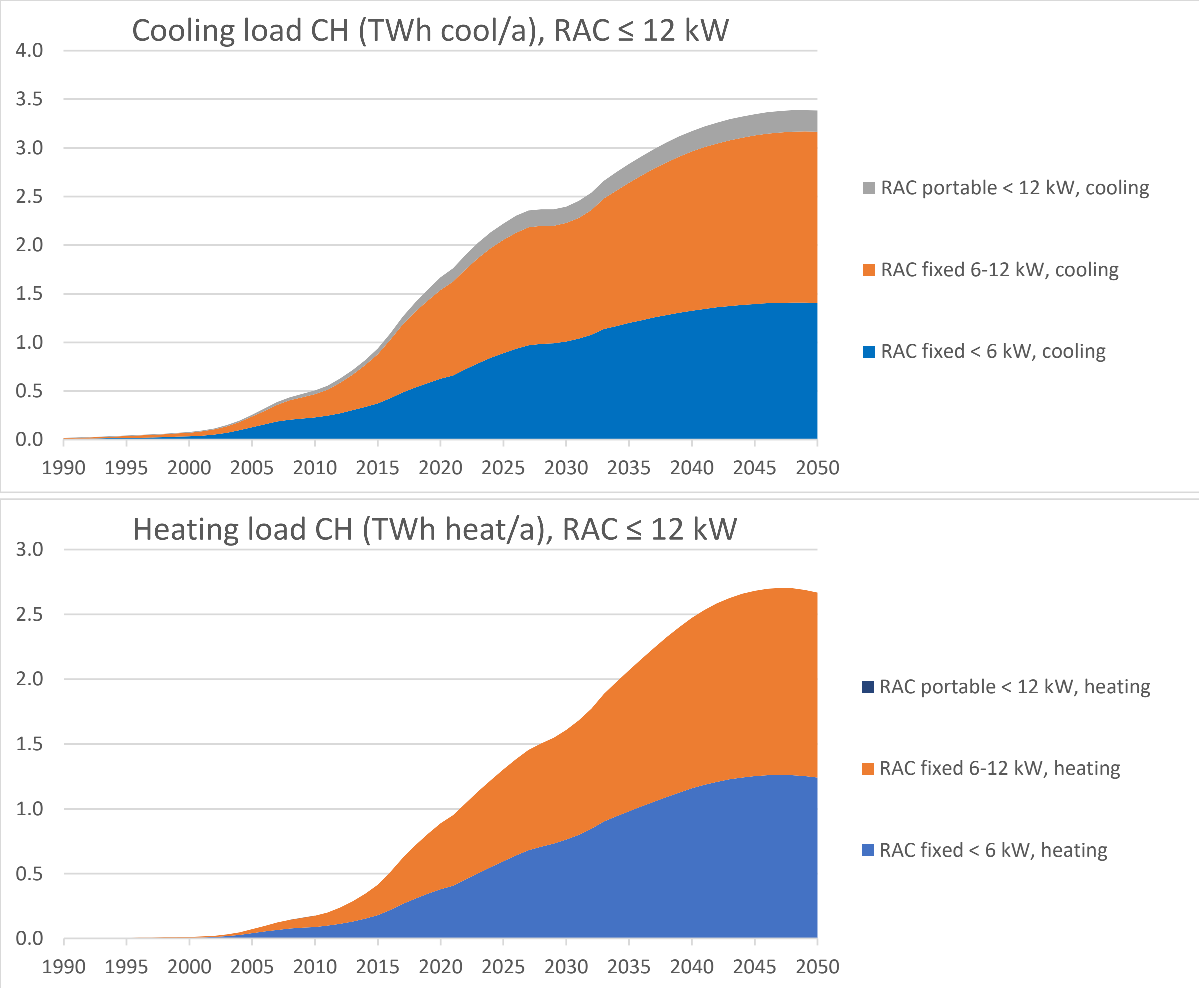
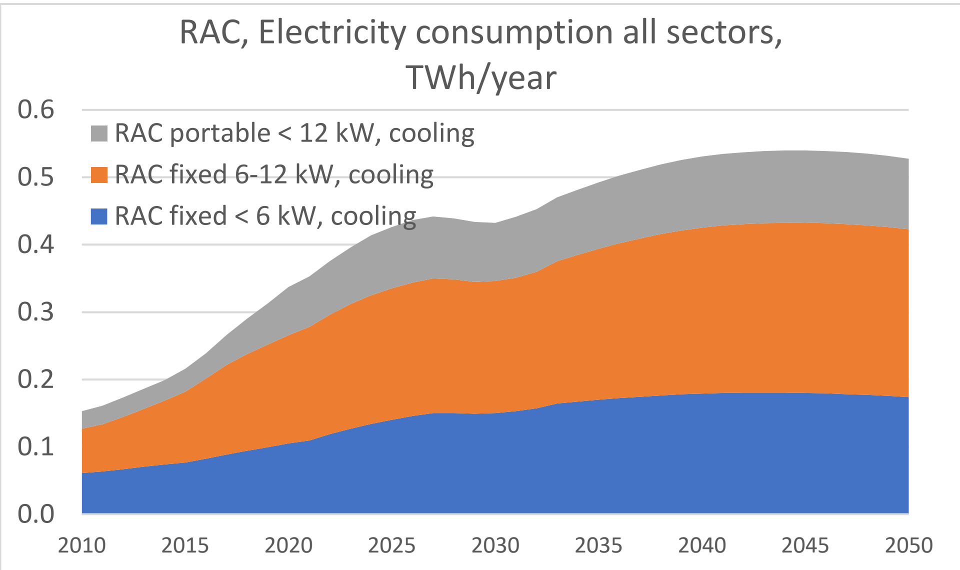


Figure 17 Annual cooling load (top) and heating load(bottom) in TWh heat/year of the stock of room air conditioners in Switzerland (for all sectors together).



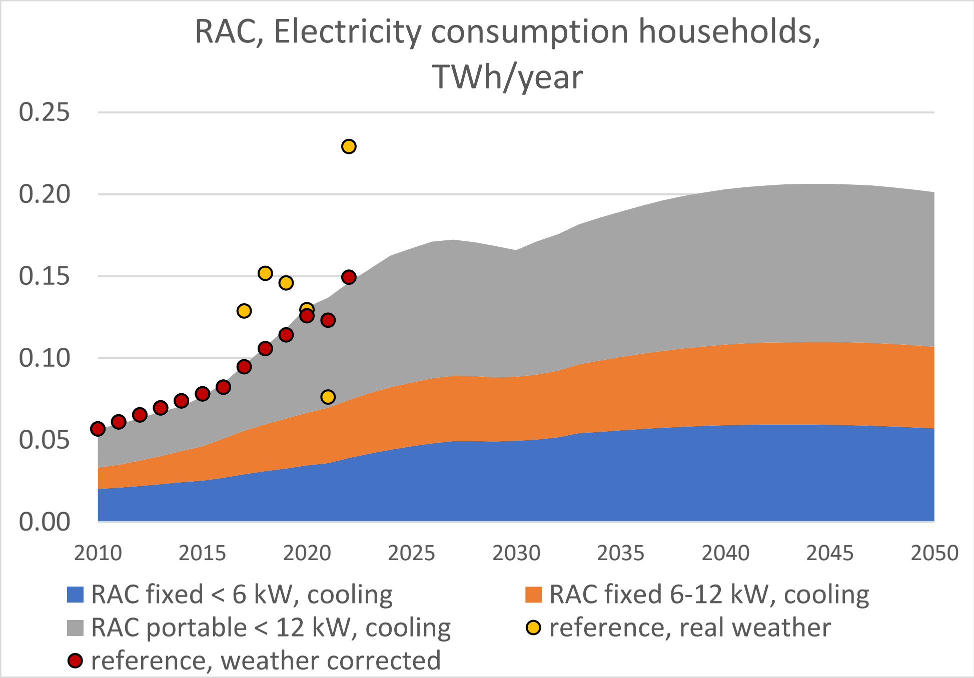


Figure 18 Annual electricity consumption (TWh/year) of the stock of room air conditioners in Switzerland, for all sectors (top) and for households only (bottom).

The household electricity consumption for space cooling approximately matches the weather-corrected reference data from Swiss documents (red bullet points in the graph).

2.5 Combined graphs

This section shows additional graphs, for the combination of all eLSHs (with split per type), or for the combination of eLSHs and RACs.

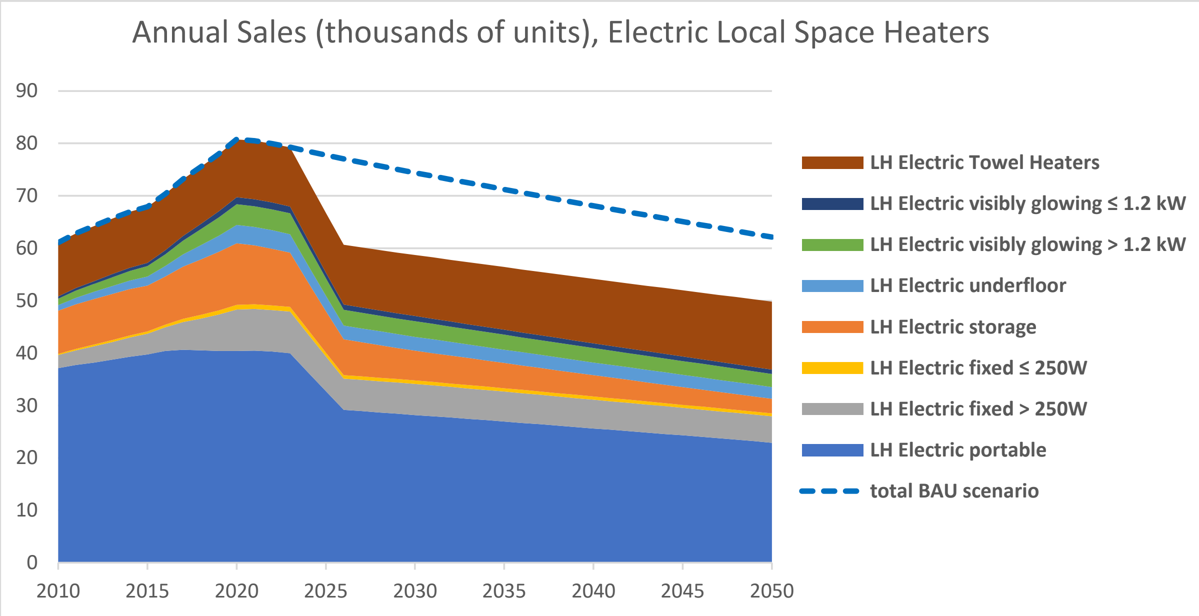


Figure 19 Sales quantities (thousands) for electric local space heaters in Switzerland, split per type. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

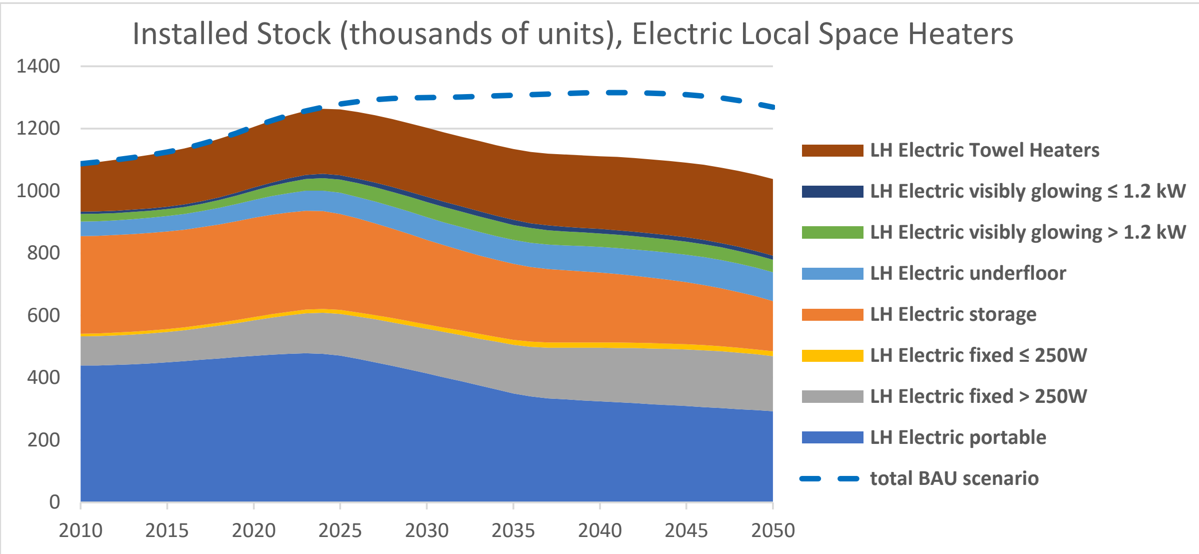


Figure 20 Stock quantities (thousands) for electric local space heaters in Switzerland, split per type. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

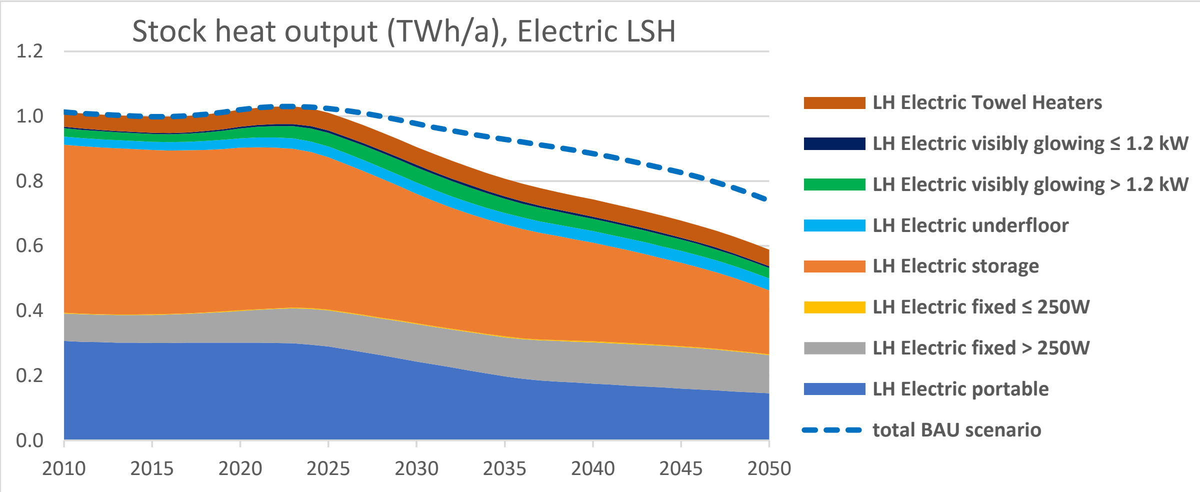
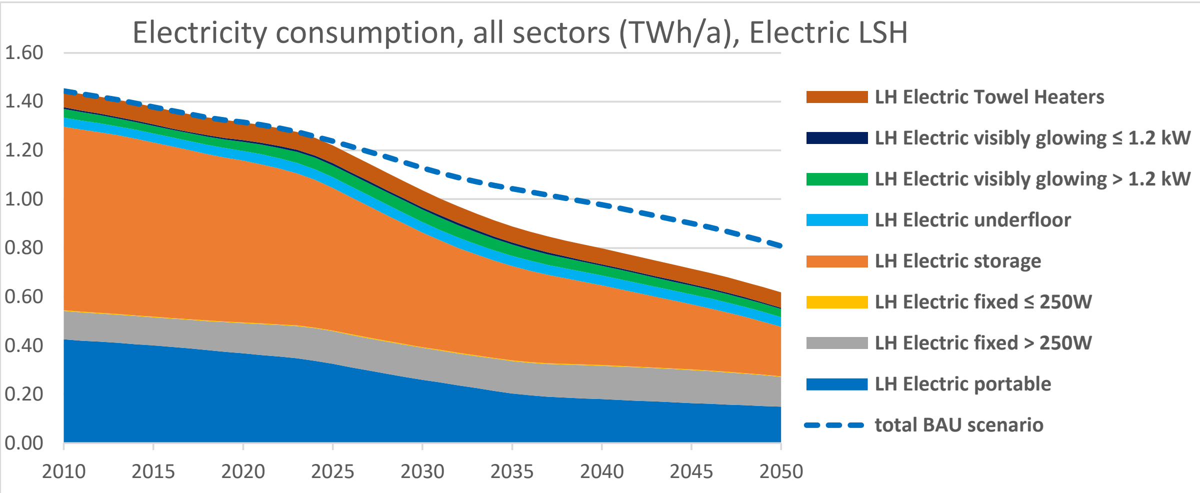


Figure 21 Annual heat output (TWh/year) by the stock of electric local space heaters in Switzerland, split per type. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.



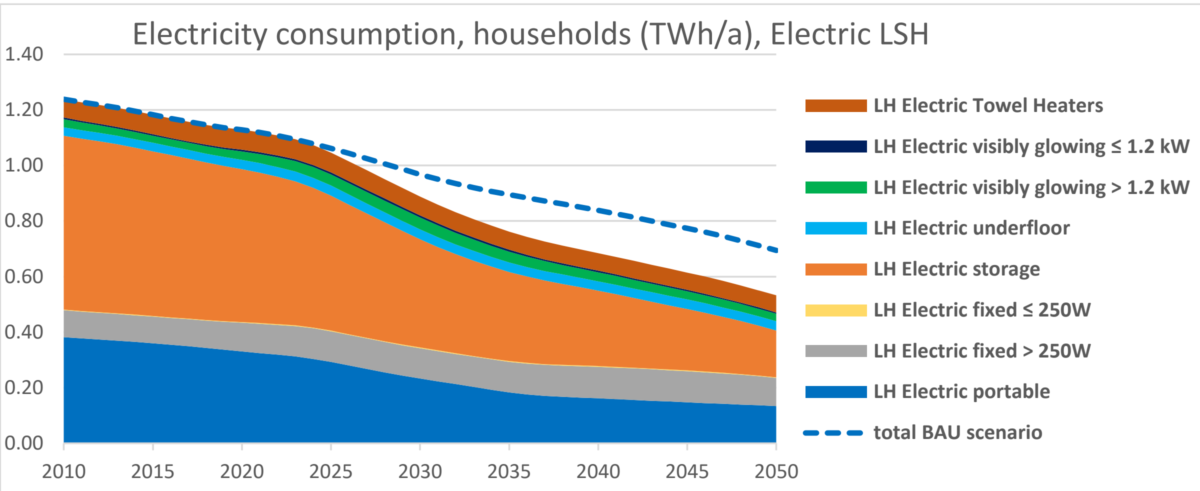
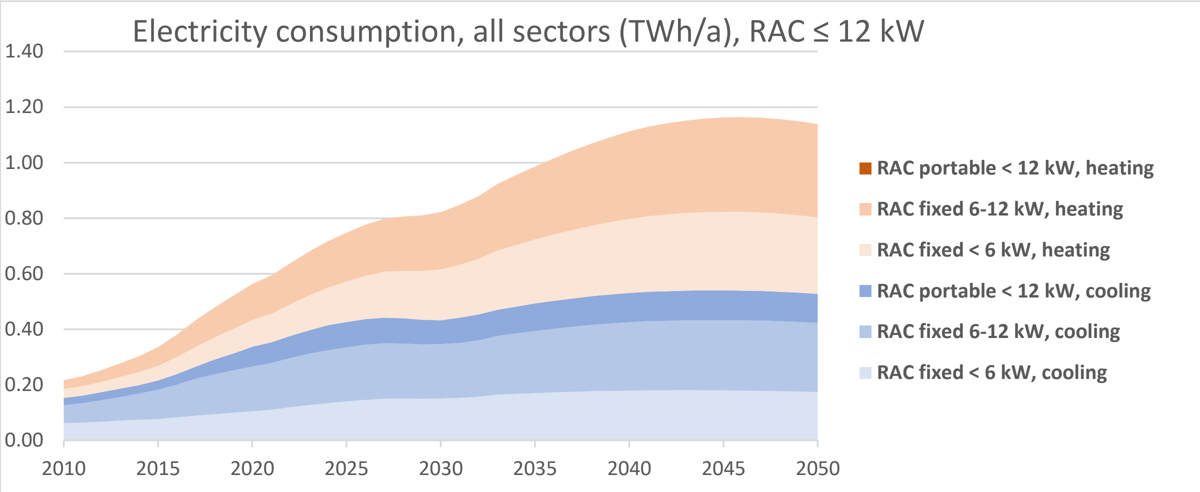


Figure 22 Annual electricity consumption (TWh/year) by the stock of electric local space heaters in Switzerland, split per type, for all sectors (top) and for households only (bottom). Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.



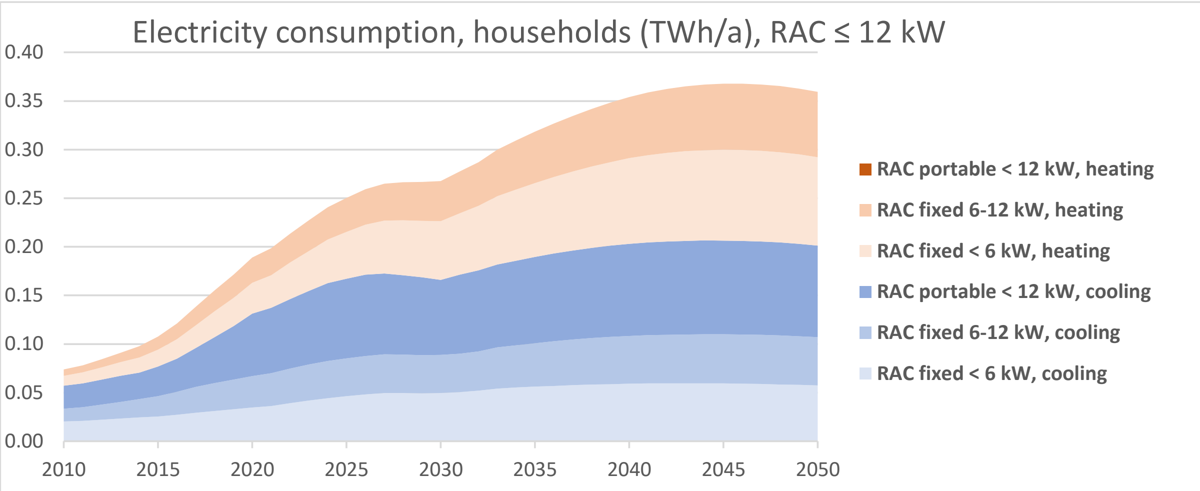


Figure 23 Annual electricity consumption (TWh/year) by the stock of room air conditioners in Switzerland, split per type and per cooling / heating function, for all sectors (top) and for households only (bottom). Data for BAU = BAU1 scenario.

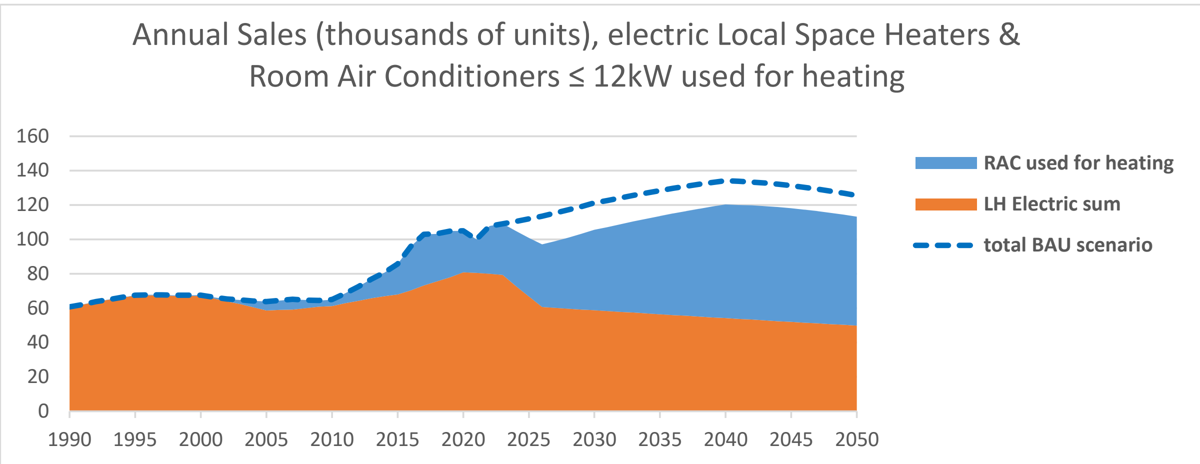


Figure 24 Sales quantities (thousands) for electric local space heaters and room air conditioners also used for heating in Switzerland. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

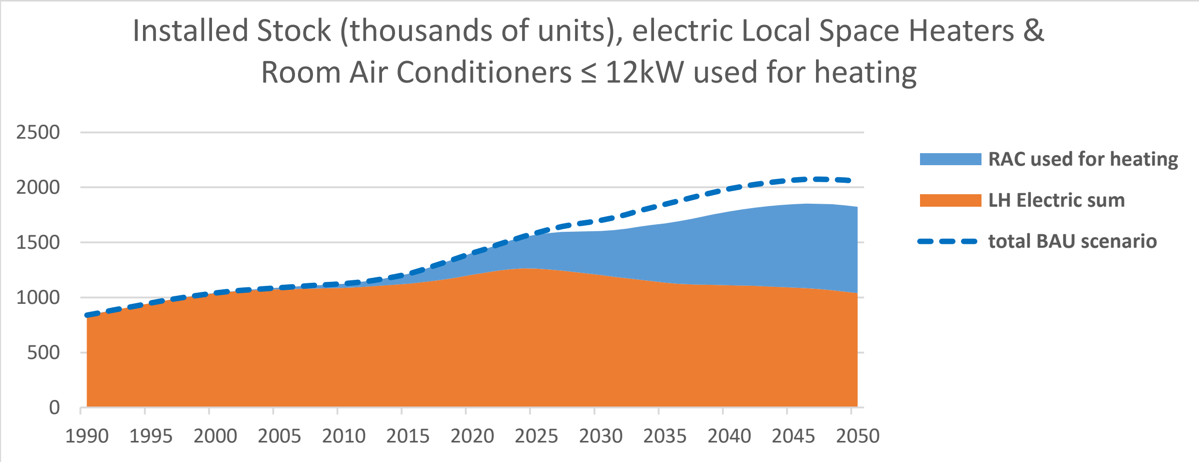


Figure 25 Stock quantities (thousands) for electric local space heaters and room air conditioners also used for heating in Switzerland. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

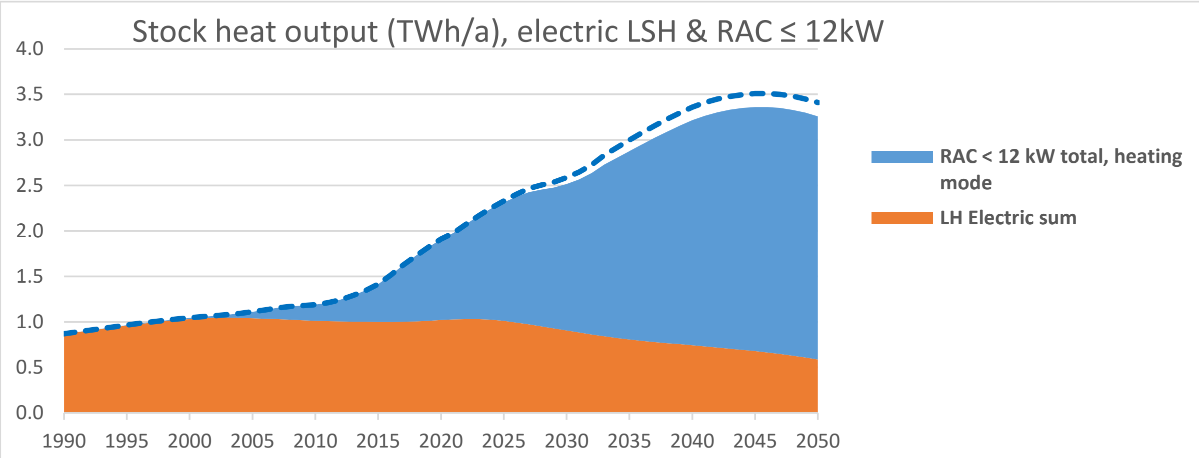


Figure 26 Annual heat output (TWh/year) of the stock of electric local space heaters and room air conditioners also used for heating in Switzerland. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

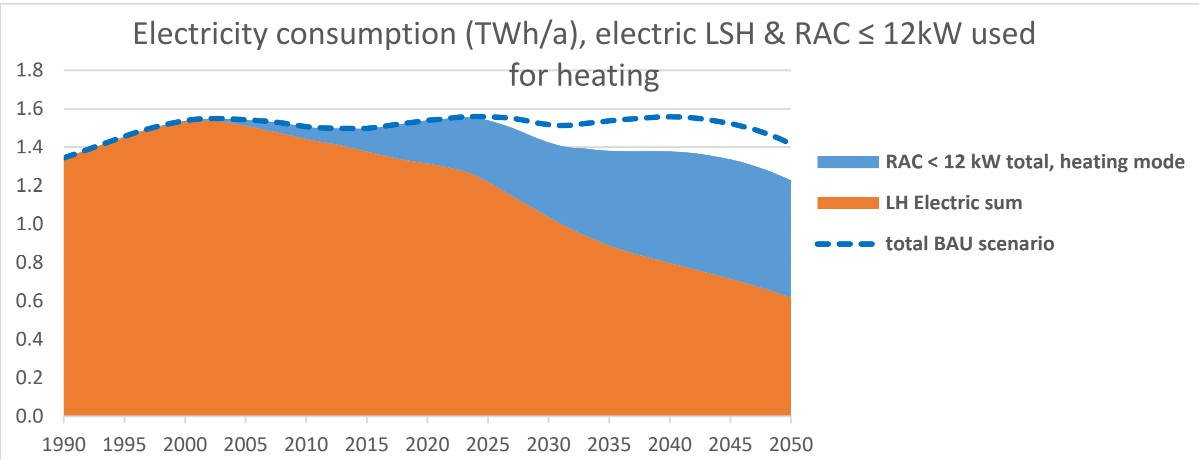


Figure 27 Annual electricity consumption (TWh/year) of the stock of electric local space heaters and room air conditioners also used for heating in Switzerland. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

3 Greenhouse gas emissions

The greenhouse gas (GHG) emissions for LSHs and RACs are computed as:
*Electricity consumption * GHG intensity for electricity*

The GHG intensity factor for electricity for Switzerland is 0.097 kgCO2eq/kWh in 2010, 0.085 in 2020, 0.075 in 2030 and 0.058 in 2050 [33]

The analysis includes only the emissions due to electricity consumption in the use-phase. Emissions occurring during the production, distribution and end-of-life phases are not included. Effects of possible refrigerant losses are also excluded.

The results for the period 2010-2050 are shown in Figure 28.
The decrease in emissions is the balance of a decrease in the GHG intensity factor for electricity, a decrease in the electricity consumption for electric LSHs and an increase in the stock and electricity consumption of RACs.

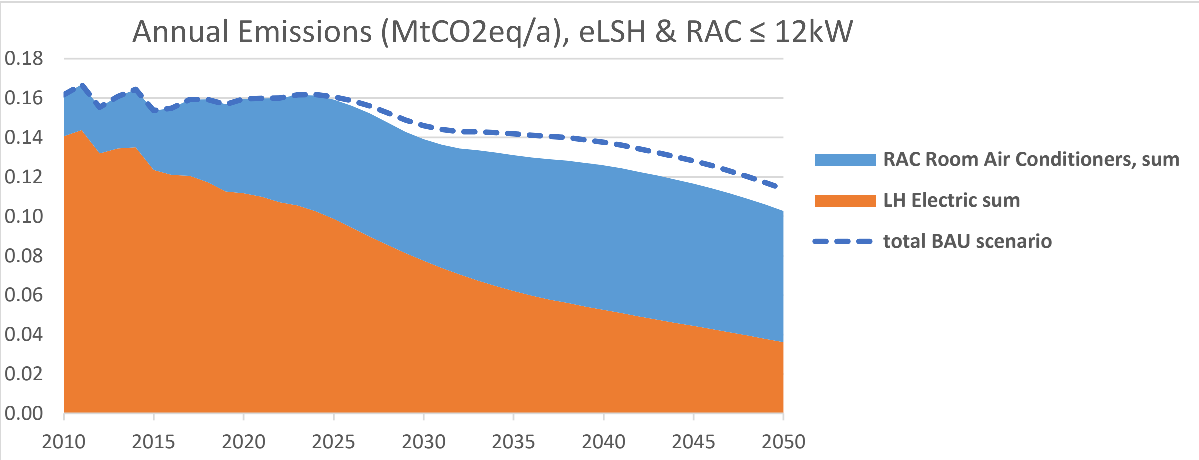


Figure 28: Greenhouse gas emissions in MtCO2equivalent per year, for electric local space heaters (LSH) and room air conditioners (RAC) in Switzerland. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

[33] Source: Analysis model underlying the study "VOBU des autonomen Nachvollzugs der EU-Ökodesignrichtlinie, BSS and VHK, Basel 15.08.2021"

4 Price and cost information

4.1 Introduction

No information was available on the product prices for LSHs and RACs in Switzerland, so that the EU27 average prices from the Ecodesign Impact Accounting 2021 (EIA) have been used as reference. The results presented below seem uncertain: more information on product prices, installation costs and maintenance costs in Switzerland would be desirable.

The EIA product prices (in 2020 euros) include the purchase price, installation costs, and 20% VAT for residential users, and are defined in function of energy efficiency. This is not convenient for the conversion to the Swiss reality. The EIA product prices for EU27 have therefore been split in the three price components, while definition of prices in function of energy efficiency has been abandoned [34].

4.2 Product purchase price (excl. VAT)

Considering the reference information of Table 3, the EU27 average purchase prices in 2022 (in 2020 euros, excl. VAT and installation costs) have been multiplied by a factor 1.2, which corresponds to the 2022 purchasing power parity and the price level index for Switzerland compared to EU27. As the CHF to Euro exchange rate in 2022 is close to 1, these prices are then assumed to be expressed in 2020 CHF.
From 2022 back to 2015, the inflation index for heaters & air conditioners has been applied, and then back to 2010 the inflation index for household appliances. For future years, the (inflation corrected) product price for the BaU scenario has been kept constant. This approach leads to a 23% decrease in product price from 2010 to 2022, for all LSH and RAC types (Table 4).

Table 3: Reference data for the conversion of EU prices to CH prices

	2010	2015	2020	2022
Exchange rate, Swiss Francs per Euro [35]	1.380	1.068	1.071	1.005
Purchasing Power Parity, CH, household appliances (EU27=1)	1.57	1.37	1.36	1.2
Price level index, CH, household appliances (EU27=100) [36]	113	128	127	120
Inflation Indices (HICP), CH, household appliances [37]	120	100	91	91
Inflation Indices (HICP), CH, heaters & air conditioners		100	94	92

[34] When energy efficiency measures are introduced, the average efficiency of sold products increases and typically this comes at the cost of a higher product price. After some years, due to learning effects and economy of scale, the prices can come down again. This mechanism is reflected in the EIA price model. In Switzerland, the average efficiency of LSHs and RACs increased over the 2010-2022 period, but from the available information, product prices went down. Hence, the definition of prices in function of efficiency does not seem adequate and has therefore been abandoned in this study.
[35] Source: https://www.macrotrends.net/2552/euro-swiss-franc-exchange-rate-historical-chart
[36] Source: Eurostat online data code PRC_PPP_IND, last update 21/06/2023, price level indices and purchasing power parity for household appliances
[37] Source: Eurostat HICP annual data - PRC_HICP_AIND, last updated 19/07/2023, for household appliances and (from 2015) for heaters & air conditioners.

4.3 Installation costs (excl. VAT)

Installation costs can be partly for installation materials but will mainly be labour costs. Based on Eurostat data, hourly labour costs in Switzerland are estimated to be approximately twice the average labour costs in EU27. The EU27 average installation costs in 2022 (excl. VAT) have therefore been multiplied by a factor 2.0 and are then assumed to be expressed in 2020 CHF. For the moment, installation costs have been assumed constant over the years.

4.4 Value Added Tax (VAT)

Different from the approach in the EIA, product purchase prices and installation costs have been defined without VAT. The Swiss VAT is added separately (only for residential users) when total acquisition costs are computed.
The Swiss VAT rates are 7.6% in 2010, 8.0% in 2011-2017, 7.7% in 2018-2023, and will increase to 8.1% in 2024 [38].

4.5 Repair and Maintenance costs

Repair and maintenance costs (per unit per year) in the EIA include 20% VAT and are the same for all years. For the conversion to Switzerland the VAT has been removed and EU27 costs have been multiplied by the same labour cost factor 2.0 used for the installation costs. These costs are then assumed to be expressed in 2020 CHF. For the moment, repair and maintenance costs have been assumed constant over the years.

4.6 Sector revenue shares

The product purchase price consists of revenues for industry [39], wholesalers, retailers (and VAT). The revenue shares for the three sectors have been taken similar to those for EU27 in the EIA 2021, but corrected to remove the share of VAT, and slightly adapted to remove small differences between the product types. Note that revenues, especially for industry, are not necessarily in Switzerland. Shares are constant over the years.

Table 4: Unit price information for local space heaters and room air conditioners in Switzerland.

2020 CHF excl. VAT	Price 2010	Price 2022	Install	Maint /year	Share retail	Share wholesale	Share industry
LH Electric portable	42	33	0	0	0.12	0.10	0.78
LH Electric fixed > 250W	338	259	54	0	0.12	0.10	0.78
LH Electric fixed ≤ 250W	170	130	54	0	0.12	0.10	0.78
LH Electric storage	1037	796	161	0	0.12	0.10	0.78
LH Electric underfloor	204	156	279	0	0.12	0.10	0.78
LH Electric visibly glowing > 1.2 kW	54	41	58	0	0.12	0.10	0.78
LH Electric visibly glowing ≤ 1.2 kW	35	27	37	0	0.12	0.10	0.78
LH Electric Towel Heaters	304	233	53	0	0.12	0.10	0.78
RAC fixed < 6 kW	874	671	1596	41	0.21	0.29	0.51
RAC fixed 6-12 kW	2365	1815	1994	43	0.20	0.27	0.53
RAC portable < 12 kW	440	338	0	0	0.14	0.17	0.69

[38] Source: Schweizerische Eidgenossenschaft, Federal Tax Administration FTA, Development of the Swiss VAT rates
[39] Intended including the supply chain, i.e. Original Equipment Manufacturers and Services.

4.7 Energy rates

The energy rates presented in Table 5 have been used for Switzerland. Prices for years after 2022 have been set identical to 2022 prices. Rates for industry have been applied also to the services and other (agriculture, forestry) sectors.

Table 5: Energy rates for Switzerland, for the residential sector (incl. VAT) and for industry (excl. VAT). Source: [40]

Real, basis 2020 CHF/kWh (NCV)	2010	2015	2020	2022	2030
Electricity, residential (incl. MwSt., Typ III (Jahresverbrauch: 4500 kWh))	0.186	0.200	0.211	0.212	0.212
Electricity, industry (ohne MwSt., gewichteter Durchschnitt der Preise für Industrie)	0.129	0.154	0.161	0.151	0.151

5 Acquisition costs and business revenues

Acquisition costs include the product purchase price, installation costs and VAT for residential users. They are computed as:
(unit price + installation costs)(1+share_residential*VAT%)*sales quantity* [41]

In 2022, Swiss users spent 153 mln CHF for the purchase and installation of electric LSHs and RACs, of which 84% was for the RACs (Figure 29). Sales quantities of RACs in 2022 (56 thousand) are lower than quantities for electric LSHs (80 thousand), but purchase prices for RACs are higher and RACs have much higher installation costs. After 2022, sales of RACs are projected to increase and consequently also the acquisition costs increase.

Figure 30 shows the subdivision of revenues from product sales and installation over the business sectors. Revenues from installation are dominant.

[40] SCHWEIZERISCHE GESAMTENERGIE-STATISTIK 2022, Bundesamt für Energie, tab.37 for residential, and tab. 39 for industry. Original rates for heating oil in CHF/100l have been converted using 10 kWh NCV/litre. (https://www.engineeringtoolbox.com/fuels-higher-calorific-values-d_169.html: 0.84 kg/L; 11.89 kWh NCV / kg => 1 L = 0.84 kg = 0.84*11.89 = 9.9876 kWh NCV)

[41] In addition, Acquisition costs for RACs are partitioned over the heating and cooling functions, in the same way as in EIA 2021, using (sales heating)/(sales heating +sales cooling) and (sales cooling)/(sales heating +sales cooling), where 'sales' heating are the RACs actually being used also for heating, and sales cooling are all RAC sales.

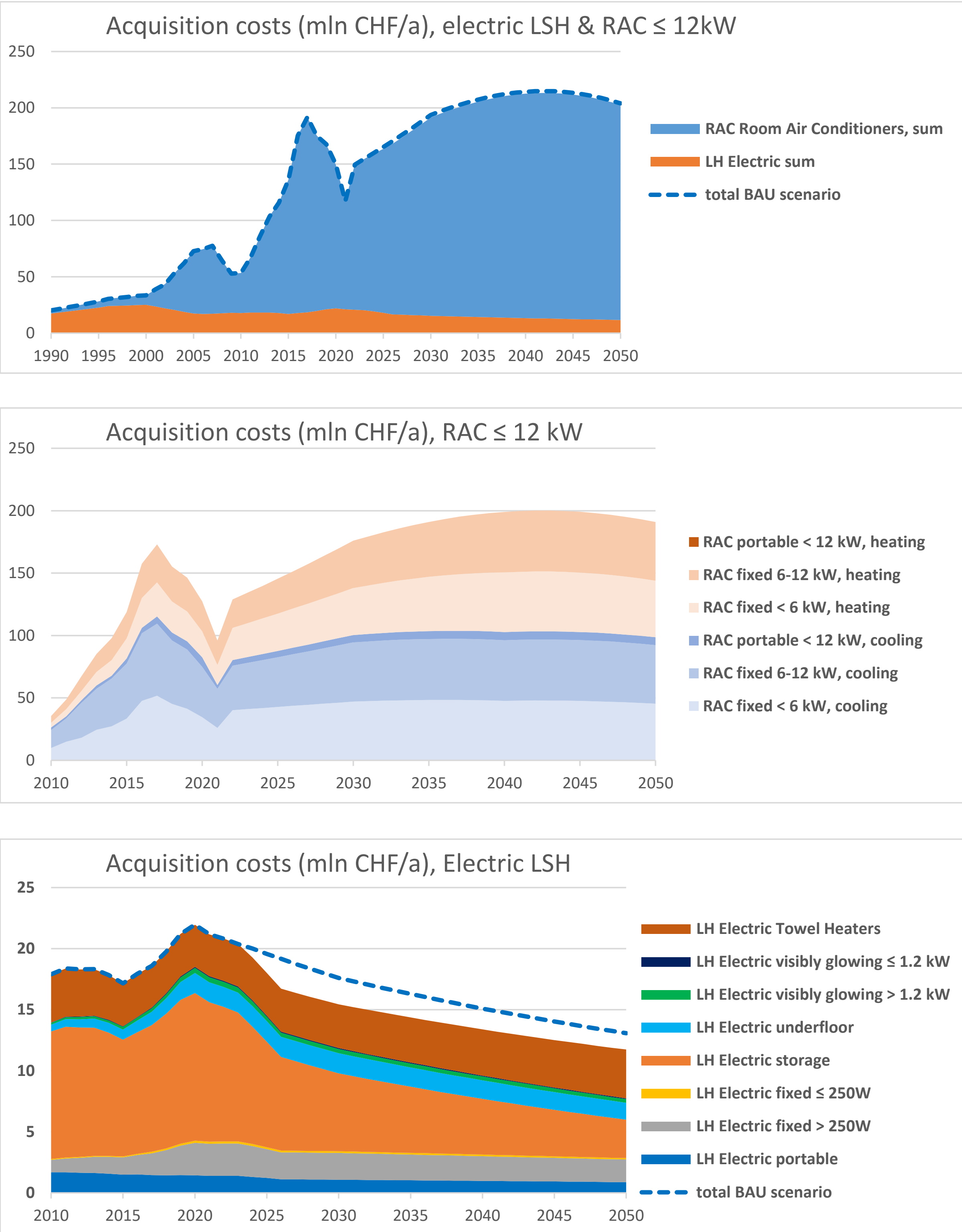


Figure 29: Acquisition costs (in million 2020 CHF) for electric local space heaters and room air conditioners in Switzerland, including product purchase price, installation costs and VAT for residential. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

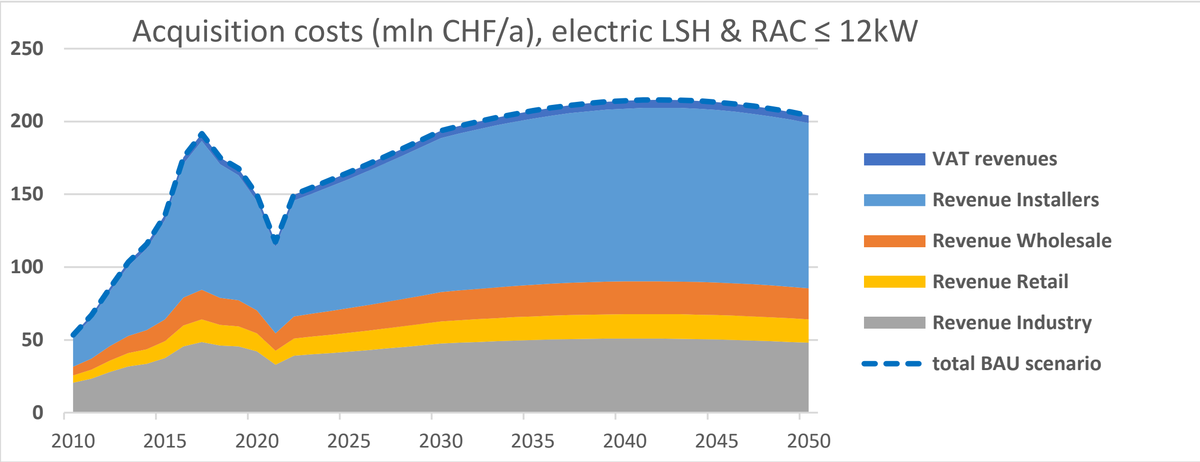


Figure 30: Subdivision of the revenues from product purchase and installation, for industry, wholesalers, retailers, installers and government (VAT). Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

6 Energy costs

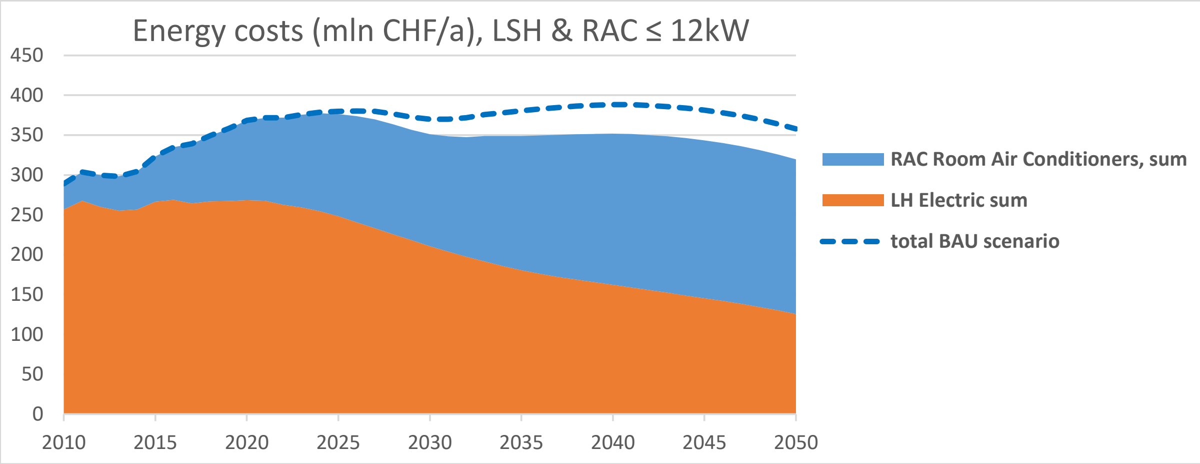
Energy costs are computed as [42]:
*electricity * (share_RES*elecrate_RES+(1-share_RES)*elecrate_NONRES))*

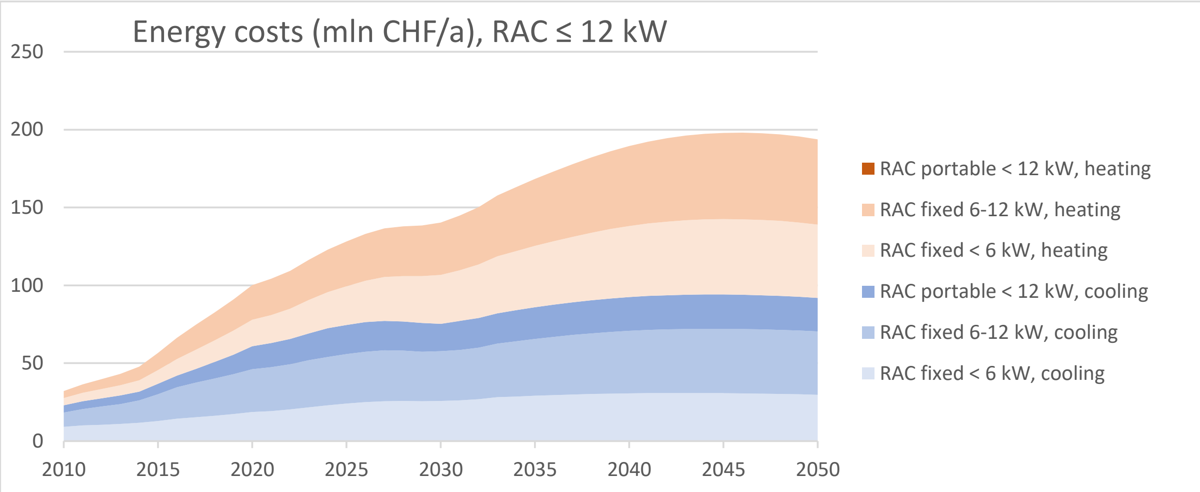
Variations in energy costs for operating LSHs and RACs (Figure 31) closely follow variations in electricity consumption. The slight deviations before 2022 are due to variations in energy rates (Table 5). Note the assumption that (inflation corrected) energy rates will not change over the period 2022-2050.

<u>In 2022, Swiss users spent 372 mln CHF for the energy used to operate electric LSHs and RACs, of which 29% was for the RACs</u> (Figure 31). After 2022, the stock of RACs is projected to increase and consequently also the energy costs for RACs increase, but this is partly compensated by decreasing energy costs for LSHs.

For RACs in 2022, 40% of energy costs is made for heating, and 60% for cooling. For LSHs in 2022, 49% of the energy costs is spent for fixed electric storage LSH.

[42] RES indicates residential; elec = electricity; fuel is natural gas or heating oil





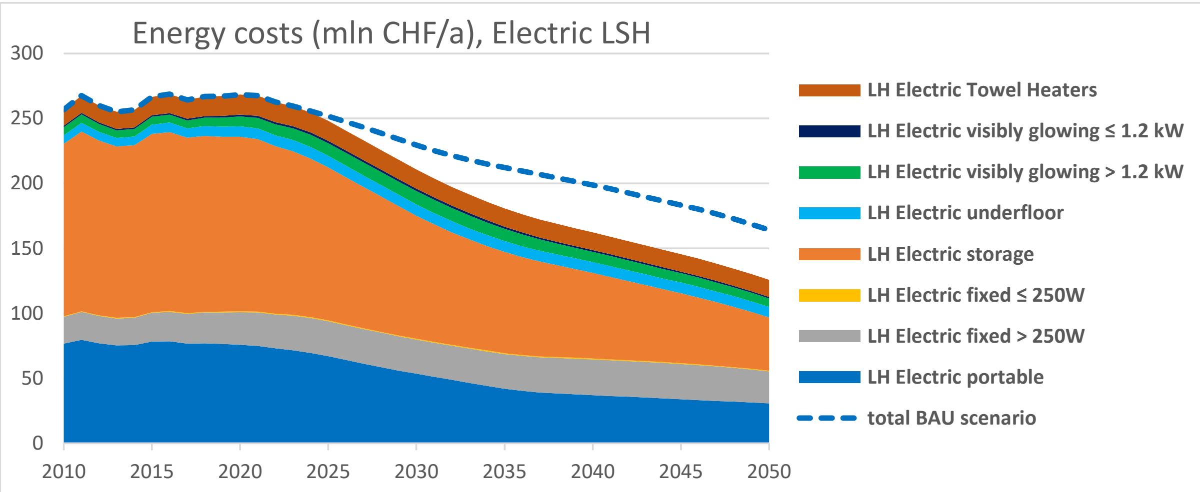


Figure 31: Energy costs (in million 2020 CHF) for operation of local space heaters and room air conditioners in Switzerland, including VAT for residential users. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

7 Repair & Maintenance costs

Repair & Maintenance costs are computed as:
(unit repair & maint costs)(1+share_residential*VAT%)*stock quantity* [43]

Repair and maintenance costs are assumed to be zero for electric LSH and for portable RACs. Hence, only R&M costs for fixed RACs remain.

In 2022, Swiss users spent 19 mln CHF for repair and maintenance of fixed RACs (Figure 32). After 2022, the stock of RACs is projected to increase and consequently also the repair and maintenance costs increase.

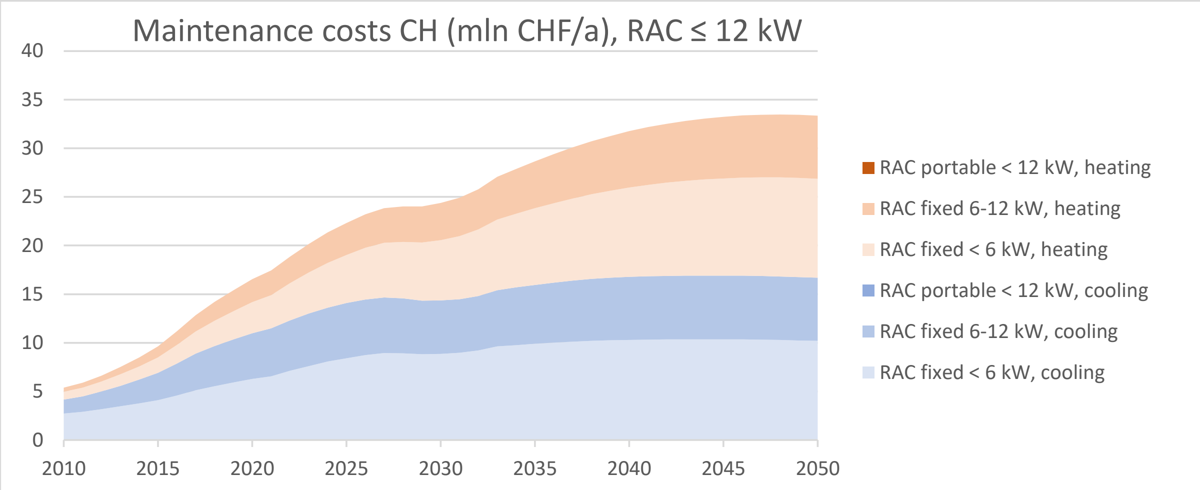


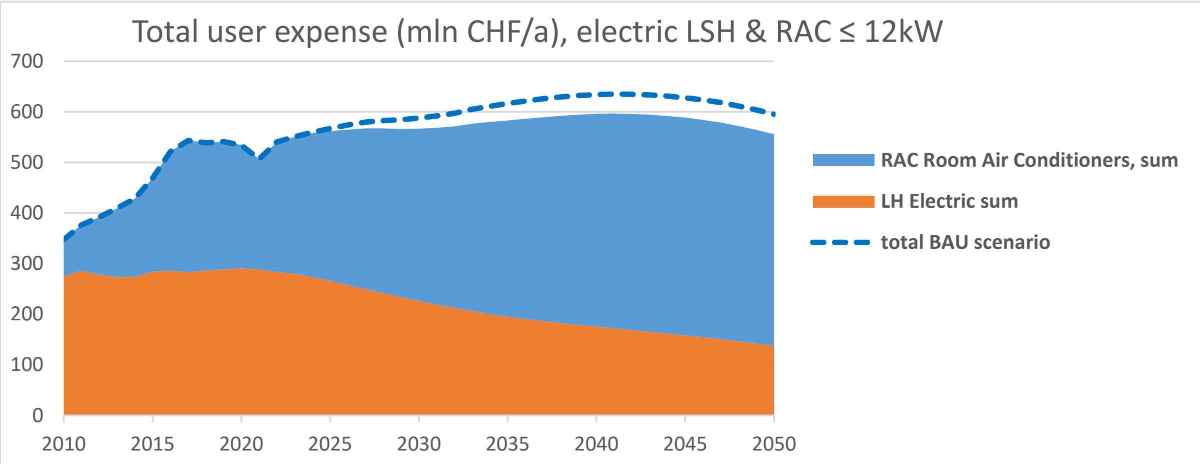
Figure 32: Repair and Maintenance costs (in million 2020 CHF) for fixed room air conditioners in Switzerland, including VAT for residential users.

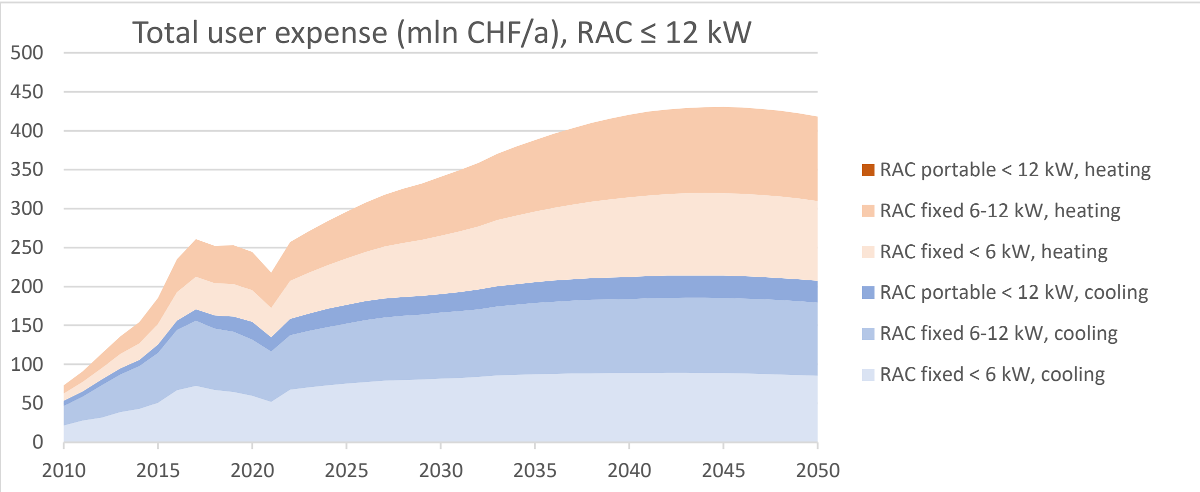
8 Total user expense

The total user expense is the sum of acquisition costs, energy costs and maintenance costs.

In 2022, Swiss users spent 540 mln CHF for the acquisition, use and maintenance of electric LSHs and RACs, of which 48% for the RACs (Figure 33). Energy costs dominated (69% of the total expense), followed by acquisition costs (28%) and maintenance costs (3.5%) (Figure 34).
After 2022, the stock of RACs is projected to increase and consequently also the expenses for RACs increase, to 58% of the total expense in 2030.

[43] Repair and Maintenance costs for RACs are partitioned over the heating and cooling functions, in the same way as in EIA 2021, using (stock heating)/(stock heating +stock cooling) and (stock cooling)/(stock heating +stock cooling), where 'stock' heating are the RACs actually being used also for heating, and stock cooling is the entire RAC stock.





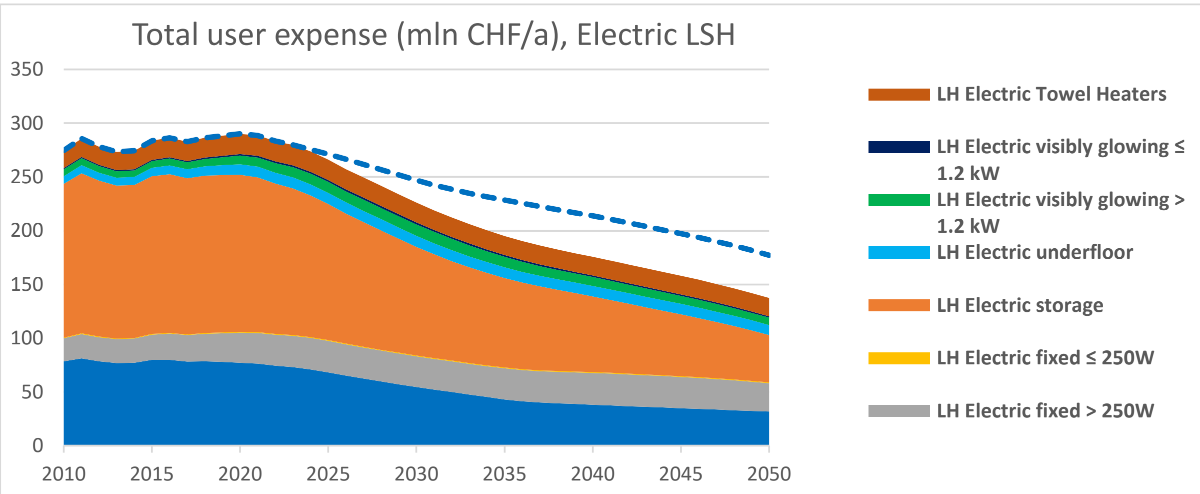


Figure 33: Total user expense (in million 2020 CHF) for acquisition, use and maintenance of local space heaters and room air conditioners in Switzerland, including VAT for residential users. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

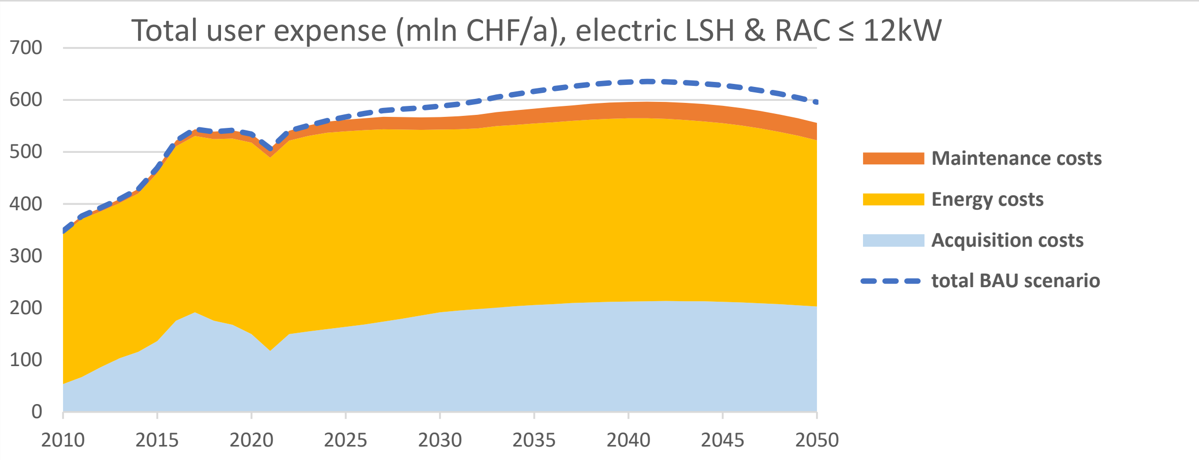


Figure 34: Subdivision of the total user expense over acquisition costs, energy costs and maintenance costs. Stacked areas for the BAU1 scenario with CH 2024 measures. Blue dashed curve for the total in the BAU scenario without CH 2024 measures.

9 Potential new measures

9.1 Introduction

9.1.1 Introduction to energy efficiency requirements for electric LSH

Each electric LSH type has an associated nominal heat output. If the heater produces exactly this amount of heat, its electric heating efficiency is 100% (all electricity input becomes heat output and ends up in the heated space).
The corresponding primary energy efficiency (as used for requirements in the regulations), depends on the efficiency of electricity generation and distribution. In EU Regulation 2015/1188 (copied by Swiss EnEV 730.02) the conversion coefficient from electricity to primary energy is CC=2.5, which implies a nominal primary energy efficiency of electric LSHs of 40% (100%/2.5).
In the revision of the EU regulation, CC=1.9, which implies a nominal primary energy efficiency of electric LSHs of 52.6% (100%/1.9).

In reality the heat load (user demand for heat output) for the space in which the electric LSH is installed will vary over the year and often be lower than the nominal heat output. Without controls, the heater will always produce the nominal heat output, which will often exceed the user demand. The user then has to apply on/off switching of the heater, or open doors or windows, to keep the room temperature at a comfortable level.
On average this leads to a situation where the electric LSH produces more heat than required, and thus to a higher consumption of electricity than strictly necessary. This translates into an electric efficiency (desired heat output divided by actual consumed electricity) lower than 100%.
When the heater is equipped with controls, it can (automatically) follow the desired heat output more closely, reducing the excess heat produced, thus reducing the electricity input, and increasing the electric efficiency. However, these controls (timers, temperature sensors, remote control signals) remain continuously active and thus consume some electricity also when the LSH is not heating (standby energy consumption). This adversely affects overall annual efficiency.

The EU regulations on LSHs reflect this reasoning (see next section): the base value for the seasonal space heating energy efficiency for electric LSHs is not 100%, but 75% (electric). This base value can increase depending on the presence of controls (ideally up to 100%) or decrease due to standby energy consumption.

As the EU regulation also applies to gas- and oil-fired LSHs, the energy efficiency requirements are expressed in terms of primary energy, also for the electric LSHs. In Regulation (EU) 2015/1188, the conversion coefficient CC from electricity to primary energy is 2.5. In terms of primary energy, the maximum nominal efficiency for electric LSH is then 100%/2.5=40%, and the base value for the seasonal efficiency is 75%/2.5=30%.

9.1.2 Current EU regulation 2015/1188 for eLSHs

For electric LSHs in CR (EU) 2015/1188, the useful efficiency in on-mode $\eta th,on$ is 100%, and the seasonal space heating energy efficiency in active mode $\eta s,on$ is 100%/2.5 = 40% (with CC=2.5)
The seasonal space heating efficiency $\eta S = \eta S,on - 10\% + F(1) + F(2) + F(3) - F(4) - F(5) = 30\% + F(1) + F(2) + F(3) - F(4) - F(5)$
where F(1) is 0-3.5% only for electric storage LSH; F(2) = 0-9% depending on controls; F(3) = 0 - 4%, F(4) depends on standby consumption vs nominal heating power, F(5) is not applicable to electric LSH (pilot flame losses).
This means that the seasonal space heating efficiency ηS for electric LSH can normally vary from 30% to 40% (primary), but can drop below 30% due to F(4), standby consumption.
In terms of electric efficiency (with CC=2.5), this means a variation from 75% to 100%, but a possible drop below 75% if standby consumption is high and the device does not meet requirements of the EU standby regulation 1275/2008.

9.1.3 Revised EU regulation 2024/1103 for eLSHs

In April 2024, a revision of EU regulation 2015/1188 was published: Ecodesign regulation 2024/1103 [44]. The revision reformulates the efficiency definitions for electric LSHs, changes the conversion coefficient CC, adapts the minimum efficiency requirements and further clarifies the scope (towel heaters clearly included with their own requirements, slave heaters no longer exempted, portable visibly glowing heaters get specific requirements).

The energy efficiency requirements in CR 2024/1103 are expressed in terms of seasonal space heating energy efficiency, ηs. This is a primary energy efficiency.

For electric LSHs, $\eta s = \eta s,on/CC$. The conversion coefficient CC=1.9 converts the electrical efficiency $\eta s,on$ in the primary energy efficiency ηs.

For electric LSH, the seasonal space heating energy efficiency in active mode
$\eta s,on = 100\% * (0.75+F(2)+F(3))$
This implies a base electrical efficiency of 75% which can be increased by correction factors F(2) and F(3) for the presence of controls, see tables below.

From the factors F(2), only one option applies. The factors F(3) can be summed if several types of controls are present. Combining the best option F(2) with the sum of all options F(3), an efficiency of 100% can be obtained, except for portable eLSHs, where the maximum attainable is 98%.

[44] COMMISSION REGULATION (EU) 2024/1103 of 18 April 2024 implementing Directive 2009/125/EC of the European Parliament and of the Council as regards ecodesign requirements for local space heaters and separate related controls and repealing Commission Regulation (EU) 2015/1188, OJ L 19.4.2024, p 1/43

The above formula for $\eta s,on$ no longer has the negative term for standby. Regulation 2024/1103 separately sets requirements for consumption in low-power modes.

If the product is placed on the market with (only one option may apply)	F(2)					
	for electric local space heaters					
	Portable	Fixed	Storage	Under-floor	Visibly glowing radiant	Towel rails
single stage heat output, no room temperature control	0	0	0	0	0	0
two or more manual stages, no temperature control	0,025	0	0	0	0,050	0,030
with mechanic thermo-stat room temperature control	0,100	0,025	0,025	0,025	0,025	0,030
with electronic room temperature control	0,160	0,050	0,050	0,050	0,080	0,030
with electronic room temperature control plus day timer	0,170	0,095	0,095	0,095	0,100	0,095
with electronic room temperature control plus week timer	0,190	0,150	0,150	0,150	0,120	0,150

If the product is placed on the market with (multiple options may apply):	F(3)					
	for electric local space heaters					
	Portable	Fixed	Storage	Underfloor	Visibly glowing radiant	Towel rails
room temperature control with presence detection	0,005	0	0	0	0,040	0
room temperature control with open window detection	0,005	0,020	0,020	0,020	0,020	0,020
with distance control option	0	0,020	0,020	0,020	0	0
with adaptive start control	0,005	0,020	0,020	0,020	0	0,020
with working time limitation	0,005	0	0	0	0,020	0,020
with black bulb sensor	0	0	0	0	0,040	0
with self-learning functionality	0	0,020	0,020	0,020	0,010	0,020
Control accuracy with CA < 2 Kelvin and CSD < 2 Kelvin	0,020	0,020	0,020	0,020	0	0,020

Table 6: Correction factors for the efficiency of electric local space heaters from CR 2024/1103. One of the factors F(2) applies, while factors F(3) can be summed for the presence of controls.

Table 7 compares the minimum seasonal efficiency requirements for electric LSHs in old CR 2015/1188 and new CR 2024/1103. The original requirements in the regulations are in terms of primary energy, and higher in the revision than in 2015/1188. However, for most electric LSH types the increase is less than might be expected based on the shift from CC=2.5 to CC=1.9: in terms of equivalent electric efficiencies, the requirements in CR 2024/1103 are less severe, but as indicated above, the bonuses for the presence of controls have also been changed. Note also that CR 2024/1103 explicitly includes towel heaters and portable visibly glowing heaters with their own efficiency requirements. In addition, slave heaters are no longer exempted [45].

Table 7: Seasonal efficiency requirements for electric LSHs in EU regulations in terms of primary energy, and the equivalent electric efficiency.

	Old CR (EU) 2015/1188		New CR (EU) 2024/1103	
	Primary (CC=2.5)	Electric	Primary (CC=1.9)	Electric
LH Electric portable	36%	90.0%	44.7%	84.9%
LH Electric fixed > 250W	38%	95.0%	47.5%	90.3%
LH Electric fixed ≤ 250W	34%	85.0%	43.1%	81.9%
LH Electric storage	38.5%	96.3%	47.3%	89.9%
LH Electric underfloor	38%	95.0%	47.5%	90.3%
LH Electric visibly glowing > 1.2 kW	35%	87.5%	46.8%	88.9%
LH Electric visibly glowing ≤ 1.2 kW	31%	77.5%	40.5%	77.0%
LH Electric Towel Heaters > 250W			46.0%	87.4%
LH Electric Towel Heaters ≤ 250W			42.1%	80.0%
LH electric portable visibly glowing			39.4%	74.9%

9.1.4 Swiss regulation for electric LSH

The Swiss regulation on LSHs [46] copies the definitions and requirements of EU regulation 2015/1188. However, from 01.01.2024 the Swiss regulation requires an efficiency of 39% for all electric LSHs (except towel heaters). This refers to the definitions of 2015/1188, which prescribe a CC=2.5, so the 39% (primary) corresponds to 97.5% electric efficiency.

The 39% efficiency can only be reached by electric LSHs with advanced controls and low standby consumption, and not all electric LSH models are able to meet

[45] Slave heaters are products sold without controls. They were exempted in CR 2015/1188, but CR 2024/1103 removed the exemption. Manufacturers of products sold without controls have to indicate which (combination) of controls can be added to meet the minimum efficiency requirements of CR 2024/1103.

[46] Energieeffizienzverordnung, EnEV 730.02, Verordnung über die Anforderungen an die Energieeffizienz serienmässig hergestellter Anlagen, Fahrzeuge und Geräte (November 2017).
„Anhang 1.18 Anforderungen an die Energieeffizienz und an das Inverkehrbringen und Abgeben von Einzelraumheizgeräten"

this requirement. Additional controls also means additional costs, so portable devices and cheap fixed devices may be affected in particular. This could mean that they can no longer be placed on the market, which was the intention of the added Swiss requirement. However, as noted by BFE, there are already portable eLSHs on the market that meet the 39% requirement.

If Switzerland wants to adopt also the revised (EU) regulation 2014/1103, the 39% requirement has to be reassessed because it would be lower than all revised requirements of the EU. The equivalent new value would be 39%*2.5/1.9 = 51.3% primary (the same 97.5% electric as now).
If Switzerland wants to apply the calculation methods of CR 2024/1103, products will need the best option F(2) plus at least 4 of the 5 control options F(3) [47], to reach the 97.5%.

The Swiss 39% primary energy efficiency requirement for electric LSHs (97.5% electric efficiency) is already active and thus has been considered as part of the BaU1 scenario in this study [48]. This scenario (with impacts of CH 2024 measures) assumes that 25% of the sales of eLSHs will disappear from the market (except for towel heaters), and that the remaining products will have an average electric efficiency of 97.5%.
As indicated by BFE, the 25% reduction in sales will not shift to RACs (as is assumed in EU27 scenario modelling), but mainly to central heating systems, which are out-of-scope for the current study.

An optional additional measure is the application of the 97.5% requirement also to towel heaters. This is considered as the ECO1 option in section 9.2.

9.1.5 Ongoing revision of the EU Ecodesign regulation for RACs

EU Commission Regulation 206/2012 applies to room air conditioners < 12 kW. The Swiss regulation for RACs copied the requirements from the EU regulation.

CR 206/2012 is currently under revision, but a new final regulation is not available yet (expected second half of 2025). The following minimum energy efficiency requirements are currently under consideration [49] (but by no means certain):

Minimum efficiency requirements for cooling:

Fixed split RAC < 6 kW	SEER >= 7	(was: SEER >= 4.6)
Fixed split RAC 6-12 kW	SEER >= 6	(was: SEER >= 4.3)
Fixed double duct RAC	SEER >= 3.3	(was: EER >= 2.4)

[47] For portable, only a factor 0.005 can be missing, for the other LSH types a factor 0.025.
[48] It is equivalent to the ECO2 scenario, see section 9.3
[49] This is from a draft impact assessment, status of October 2023. The limits can be subject to change, e.g. for impacts of the EU F-gas regulation on the type of refrigerants that can be used in RACs. Refrigerant types are related to attainable efficiencies.

Portable SD or DD	SEER >= 2.3	(was: EER >= 2.4)

Minimum efficiency requirements for heating:

Fixed split RAC < 6 kW	SCOP >= 4.3	(was: SCOP >= 3.8)
Fixed split RAC 6-12 kW	SCOP >= 3.8	(was: SCOP >= 3.8)
Fixed double duct RAC	SCOP >= 2.5	(was: COP >= 2.36)
Portable SD	not allowed	(was: COP >= 1.8)
Portable DD	not allowed	(was: COP >= 2.36)

In the current BaU scenario modelling, in 2022, fixed RACs < 6 kW have an average SEER=6.5 for cooling and SCOP=4.12 for heating. This would be slightly below the newly proposed requirements.

In the current BaU scenario modelling, in 2022, fixed RACs 6-12 kW have an average SEER=6.1 for cooling and SCOP=4.06 for heating. This would be slightly better than the newly proposed requirements.

In the current BaU scenario modelling, in 2022, portable RACs < 12 kW have an average SEER=1.89 for cooling while heating is not being considered. This would be slightly below the newly proposed requirements.

See section 9.4 for further information on RAC efficiencies.

9.1.6 Ongoing revision of the EU Energy Labelling regulation for LSHs/RACs

Non-electric LSHs have an energy label according to EU CDR 2015/1186.
Electric LSHs currently do not have an energy label.
RACs have an energy label according to EU CDR 626/2011 [50].

The two EU labelling regulations are currently being revised together, but a new final regulation is not available yet (expected second half of 2025). The rescaling of labels from the current A^{+++}-G to A-G classes seems certain because this is required under EU framework regulation 2017/1369.
What is currently under consideration [51], but by no means certain:

- Introduction of a single labelling scale for heating for fixed RACs and all LSHs (electric and non-electric) (also called co-label or merged label)

- Introduction of a single labelling scale for cooling for all RACs < 12 kW (fixed and portable, ducted and non-ducted).

[50] Switzerland uses the EU labelling scheme, see e.g. 6305-EnergieSchweiz-Faktenblatt-Raumklimageräte-D.pdf, but only down to class D (lower classes are indeed irrelevant due to the Ecodesign minimum requirements.
[51] This is from a draft impact assessment, status of November 2023, but might be subject to change.

The proposed label class thresholds (status November 2023) are in Table 8.

The main idea behind the use of a merged label for heating would be to inform users that RACs for heating are more efficient than (electric) LSHs. The EU scenario analysis for the impact of a merged heating label currently assumes that 9.1% of the sales of fixed eLSH > 250 W would shift to a RAC fixed < 6 kW. Considering BFE statements that sales of fixed eLSHs are not expected to shift to RACs, it seems doubtful if the same would apply in Switzerland.

The main idea behind the possible use of a merged label for cooling would be to inform users that fixed RACs are more efficient than portable RACs. The EU scenario analysis for the impact of a merged cooling label currently assumes that 19.1% of the sales of portable RACs would shift to RAC fixed < 6 kW.

Table 8: Proposed EU energy label classes for local space heaters and room air conditioners (status November 2023, subject to change)

	Heating (LSHs and RACs)			Cooling (RACs)
Class	**Minimum SCOP**	**Minimum Electrical efficiency**		**Minimum SEER**
A	6.3	333%		11.6
B	4.3	226%		8.5
C	2.6	135%		6.1
D	1.6	85%		4.5
E	1.0	51%		3.4
F	0.9	46%		2.4
G	0.0	0%		1.9

In Switzerland, from January 2024, electric LSHs are required to have 97.5% electric efficiency (section 9.1.4). If a primary energy factor of 1.9 is applied (as done in EU regulations), this would mean 51.3% primary energy efficiency. On the revised label scale, this closely corresponds to the lower threshold of 51% for class E, if currently proposed values are confirmed [52].

For RACs, if currently discussed EU Ecodesign limits and Label class thresholds would be confirmed (further details in section 9.4):

For heating:

- split RAC 6-12 kW (proposed SCOP >= 3.8 in EU Ecodesign) would have to be at least label class C (SCOP >= 2.6)
- split RAC < 6 kW (proposed SCOP >= 4.3 in EU Ecodesign) would have to be at least label class B (SCOP >= 4.3).

[52] The minimum SCOP for heating for class E, shown as 1.0 in the table, is an electric efficiency, which would correspond to 52.6% primary efficiency when applying a CC=1.9. However, the SCOP value in the table has been rounded up from 0.97, which indeed corresponds to 51.0% primary energy efficiency.

- fixed DD RAC (proposed SCOP >= 2.5 in EU Ecodesign) would have to be very high in class D (SCOP >= 1.6), or more likely class C (SCOP >= 2.6)
- for portable SD or DD the heating function would not be allowed

For cooling:

- split RAC 6-12 kW (proposed SEER >= 6 in EU Ecodesign) would have to be at least high class D (SEER >= 4.5), but majority might be class C (SEER >= 6.1)
- split RAC< 6 kW (SEER >= 7) would have to be at least high class C (SEER >= 6.1).
- fixed DD RAC (SEER >= 3.3) would have to be very high in class F (SEER >= 2.4), or more likely class E (SEER >= 3.4)
- portable SD or DD RAC (SEER >= 2.3) would have to be very high in class G (SEER >= 1.9), or more likely class F (SEER >= 2.4)

9.2 ECO1: more severe requirements for towel heaters

Towel heaters are currently not covered by the Swiss 01.01.2024 minimum efficiency requirements for electric local space heaters (section 9.1.4).

The impact of introducing a minimum electric efficiency requirement of 97.5% for towel heaters starting from 2026 has been modelled [53].
As explained in section 2.2, the analysis assumes that the requirement will lead to a 25% decrease in towel heater sales over the period 2026-2028 and that remaining heaters will have an average efficiency of 97.5%.

Purchase prices for towel heaters in the BaU1 scenario decrease from 304 CHF in 2010 to 233 CHF in 2022 and then remain constant (this is excl. VAT, excl. installation, in CHF 2020).
The Ecodesign Impact Accounting 2024 [5] provides product purchase prices for best-available-technology (BAT) products. For towel heaters, the BAT product price (with 94% efficiency) is 12% higher than the 2022 product price (with 82% efficiency). To reach the 97.5%, products will have to use the best F(2) control option and at least four of the five F(3) control options of Table 6. A price increase of 15% has been assumed for these controls.
Installation costs in the BaU1 scenario are 53 CHF (excl. VAT) and constant over the years. The additional controls might require some additional installation work, a 10% increase of costs has been assumed.

Table 9 shows the result of the modelling, comparing the situation with new measures (ECO) with the situation without new measures (BaU1), for years 2030, 2035, 2040. For reference, the BaU1 value for 2025 is also reported.

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[53] This corresponds to 51.3% primary efficiency with CC=1.9, identical to the 39% with CC=2.5 already applicable to other eLSH types.

Note that towel heaters are assumed to have an average lifetime of 20 years. This means that the full impacts of measures taken in 2026 will be reached in 2046.

The electricity savings in 2040 are 17.2 GWh (-26% compared to BaU1). The user expense savings in 2040 are 4.2 million CHF, of which 3.6 million are due to lower energy costs.

The heat produced by the stock of towel heaters in 2040 reduces by 9.5 GWh compared to the situation without new measures. This heat load will have to be covered by other means (e.g. by central heating), and this will reduce the above energy and expense savings, but this is not included in the current analysis.

Table 9: Change in impacts due to application of 97.5% minimum electric efficiency requirements to towel heaters from 2026

Towel Heaters in CH	2025	2030			2035			2040		
Parameter	**BaU1**	**BaU1**	**ECO1**	**Inc.**	**BaU1**	**ECO1**	**Inc.**	**BaU1**	**ECO1**	**Inc.**
Sales (thousands)	11.4	11.6	8.7	**-2.9**	12.0	9.0	**-3.0**	12.3	9.2	**-3.1**
Stock (thousands)	212	221	210	**-11**	228	201	**-27**	234	192	**-42**
Stock heat output (GWh heat / year)	55.0	55.1	52.3	**-2.9**	53.5	44.0	**-6.3**	53.5	44.0	**-9.5**
Unit electrical efficiency (% sales average)	82.2	82.6	97.5	**+14.9**	82.6	97.5	**+14.9**	82.6	97.5	**+14.9**
Unit electrical efficiency (% stock average)	75.6	79.0	81.4	**+2.4**	81.5	87.4	**+5.9**	82.4	92.2	**+9.8**
Electricity consumption (GWh / year)	72.7	69.8	64.2	**-5.6**	66.6	55.0	**-11.6**	64.9	47.7	**-17.2**
Greenhouse gas emissions (kton CO2 eq /year)	5.9	5.2	4.8	**-0.4**	4.7	3.8	**-0.8**	4.3	3.1	**-1.1**
Unit purchase price (CHF 2020, excl. VAT)	233	233	268	**+35**	233	268	**+35**	233	268	**+35**
Unit install costs (CHF 2020, excl. VAT)	53	53	58	**+5**	53	58	**+5**	53	58	**+5**
Acquisition costs (million CHF, incl. VAT)	3.5	3.6	3.1	**-0.5**	3.7	3.2	**-0.5**	3.8	3.2	**-0.6**
Energy costs (million CHF)	15.3	14.7	13.5	**-1.2**	14.0	11.6	**-2.5**	13.7	10.1	**-3.6**
Repair and maintenance costs (million CHF)	0	0	0	**0**	0	0	**0**	0	0	**0**
Total user expense (million CHF)	18.8	18.3	16.6	**-1.7**	17.7	14.7	**-3.0**	17.5	13.3	**-4.2**

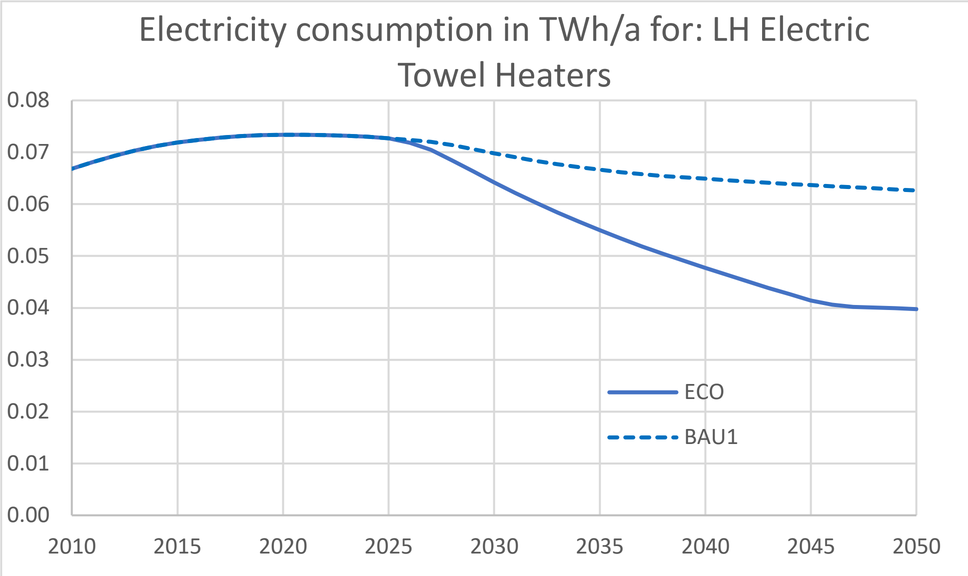

Figure 35: Electricity consumption in GWh/year for towel heaters in Switzerland, without new measures (BaU1), and with 97.5% electric efficiency requirement from 2026 (ECO1).

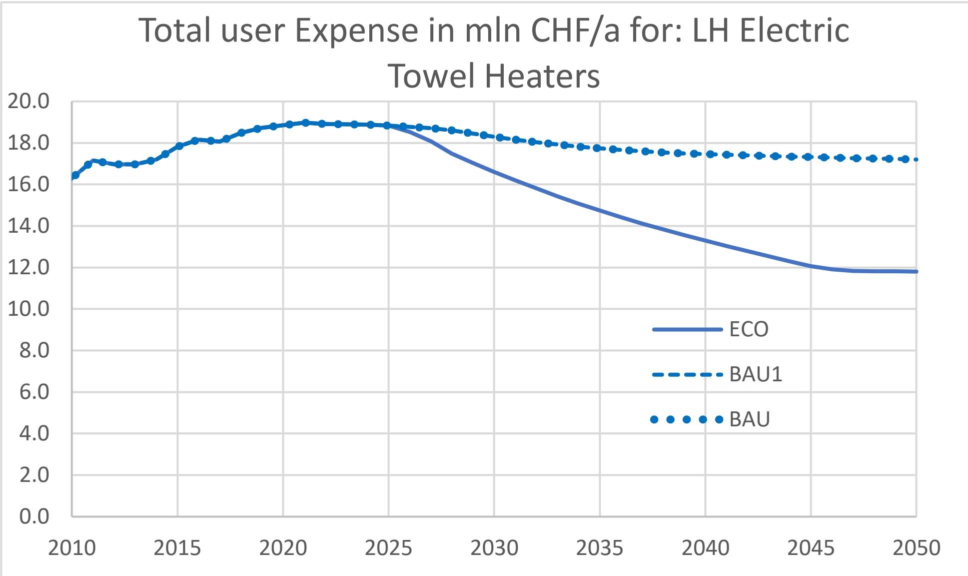

Figure 36: Total user expenses (for acquisition, energy and maintenance) in million CHF 2020 per year, for towel heaters in Switzerland, without new measures (BaU=BAU1), and with 97.5% electric efficiency requirement from 2026 (ECO1).

9.3 ECO2: minimum label class requirement for electric LSHs

From 01.01.2024, Swiss regulation EnEV 730.02 requires a 97.5% electric efficiency for all electric LSHs except towel heaters (section 9.1.4).
As discussed in section 9.1.6, the existing efficiency requirement is expected to be equivalent to requiring energy label class E under the future EU energy labelling regulation (still under development and subject to change).

Compared to the BaU1 scenario, which considered the 97.5% electric efficiency requirement, the substitution by a potential future requirement of minimum energy label class E (ECO2 scenario) is therefore not expected to change the impacts.

As explained in section 2.3, the BaU1 = ECO2 scenario analysis assumes that the requirement will lead to a 25% decrease in eLSH sales over the period 2024-2026 and that remaining heaters will have an average efficiency of 97.5%. Although the label class E requirement could also apply to towel heaters from 2026, they are excluded here because already analysed in the previous section (ECO1).

The Ecodesign Impact Accounting 2024 [5] provides product purchase prices for best-available-technology (BAT) products.
For eLSHs other than underfloor models, the BAT prices are 3 to 7% higher than product prices in 2022, but several of the BAT products stay below the 97.5% target efficiency, so the price increase to reach that efficiency will be higher. To reach the 97.5% products will have to use the best F(2) control option and at least four of the five F(3) control options of Table 6. A price increase of 10% has been assumed for these controls.
For underfloor eLSH, the BAT price increase is 54% (for an efficiency of 97.0%), compared to a 2022 product with 80% efficiency. The reason for the high price increase is probably that many underfloor models are now sold without any controls (these were exempted slave heaters under EU regulation 2015/1188). A price increase of 50% has therefore been assumed for underfloor models.

The additional controls might require some additional installation work. An increase of 10% has been used for eLSHs except underfloor models, and an increase of 25% for underfloor models [54].

Table 10 shows the result of the modelling, comparing the situation with measures (BaU1=ECO2) with the situation without the 2024 measures (BaU), for years 2030, 2035, 2040. For reference, the BaU value for 2020 is also reported.
Note that electric LSHs are assumed to have average lifetime between 12 and 35 years. This means that the full impacts of measures taken in 2024 will be reached in 2059.

The ECO2 electricity savings in 2040 are zero compared to BaU1.

[54] Portables do not have installation costs, so the 10% increase has no effect.

The ECO2 electricity savings in 2040 are 179 GWh compared to BaU (-20%).

The user expense savings in 2040 are 38.0 million CHF (ECO2 versus BaU), of which 36.4 million are due to lower energy costs.

The heat produced by the stock of electric LSHs (except towel heaters) in 2040 reduces by 142 GWh compared to the situation without the 2024 measures (BaU). This heat load will have to be covered by other means (e.g. by central heating), and this will reduce the above energy and expense savings, but this is not included in the current analysis.

Table 10: Change in impacts compared to the BAU scenario without measures, due to application of 97.5% minimum electric efficiency requirements from 2024 (BaU1) or application of minimum label class E (ECO2) to electric LSHs (except towel heaters) (BaU1 = ECO2 scenario)

Electric LSH except towel heaters in CH	**2020**	**2030**			**2035**			**2040**		
Parameter	**BaU**	**BaU**	**ECO2**	**Inc.**	**BaU**	**ECO2**	**Inc.**	**BaU**	**ECO2**	**Inc.**
Sales (thousands)	69.7	62.7	47.1	**-15.7**	59.3	44.5	**-14.8**	55.8	41.9	**-14.0**
Stock (thousands)	1011	1078	981	**-97**	1080	907	**-173**	1082	878	**-204**
Stock heat output (GWh heat / year)	968	922	850	**-72**	875	753	**-122**	832	690	**-142**
Electricity consumption (GWh / year)	1242	1058	966	**-92**	977	822	**-155**	912	733	**-179**
Greenhouse gas emissions (kton CO2 eq /year)	106	79.2	72.3	**-6.9**	68.3	57.5	**-10.8**	60.1	48.3	**-11.8**
Acquisition costs (million CHF, incl. VAT)	18.5	14.0	11.9	**-2.2**	12.6	10.7	**-1.9**	11.3	9.6	**-1.7**
Energy costs (million CHF)	253	215	196	**-18.7**	198	167	**-31.5**	185	149	**-36.4**
Repair and maintenance costs (million CHF)	0	0	0	**0**	0	0	**0**	0	0	**0**
Total user expense (million CHF)	271	229	208	**-20.8**	211	177	**-33.4**	196	158	**-38.0**

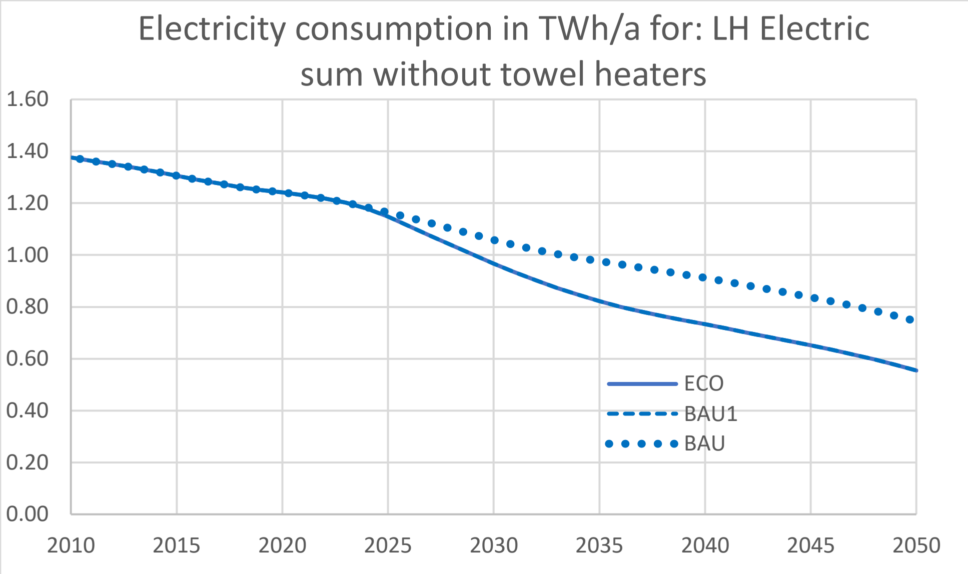

Figure 37: Electricity consumption in GWh/year for electric local space heaters (except towel heaters) in Switzerland, without the 2024 measures (BaU), and with the 97.5% electric efficiency requirement from 2024 (BaU1) or the minimum label class E requirement from 2026 (ECO2) (BaU1 = ECO2).

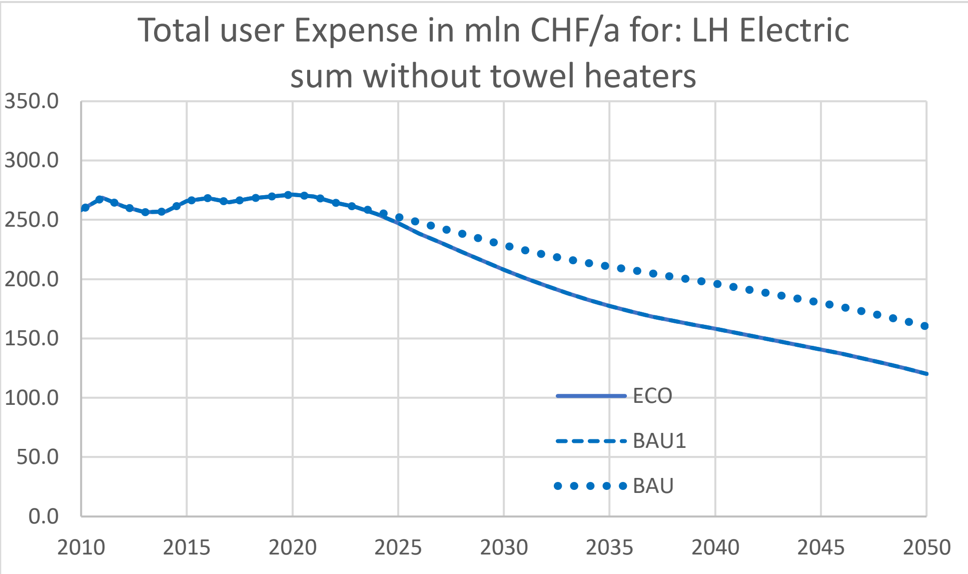

Figure 38: Total user expenses (for acquisition, energy and maintenance) in million CHF 2020 per year, for electric local space heaters (except towel heaters) in Switzerland, without measures (BaU), and with the 97.5% electric efficiency requirement from 2024 (BaU1) or the minimum label class E requirement from 2026 (ECO2) (BaU1 = ECO2).

9.4 ECO3: more severe label class requirement for RACs

For fixed double-duct (fDD) models, single-duct (SD) models, and ducted-splits models, see the remarks in section 2.4. Only portable RACs, fixed RACs < 6 kW and fixed RACs 6-12 kW are considered here, and this is assumed to cover also the fDD, SD and ducted-splits models. For portable RACs, only cooling is considered, not heating.

9.4.1 Cooling by portable RACs

For cooling by portable RACs, the existing Ecodesign requirement is EER ≥ 2.4 and this corresponds to existing Energy label class B (from EER 2.4 to 2.6).

According to the 1157 registrations for single-duct cooling in the EPREL database of November 2024, 1055 models (91.2%) are in class A (EER 2.6 to 3.1) and 8.6% are in class A+ or better. Only 0.2% is in class B. Hence, current models are better than required.
The EER between 2.6 and 3.1 for 91% of the models is high compared to the average SEER of 1.9 (approximately EER=2.06?) [55] in 2024 used in the current analysis [56].

The new proposed minimum Ecodesign requirement for cooling by portable RACs is SEER ≥ 2.3, which seems close to the previous EER ≥ 2.4, and which is probably already met by more than 99% of the products now on the market.
On the new proposed energy labelling scale, almost all models now on the market would be in class F (SEER between 2.4 and 3.4).

Switzerland could set a minimum class F requirement for portable RACs, but this would not improve the market. Setting new proposed class E (SEER between 3.4 and 4.5) as a minimum requirement seems much too high. Hence, no analysis has been performed to assess the effect of potential new measures.

9.4.2 Cooling by fixed RACs < 6 kW

For cooling by fixed RACs < 6 kW, the existing Ecodesign requirement is SEER ≥ 4.6 and this corresponds to existing Energy label class B (from SEER 4.6 to 5.1).

According to the 8867 registrations for RACs < 6 kW [57] in the EPREL database of November 2024, 2025 models (23%) are in class A+++ (SEER ≥ 8.5), 5988 models (68%) in class A++ (SEER 6.1 to 8.5), 540 models (6%) in class A+ (SEER 5.6 to 6.1) and 286 models (3%) in class A (SEER 5.1 to 5.6). Only 0.3% is in class B. Hence, current models are much better than required.
For comparison, the average SEER in 2024 in the current modelling is 6.6, which could be reasonable.

[55] An exact conversion between EER and SEER is not possible without also knowing the EERs at part loads, but for EER values between 2 and 3, online conversion calculators indicate that SEER is 8 to 6% smaller than EER.
[56] The RAC efficiencies in the modelling come from the Ecodesign Impact Accounting and are based on the 2018/2019 EU review study.
[57] EPREL, category other, any function, design cooling load 0-6 kW (captures cooling only, heating only and reversible)

The new proposed minimum Ecodesign requirement for cooling by fixed RACs < 6 kW is SEER ≥ 7, which is much higher than the previous SEER ≥ 4.6.
On the new proposed energy labelling scale, class C (SEER between 6.1 and 8.5) is identical to the current class A++, with 68% of EPREL models. New class B (SEER between 8.5 and 11.6) covers the current class A+++, with 23% of EPREL models. The SEER ≥ 7 is thus halfway in class C.

If Switzerland wants to set requirements for fixed RACs < 6 kW in terms of energy classes, minimum class C would mean SEER ≥ 6.1 (lower than the EU proposed Ecodesign limit of 7), and 91% of currently marketed models would already meet this. Setting class B (SEER between 8.5 and 11.6) as a minimum requirement seems high (although 23% of models already meets this), and further study would be necessary to verify what this means in terms of costs for the users.

9.4.3 Cooling by fixed RACs 6-12 kW

For cooling by fixed RACs 6-12 kW, the existing Ecodesign requirement is SEER ≥ 4.6 and this corresponds to existing Energy label class B (from SEER 4.6 to 5.1).

According to the 12742 registrations for RACs 6-12 kW [58] in the EPREL database of November 2024, 310 models (2.4%) are in class A+++ (SEER ≥ 8.5), 9841 models (77%) in class A++ (SEER 6.1 to 8.5), 1124 models (8.8%) in class A+ (SEER 5.6 to 6.1) and 1107 models (8.7%) in class A (SEER 5.1 to 5.6). Only 2.7% is in class B. Hence, current models are much better than required.
For comparison, the average SEER in 2024 in the current modelling is 6.2, which could be reasonable.

The new proposed minimum Ecodesign requirement for cooling by fixed RACs 6-12 kW is SEER ≥ 6, which is much higher than the previous SEER ≥ 4.3.
On the new proposed energy labelling scale, class C (SEER between 6.1 and 8.5) is identical to the current class A++, with 77% of EPREL models. New class B (SEER between 8.5 and 11.6) covers the current class A+++, with 2.4% of EPREL models. The SEER ≥ 6 is just below the lower threshold of class C (SEER=6.1).

If Switzerland wants to set requirements for fixed RACs 6-12 kW in terms of energy classes, minimum class C would be an option. It would mean SEER ≥ 6.1 (slightly higher than the EU proposed Ecodesign limit of 6), and nearly 80% of currently marketed models would already meet this. Setting class B (SEER between 8.5 and 11.6) as a minimum requirement seems high (only 2.4% of models already meets this).

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[58] EPREL, category other, any function, design cooling load 6.1-12 kW (captures cooling only, heating only and reversible)

9.4.4 Heating by fixed RACs < 6 kW

For heating by fixed RACs < 6 kW, the existing Ecodesign requirement is SCOP ≥ 3.8 and this is inside the existing Energy label class A (from SCOP 3.4 to 4.0).

There are 8807 registrations for reversible RACs < 6 kW [59] in the EPREL database of November 2024. Compared to the total of 8867 models, this means that 99.3% is reversible. 645 models (7%) are in class A+++ (SCOP ≥ 5.1), 1845 models (21%) in class A++ (SCOP 4.6 to 5.1), 5614 models (64%) in class A+ (SCOP 4.0 to 4.6) and 701 models (8%) in class A (SCOP 3.4 to 4.0). Hence, current models are better than required.
For comparison, the average SCOP in 2024 in the current modelling is 4.2, which could be reasonable.

The new proposed minimum Ecodesign requirement for heating by fixed RACs < 6 kW is SCOP ≥ 4.3, higher than the previous SCOP ≥ 3.8.
On the new proposed energy labelling scale for heating, the SCOP ≥ 4.3 means class B (SCOP 4.3 to 6.3). This is certainly met by 28% of the models currently on the market, and probably by a part of the 64% of models currently in class A+ (SCOP 4.0 to 4.6).

If Switzerland wants to set requirements for heating by fixed RACs < 6 kW in terms of energy classes, minimum class B would be identical to the currently proposed EU Ecodesign limit.
The average SCOP in the BaU scenario modelling now increases from 4.2 in 2026 to 4.6 in 2050. An ECO scenario could be modelled, increasing this to 4.3 in 2026 to 4.6 in 2050. This has not been done yet.

9.4.5 Heating by fixed RACs 6-12 kW

For heating by fixed RACs 6-12 kW, the existing Ecodesign requirement is SCOP ≥ 3.8 and this is inside the existing Energy label class A (from SCOP 3.4 to 4.0).

There are 12742 registrations for reversible RACs 6-12 kW [60] in the EPREL database of November 2024. This is the same as the total above, so 100% is reversible. 12 models (0.1%) are in class A+++ (SCOP ≥ 5.1), 741 models (6%) in class A++ (SCOP 4.6 to 5.1), 9518 models (75%) in class A+ (SCOP 4.0 to 4.6) and 2469 models (19%) in class A (SCOP 3.4 to 4.0). Hence, current models are (slightly) better than required.
For comparison, the average SCOP in 2024 in the current modelling is 4.1, which could be reasonable.

The new proposed minimum Ecodesign requirement for heating by fixed RACs 6-12 kW is SCOP ≥ 3.8, identical to the existing limit.

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[59] EPREL, category other, reversible, design cooling load 0-6 kW
[60] EPREL, category other, reversible, design cooling load 6-12 kW

On the new proposed energy labelling scale for heating, the SCOP ≥ 3.8 means class C (SCOP 2.6 to 4.3). This SCOP ≥ 3.8 is certainly met by 81% of the models currently on the market, and probably by a part of the 19% of models currently in class A (SCOP 3.4 to 4.0).

If Switzerland wants to set requirements for heating by fixed RACs 6-12 kW in terms of energy classes, minimum class C (SCOP 2.6 to 4.3) would be too low, while minimum class B (SCOP 4.3 to 6.3) could be too high. Especially for RACs 6-12 kW, the allowed refrigerant types in relation to the EU F-gas regulation are important. The European Commission is currently reviewing the Ecodesign limits and maybe also the label classes for this.