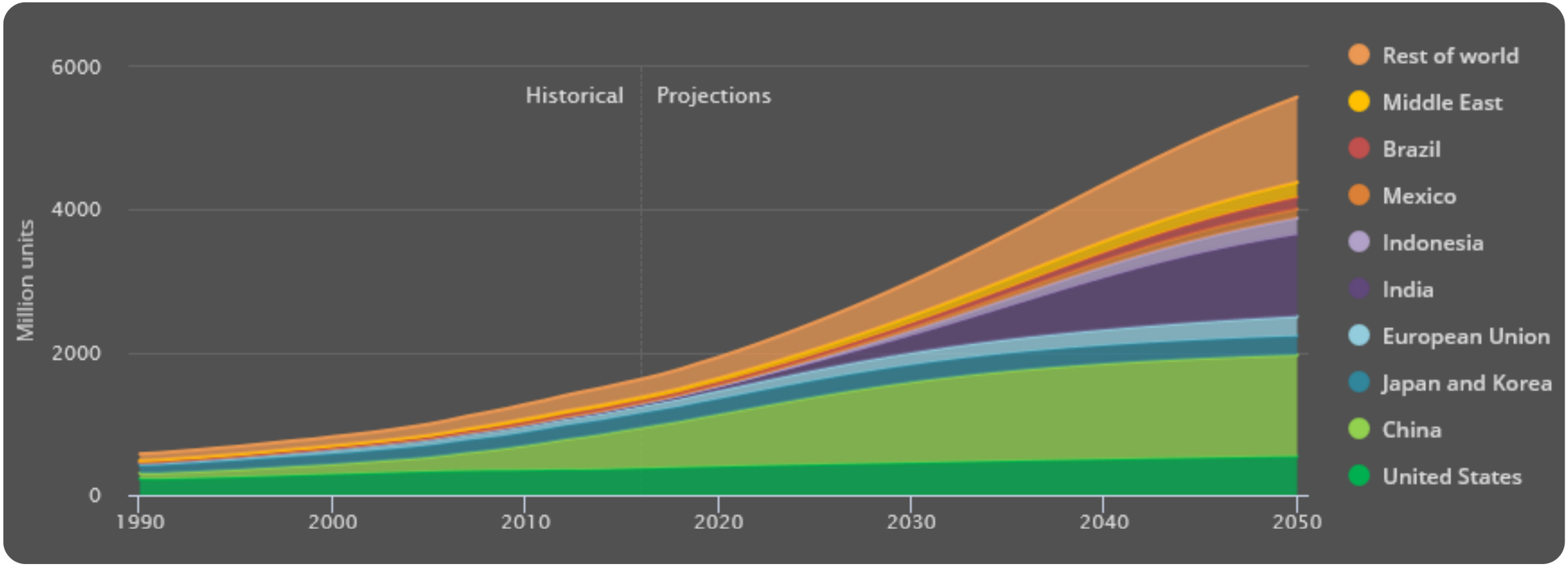
BUDÚCNOSŤ

chladiacej a klimatizačnej techniky

Vladimír Orovnický
Daikin Slovensko

Predikcia celosvetového rastu klimatizačnej techniky

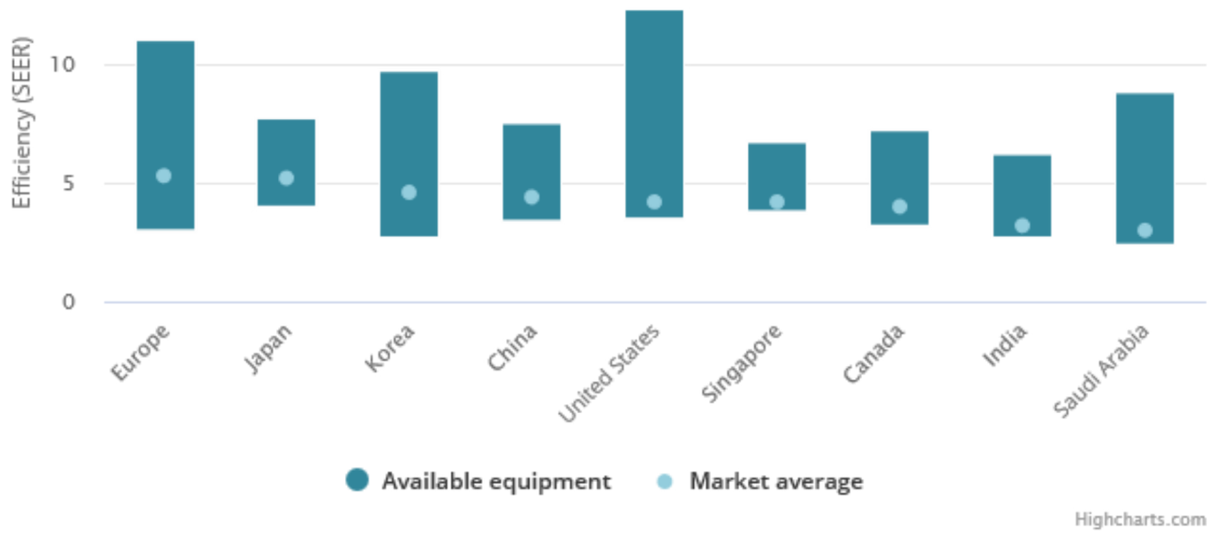


Zdroj: International Energy Agency - Future of cooling

Budúcnosť Chladenia

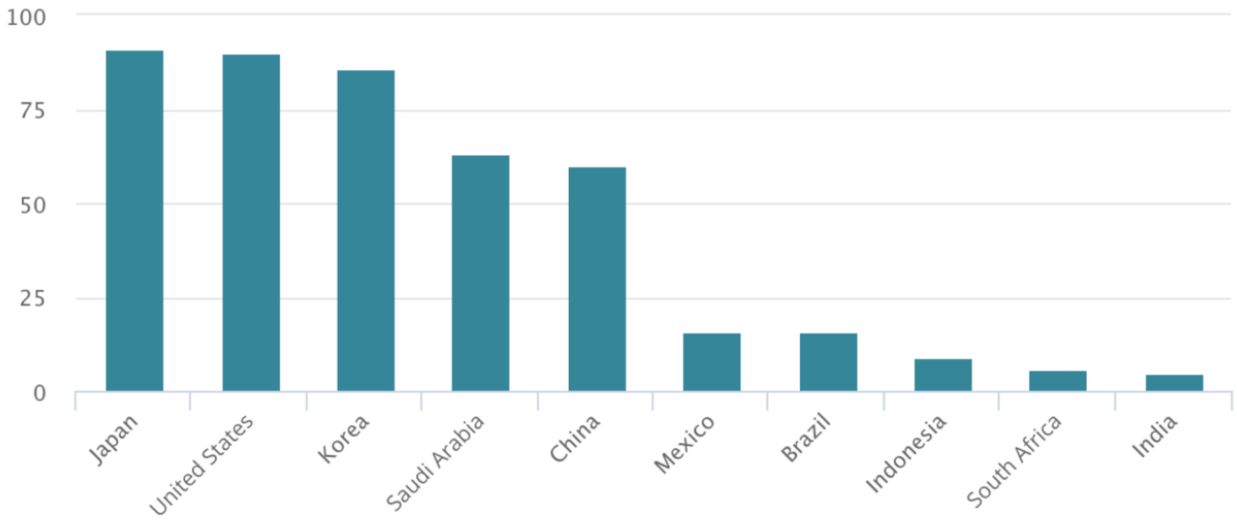
2018

Porovnanie SEER a dostupnosti rezidenčných klim. zariadení vo vybraných štátoch



2018

Percentuálne množstvo domácností vlastniacich klimatizačné zariadenie



Zdroj: International Energy Agency - Future of cooling

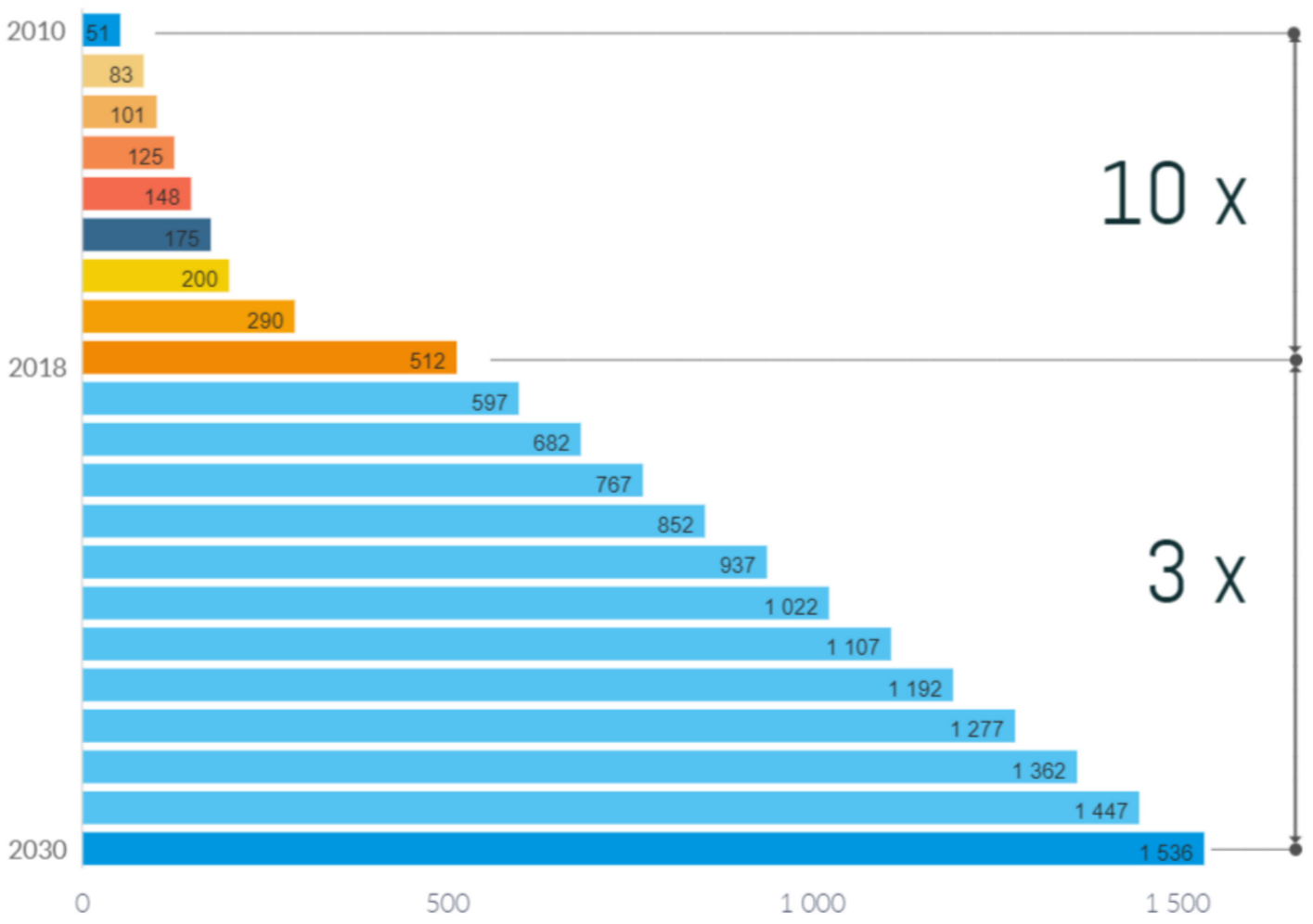
Životný cyklus klimatizácie

2, 98 mil ton CO_2	**1,31 mil ton CO_2**	**42 000 ton CO_2**	**296,78 mil ton CO_2**	**30,63 mil ton CO_2**
Emisie z nakúpených materiálov	Znečistená voda 10,42 mil m³ chemické subst. 2 000 t	Emisie produkované pri preprave tovaru	Emisie vytvorené prevádzkou Daikin zariadení na trhu	Emisie vytvorené ničením skleníkových plynov
Hliník, železo, meď chemické produkty Plast **1,08 mil ton**	Elektrina, plyn, para, voda: 12,33 mil m³, potreba energie **15,080 TJ**	Nafta, benzín spotrebovaná na transport **Palivo**	Energia spotrebovaná prevádzkou zariadení DAIKIN na trhu **377 TWh**	

7%

Podiel tepelných čerpadiel na OE v roku 2018

Tepelné čerpadlá na Slovensku



Zdroj:SZCHKT, Návrch Integrovaného a energetického plánu SR

Enviromentálna vízia 2050

Cesta k enviromentálne uvedomelej spoločnosti

Vo všetkých aspektoch našich činností vrátane vývoja produktov, výroby a predaja musíme formulovať iniciatívy, ktoré udržiavajú a zlepšujú životné prostredie. Medzitým musíme podporovať vývoj nových výrobkov a inováciu technológií, ktoré povedú k zdravšiemu životnému prostrediu.

ENERGETICKÁ EFEKTÍVNOSŤ

V priebehu životného cyklu klimatizačného zariadenia, od návrhu a výroby až po použitie a zneškodnenie, sa väčšina CO2, ktorá sa uvoľňuje, vyskytuje počas používania produktu.

CHLADIVÁ S NÍZKYM GWP

Od chladív sa vyžadujú rôzne charakteristiky v závislosti od toho, či sa používajú napríklad v obytných alebo komerčných klimatizačných zariadeniach, ohrievačoch vody a priestoru alebo v chladiacich zariadeniach.

ŽIVOTNÝ CYKLUS

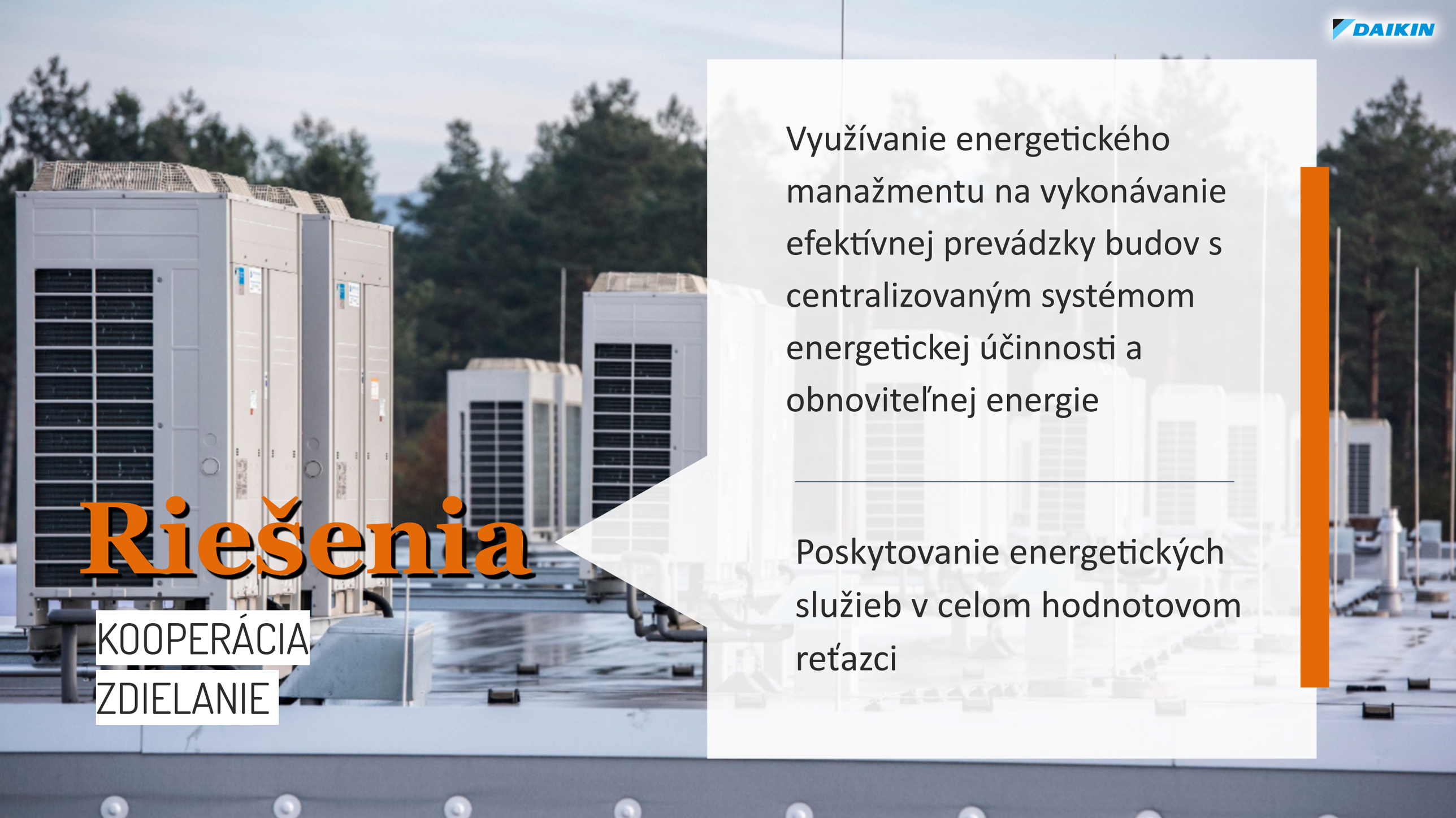
Daikin je jediný komplexný výrobca klimatizačných zariadení, ktorý vyvíja všetko od chladiva po klimatizáciu a zaoberá sa regeneráciou, recykláciou a deštrukciou chladív.

Produkty

EER 37,5

Teoretická účinnosť Carnotovho cyklu. Dnes klimatizačné zariadenia pre domácnosti a komerčné použitie dosahujú maximálne 14% z tejto hodnoty

Zdroj: Iain Campbell, Ankit Kalanki, Sneha Sachar - Solving the global cooling challange



Riešenia

KOOPERÁCIA

ZDIELANIE

Využívanie energetického manažmentu na vykonávanie efektívnej prevádzky budov s centralizovaným systémom energetickej účinnosti a obnoviteľnej energie

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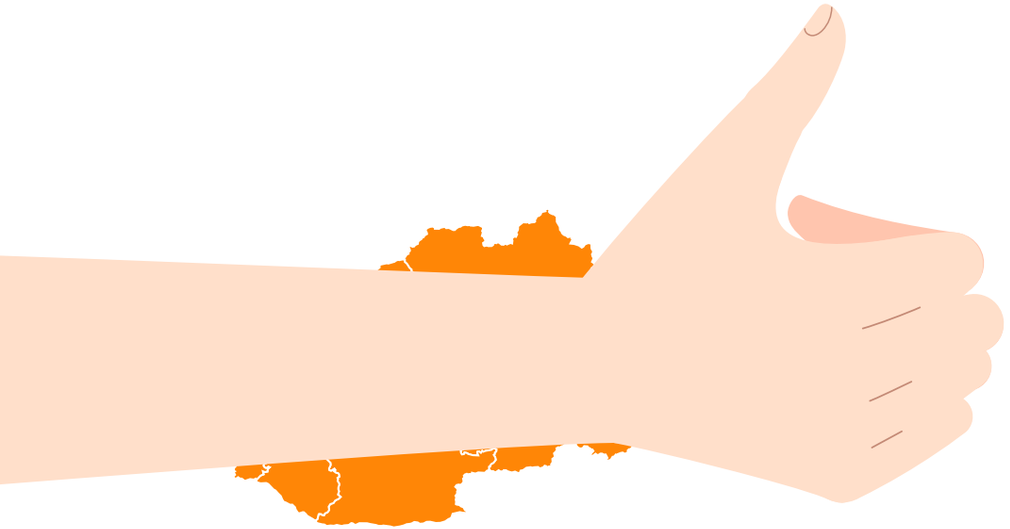
Poskytovanie energetických služieb v celom hodnotovom reťazci

Slovensko



Európske monitorovacie centrum

21 monitorovacích miest, ktoré priemerne znížili spotrebu elektrickej energie o 15 - 25 %. Zároveň inštaláciou monitorovacieho systému nie je potrebné vykonávať energetický audit. (Návrh novely zákona č 214/2012 Z.z)

- Mesačný prehľad spotreby energie
- Spotreba po vnútorných jednotkách
- Spotreba energie počas voľných dní.
- Spotreba energie počas pracovných dní
- Nastavenie vnútornej teploty
- Vyhodnotenie výkonu vonkajších jednotiek

Monitorovací systém

2 €

Jednotka/rok

Cloud riešenie

min 500 €

ACCESS

4 €

Jednotka/rok

Access

Prediktívny servis

min 500 €

ACTIVE MONITORING

6 €

Jednotka/rok

Active monitoring

Reporting

min 500 €

ALL CONNECTED

SILA VZDUCHU

Daikin sleduje kvalitu vnútorného prostredia , ktorá jednoznačne prispieva k zdraviu ľudí a k pohodlnému životnému štýlu. Uprostred rastúcich potrieb na kvalitu ovzdušia v dôsledku jeho znečistenia spôsobeného hospodárskym rozvojom v rozvíjajúcich sa krajinách a sprísňovaním predpisov týkajúcich sa priestorovej hygieny vo všetkých priemyselných odvetviach, sledujeme bezpečnejšie, zdravšie a pohodlnejšie ovzdušie z rôznych uhlov pohľadu vrátane čistoty, prúdenia vzduchu a zápachu, ktoré tiež prispievajú k vytváraniu komfortného a zdravého prostredia v kancelárskom, domácom a nemocničnom prostredí

01 Svieži vzduch

Produktívne kancelárie, miestnosti zvyšujúce koncentráciu, miestnosti pomáhajúce zvyšovaniu kvality spánku

02 Zdravý vzduch

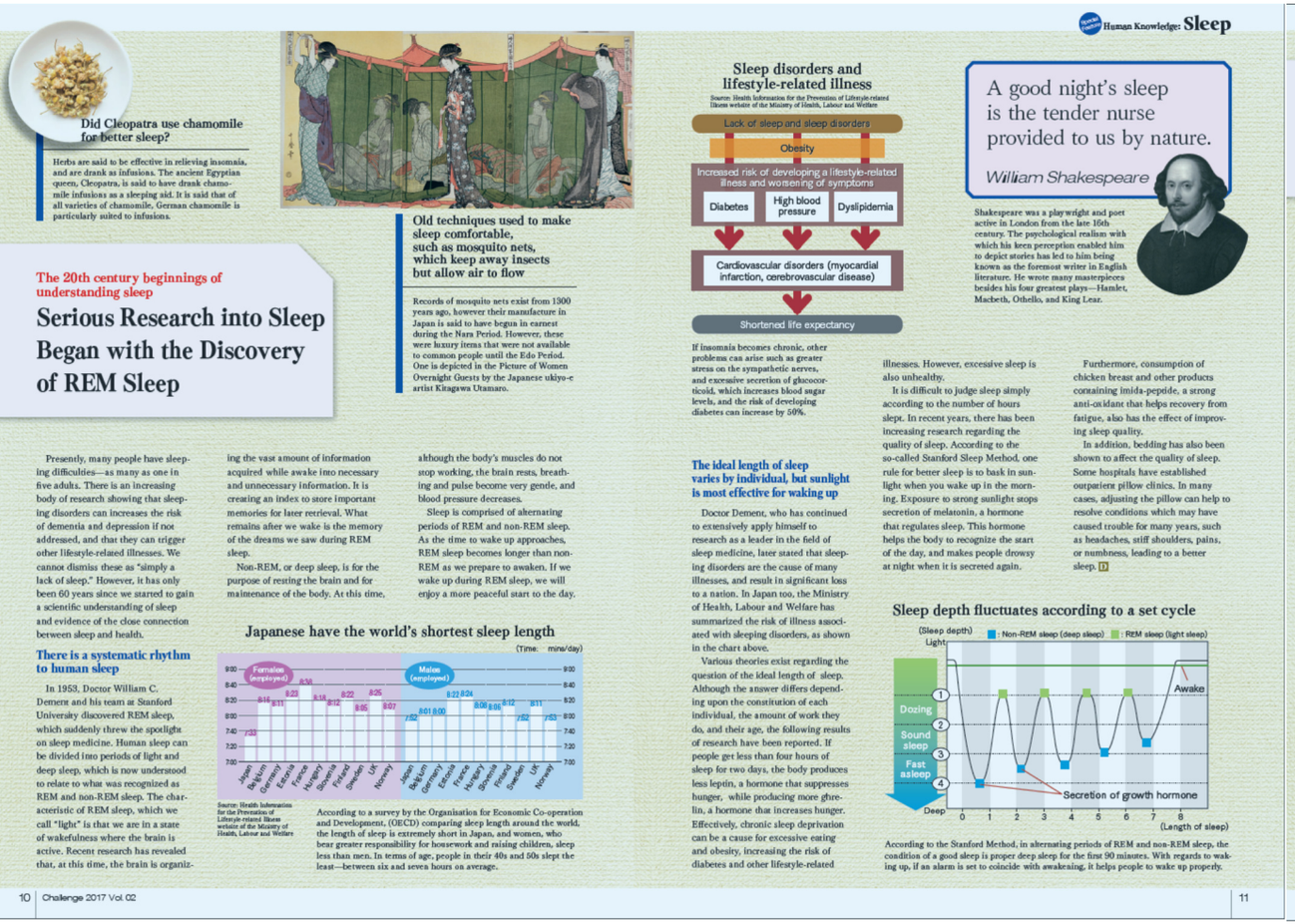
Znižovanie porúch spánku, miestnosti citlivé na stres, miestnosti znižujúce teplotný šok

03 Bezpečný vzduch

Ochrana zdravia pred atmosferickým znečistením, znižovanie rizika infekčných chorôb, predchádzanie úpalu

Spánok

Aká je cena, ktorú by ste zaplatili za spánok ? V súčasnosti veľa ľudí pravidelne používa rôzne pomôcky na zmiernenie nespavosti. Táto tendencia s s vekom stúpa. Je pravdepodobné, že práve v spálňach sa "air conditioning" zmení na **"human conditioning"**.



Human Knowledge: Sleep

Did Cleopatra use chamomile for better sleep?

Herbs are said to be effective in relieving insomnia, and are drank as infusions. The ancient Egyptian queen, Cleopatra, is said to have drank chamomile infusions as a sleeping aid. It is said that of all varieties of chamomile, German chamomile is particularly suited to infusions.

Old techniques used to make sleep comfortable, such as mosquito nets, which keep away insects but allow air to flow

Records of mosquito nets exist from 1300 years ago, however their manufacture in Japan is said to have begun in earnest during the Nara Period. However, these were luxury items that were not available to common people until the Edo Period. One is depicted in the Picture of Women Overnight Guests by the Japanese ukiyo-e artist Kiragawa Utamaro.

The 20th century beginnings of understanding sleep

Serious Research into Sleep Began with the Discovery of REM Sleep

Presently, many people have sleeping difficulties—as many as one in five adults. There is an increasing body of research showing that sleeping disorders can increases the risk of dementia and depression if not addressed, and that they can trigger other lifestyle-related illnesses. We cannot dismiss these as "simply a lack of sleep." However, it has only been 60 years since we started to gain a scientific understanding of sleep and evidence of the close connection between sleep and health.

There is a systematic rhythm to human sleep

In 1953, Doctor William C. Dement and his team at Stanford University discovered REM sleep, which suddenly threw the spotlight on sleep medicine. Human sleep can be divided into periods of light and deep sleep, which is now understood to relate to what was recognized as REM and non-REM sleep. The characteristic of REM sleep, which we call "light" is that we are in a state of wakefulness where the brain is active. Recent research has revealed that, at this time, the brain is organizing the vast amount of information acquired while awake into necessary and unnecessary information. It is creating an index to store important memories for later retrieval. What remains after we wake is the memory of the dreams we saw during REM sleep.

Non-REM, or deep sleep, is for the purpose of resting the brain and for maintenance of the body. At this time, although the body's muscles do not stop working, the brain rests, breathing and pulse become very gentle, and blood pressure decreases.

Sleep is comprised of alternating periods of REM and non-REM sleep. As the time to wake up approaches, REM sleep becomes longer than non-REM as we prepare to awaken. If we wake up during REM sleep, we will enjoy a more peaceful start to the day.

Japanese have the world's shortest sleep length

(Time: mins/day)

Source: Health Information for the Prevention of Lifestyle-related Illness website of the Ministry of Health, Labour and Welfare

According to a survey by the Organisation for Economic Co-operation and Development, (OECD) comparing sleep length around the world, the length of sleep is extremely short in Japan, and women, who bear greater responsibility for housework and raising children, sleep less than men. In terms of age, people in their 40s and 50s slept the least—between six and seven hours on average.

Sleep disorders and lifestyle-related illness

Source: Health Information for the Prevention of Lifestyle-related Illness website of the Ministry of Health, Labour and Welfare

Lack of sleep and sleep disorders → Obesity → Increased risk of developing a lifestyle-related illness and worsening of symptoms: Diabetes, High blood pressure, Dyslipidemia → Cardiovascular disorders (myocardial infarction, cerebrovascular disease) → Shortened life expectancy

If insomnia becomes chronic, other problems can arise such as greater stress on the sympathetic nerves, and excessive secretion of glucocorticoid, which increases blood sugar levels, and the risk of developing diabetes can increase by 50%.

The ideal length of sleep varies by individual, but sunlight is most effective for waking up

Doctor Dement, who has continued to extensively apply himself to research as a leader in the field of sleep medicine, later stated that sleeping disorders are the cause of many illnesses, and result in significant loss to a nation. In Japan too, the Ministry of Health, Labour and Welfare has summarized the risk of illness associated with sleeping disorders, as shown in the chart above.

Various theories exist regarding the question of the ideal length of sleep. Although the answer differs depending upon the constitution of each individual, the amount of work they do, and their age, the following results of research have been reported. If people get less than four hours of sleep for two days, the body produces less leptin, a hormone that suppresses hunger, while producing more ghrelin, a hormone that increases hunger. Effectively, chronic sleep deprivation can be a cause for excessive eating and obesity, increasing the risk of diabetes and other lifestyle-related illnesses. However, excessive sleep is also unhealthy.

It is difficult to judge sleep simply according to the number of hours slept. In recent years, there has been increasing research regarding the quality of sleep. According to the so-called Stanford Sleep Method, one rule for better sleep is to bask in sunlight when you wake up in the morning. Exposure to strong sunlight stops secretion of melatonin, a hormone that regulates sleep. This hormone helps the body to recognize the start of the day, and makes people drowsy at night when it is secreted again.

Furthermore, consumption of chicken breast and other products containing imida-peptide, a strong anti-oxidant that helps recovery from fatigue, also has the effect of improving sleep quality.

In addition, bedding has also been shown to affect the quality of sleep. Some hospitals have established outpatient pillow clinics. In many cases, adjusting the pillow can help to resolve conditions which may have caused trouble for many years, such as headaches, stiff shoulders, pains, or numbness, leading to a better sleep. D

Sleep depth fluctuates according to a set cycle

(Sleep depth) Light — Deep; Non-REM sleep (deep sleep); REM sleep (light sleep); Dozing; Sound sleep; Fast asleep; Awake; Secretion of growth hormone; (Length of sleep)

According to the Stanford Method, in alternating periods of REM and non-REM sleep, the condition of a good sleep is proper deep sleep for the first 90 minutes. With regards to waking up, if an alarm is set to coincide with awakening, it helps people to wake up properly.

> A good night's sleep is the tender nurse provided to us by nature.
>
> *William Shakespeare*

Shakespeare was a playwright and poet active in London from the late 16th ceatury. The psychological realism with which his keen perceptgion enabled him to depict stories has led to him being known as the foremost writer in English literature. He wrote many masterpieces besides his four greatest plays—Hamlet, Macbeth, Othello, and King Lear.

Human Knowledge: Sleep

In order to sleep better

An Order-Made Era is Approaching for Sleep

For modern, busy people, it can be hard to ensure sufficient sleep length. Thomas Edison, the inventor, known for his short sleeping hours, is reputed to have said that the more foolish a person, the more prone they were to sleep in excess. In terms of cutting back on sleep to have more time in the day, modern people are on a par with Edison.

Could it be the price to pay for making light of sleep? Presently, many people regularly use sleep inducers to alleviate insomnia. This tendency becomes more apparent with age.

An era when more sophisticated, multi-functional air conditioners are required in the bedroom

This background is spurring research into sleep, and Daikin is also staking its prestige as an air conditioning manufacturer on continuing research and development. One example is Daikin's research into "soine," which started in around 2000. Soine is a concept product perfected by Daikin over a 10-year period. It constantly monitors the sleeping condition of people, automatically adjusting room temperature using a dedicated controller for sleeping.

One cue that inspired the research was feedback from consumers indicating that they tended to use expensive, sophisticated air conditioning in the living room, but were not so particular about air control in the bedroom. Looking back on that time, Takehiko Hiei, who worked on the research for many years, said that "We wanted to change people's perception of sleep through the introduction of multi-functional air condicioning for the bedroom." As research progressed, they discovered the following with regards to body temperature regulation in sleeping people.

During sleep, the human body's temperature regulating function is reduced in comparison with during the waking hours, and it also differs between REM and non-REM sleep. The body is particularly susceptible to changes in the surrounding temperature during REM sleep. At this time, the body's ability to regulate temperature through perspiration is reduced.Furthermore, we discovered that, because the proportion of REM sleep is higher during the latter hours of sleep, it is easier to catch a chill if the room temperature is too low at dawn.

For this reason, soine uses a rubber tube containing air-pressure sensors to detect the state of sleep. Because body temperature falls during deep, non-REM sleep, it supports this by decreasing the room temperature by 1℃. Then, because the body's temperature regulating function is less effective during light, REM sleep, soine raises the room temperature by 1℃ so that the sleeper does not feel the cold.

In addition, body temperature is affected by one further rhythm during sleep, whereby body temperature gradually falls three to four hours after we fall asleep. Thereafter, body temperature slowly rises again until we wake up, in a gentle V-curve. Consequently, in addition to the ±1℃ adjustment to the base temperature, we set soine to lower the room temperature 2℃ over a period of three hours from the time of sleep, and to gradually return to the original room temperature by the tie the sleeper wakes up.

"However, room temperature is not the only factor that impacts sleep. Light and sound, the body size of each individual, and differences in metabolism also have an impact. For this reason, in the future, we would like to take these factors into account, to build a system that provides sleeping conditions suited to each individual," according to Hiei, who worked with Yasumoto on the research for soine.

In order to verify the accuracy of soine, tests were conducted on the soine itself, while polysomnography tests were conducted simultaneously. (See photographs on the next page.) Over 10, years, we gathered data on over 10,000 people using polysomnography and other testing, and continue our research to this day.

Our sophisticated dedicated controller for sleep will revolutionize sleeping. That time is surely coming soon. D

Soine, a dedicated controller for sleep

1. Movements such as rolling during sleep
2. Soine senses this and estimates sleep rhythm
3. It tells the air conditioner the optimum temperature for this rhythm
4. The temperature is automatically adjusted according to the sleep rhythm

Receiver; Transmitter

Experiments aimed at improvements

Polysomnography (PSG) is a method whereby electrodes are attached to the face, head, and body using tape to record brainwaves, breathing, and the movement of the eyes and muscles, in order to investigate the state of sleep. Airitmo is a sofa developed based upon soine technology, which conducts sensing on the sitter.

Takehiko Hiei

In the past, we applied our efforts to reducing air conditioner noise and creating optimized control, together with sleep sensing, sleep comfort control, and monitoring of body information. "We want to provide the best possible air 24 hours a day, 365 days a year."

Chiaki Yasumoto

Since joining Daikin, I have been involved in initiatives to develop air that is kind to humans, and dedicated sleep controller development, as well as sensors for monitoring of body information. We aim to deliver the optimum air for each individual.

Zoom in

One form of the ideal sleeping space as conceived by Daikin

A "sleeping capsule" created in the quest for a comfortable sleeping space

Daikin has combined its air conditioning technologies, developing a "sleeping capsule" in its pursuit of a comfortable sleeping space. The capsule uses the principle of keeping the head cool and the feet warm, adjusting heat distribution by approximately 4℃, thereby reducing the activity of the sympathetic nerves, which control stimulation, in order to achieve a more comfortable sleep. At the beginning of sleep, it uses a foot warmer and vibrator synergistically to promote blood flow and thereby encourage sleep. It simultaneously delivers air containing negative ions and forest aromas, which are said to have a positive effect on sleep, to enhance relaxation.

① Air conditioning module	Air conditioning using a quiet Peltier device with no engine.
② Air purifier	Delivering clean air containing negative ions and phytoncide.
③ Foot warmer	Warms the feet to prevent chills and to stimulate blood flow.
④ Vibrator	Uses a gentle massaging effect to stimulate blood flow.

TIC is equipped with a range of testing equipment to assist in developing the ideal sleeping space. The photograph to the left shows the test subject going through their regular indoor routine. We measure the room temperature, humidity, oxygen, CO_2 and so on in this room to measure the effect of room environments on humans. We leverage these facilities to undertake our sleep-related research.

Reporter for "Sleep"

Jun Kobayashi
Challenge Planning and Editing Supervisor
Technology and Innovation Center

We believe that air conditioning should evolve into human conditioning. Would you like to discuss your air conditioning dreams with us? We welcome your comments by email at the following address.

challenge@daikin.co.jp

Počítanie Ovečiek

Keď myslíme na prvky optimálneho prostredia, zvyčajne myslíme na vlhkosť, teplotu, vôňu a svetlo. Pri spánku výzkum ukázal, že jedným z faktorov, ktoré napohámajú spánku, je rytmus, či už ide o rytmus srdca, jemný vánok alebo kolísku, alebo aj vibrácie v automobile a vo vlaku. Myšlienka vytvorenia pohodlného rytmu v priestore spánku pomocou ovládania klimatizácie nás viedla k novému konceptu. Koncepcia tohto inovatívneho produktu sa nazýva „Počítanie ovečiek“, pretože rytmicky vysiela jemne tlakové vlny vzduchu ktoré uspávajú ako keby ste počítali ovečky

POZORNOSŤ

Aktivácia sympatickej nervovej sústavy
Prevencia ospalosti
Zvýšenie koncentrácie

Aktivácia parasympatickej nervovej sústavy
Relaxácia
Znižovanie únavy

UVOĽNENIE

1

Konvenčné riadenie

Teplota, Vlhkosť vzduchu, Prietok vzduchu, Filtrácia

2

Inovatívne riadenie

Stimulácia zmyslov, Zmeny kvality vzduchu, Premenlivý prietok vzduchu, Premenlivá teplota vzduchu

DAIKIN

Produktivita

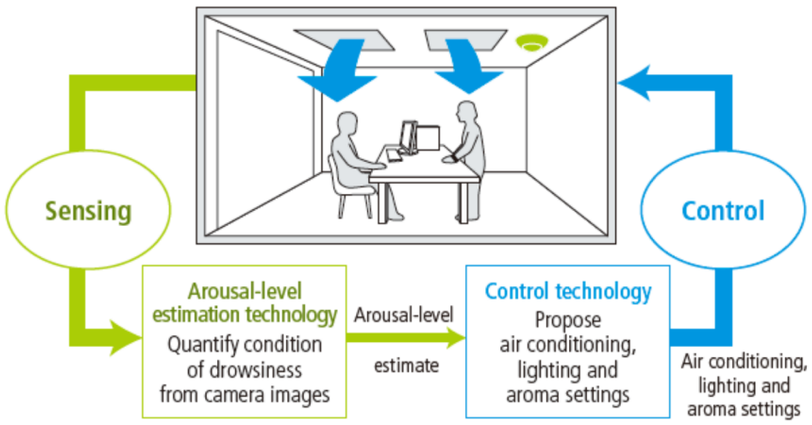
Pri zvyšovaní intelektuálnej produktivity zohráva hlavnú úlohu klimatizácia. Tá umožnuje ľuďom v tropickom podnebí fungovať rovnako efektívne ako ich náprotivky v chladnejších klimatických podmienkach.

Technológia

Daikin sa snaží vytvoriť nové riešenia v oblasti klimatizácie, ktoré ponúkajú pokročilejšie riešenia, a tie vyžadujú použitie IoT a AI technológie tak, aby pomohli identifikovať duševný a fyzický stav ľudí

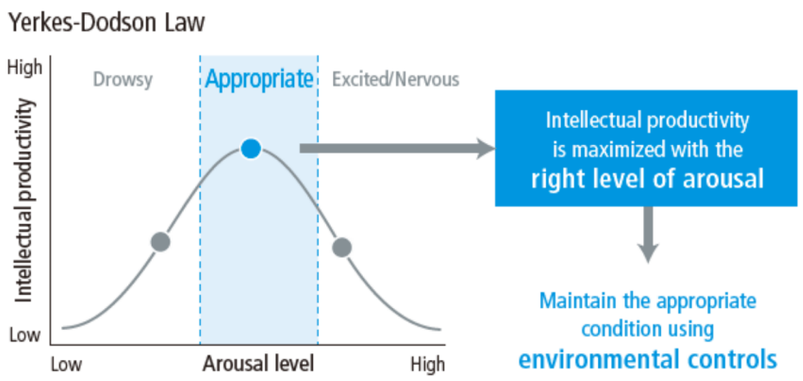
Zdravie

Zdravie je ovplyvňované mnohými psychickými a fyzickými faktormi, vrátane kvality spánku, únavy a stresu. Medzi tieto únavy patria také, ktoré si vyžadujú špecifické riešenia. Je však ťažké objektívne vyhodnotiť únavu a nie je jasná, korelácia medzi príčinami únavy a chorobami.



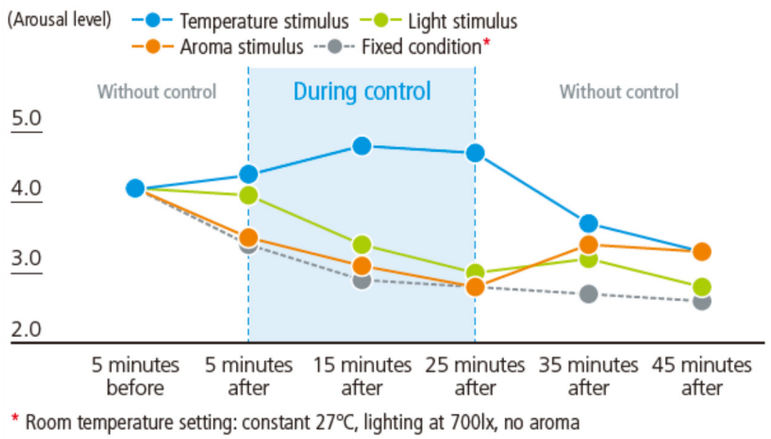
Prepojenie snímania (NEC) a kontroly (Daikin / NEC)

Na základe týchto overovacích testov Daikin a NEC vybudovali prototypový kontrolný systém na detekciu príznakov ospalosti od stupňa otvorenia očí a použitie stimulu kombinujúceho klimatizáciu, osvetlenie a arómu. Výzkum prebiehal v kanceláriách Daikin (40 m²) a NEC (200 m²). Prostredníctvom týchto pokusov sa získajú údaje o úrovni vzrušenia, keď zamestnanci pracujú, a vykoná sa environmentálna kontrola klimatizácie a osvetlenia.



Vzťah medzi úrovňou vzrušenia a výkonom

Udržiavanie správnej úrovne vzrušenia bez evokovania ospalosti sa považuje za dôležité pre zvýšenie intelektuálnej produktivity (viď graf). Na skúmanie najlepšej metódy a načasovania aplikácie environmentálnych stimulov na udržanie úrovne vzrušenia sa na subjekty aplikovali stimuly zložené z klimatizácie (teplota), osvetlenia (osvietenie) a arómy (vône), pričom sa periodicky merala úroveň ich vzrušenia na overenie zmien.

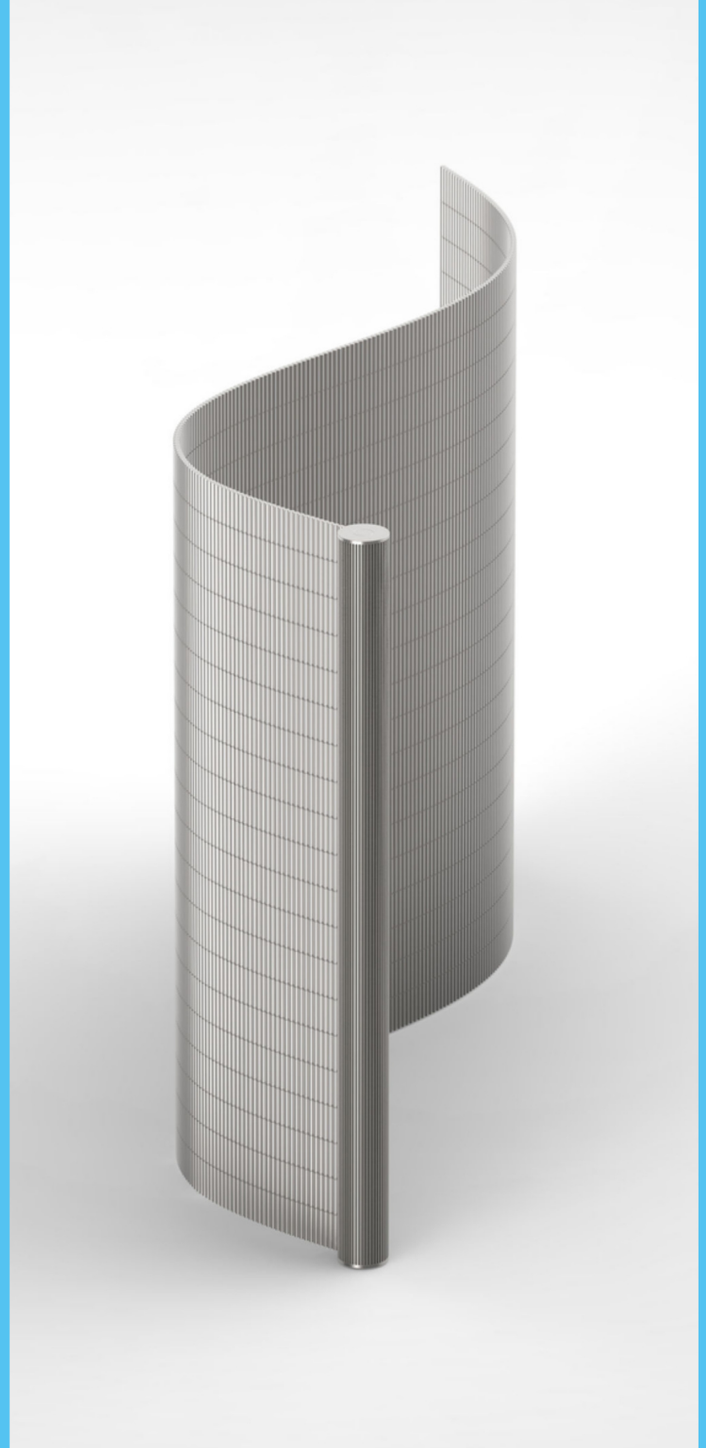


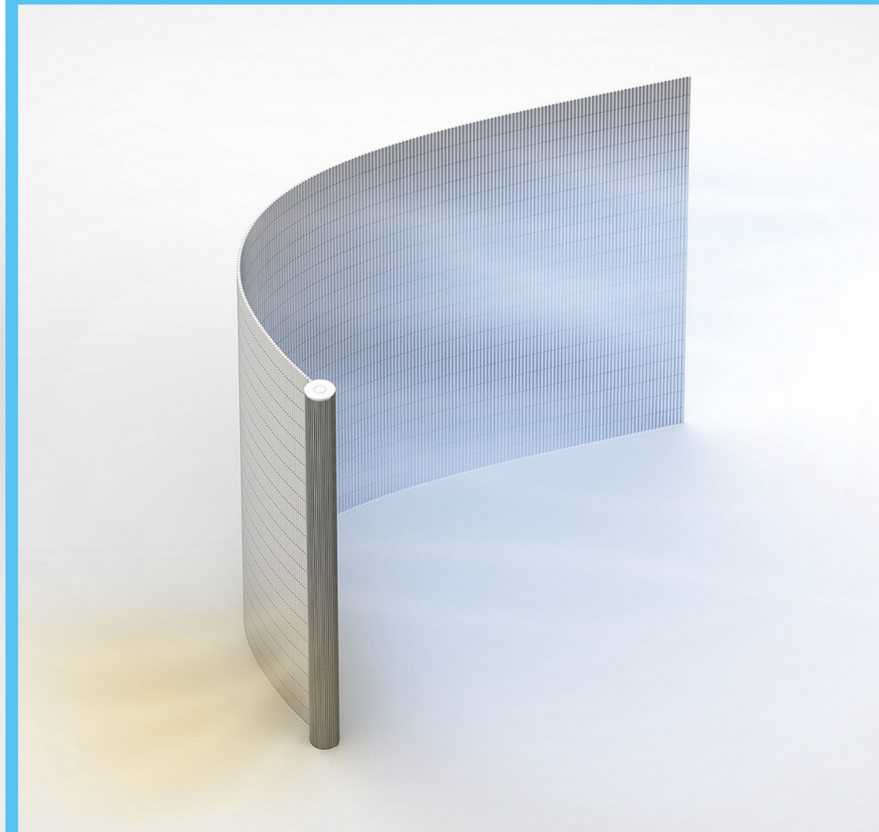
Zmeny úrovne vzrušenia v dôsledku rôznych stimulov

Výsledky potvrdili, že teplotný stimul z klimatizácie dokáže udržať správnu úroveň vzrušenie dlhšie v porovnaní so svetlom a vôňou. Priemerná úroveň vzrušenia v porovnaní s žiadnymi podnetmi bola o dva stupne vyššia a ospalosťi sa zabránilo o viac ako 45 min. od momentu objavenia sa jej príznakov Správna úroveň vzrušenia sa udržiavala pri znižovaní teploty v miestnosti o 3 stupne C°. V tomto nastavení teploty sa dá vrátiť aj na pôvodnú hodnotu v krátkom časovom období. Tým sa aj potvrdila rovnováha s komfortom

LINEA

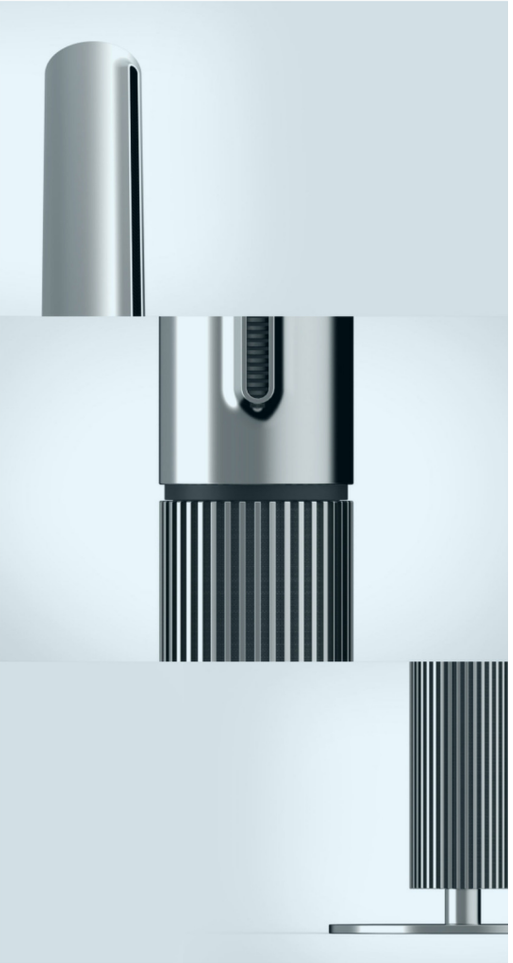
Prostredie, ktoré ľuďom skutočne pomáha sústrediť sa, môže viac závisieť od nálady, v ktorej sa nachádzame. Myslíme si, že práca v priestore, ktorý zodpovedá nálade, je faktorom, ktorý zvyšuje koncentráciu. Ak je to pravda, súkromný priestor by sa mal vytvoriť flexibilne a ľahko v závislosti od situácie. Z tohto hľadiska sme vyvinuli túto osobnú klimatizačnú jednotku a oddelovač . Linea môže byť zvinutá do kompaktnej veľkosti pre ľahkú prenosnosť a bola navrhnutá tak, aby vytvorila súkromný priestor kdekoľvek. Vďaka vetraniu poskytuje pohodlnú klímu okolo používateľov. Senzor zisťuje podmienky používateľov a reguluje teplotu, vlhkosť a zápach, čím vytvára priestor, ktorý im pomáha sústrediť sa





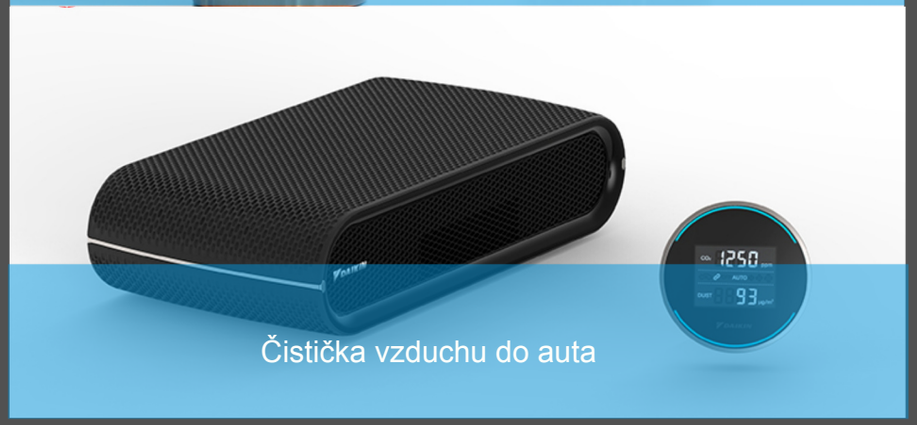
Vzduchová sprcha / čisťička vzduchu a kontrola vône

Hower je osviežovač vzduchu pre vchodové dvere. Toto zariadenie poskytuje psychologickú bariéru medzi súkromným a verejným životom tým, že privádza vzduch a vôňu pri vstupe do domu. Keď opustíte dom, sprcha vám môže podľa potreby rozjasniť vašu náladu a keď sa vraciate domov, vzduchová sprcha omladzuje a odstraňuje všetky škodlivé látky, ktoré na vás prilnú vo vonkajšom prostredí, vrátane častíc PM 2,5. Odnímateľný vzduchový filter zhromažďuje všetky škodlivé látky. Vzduchová sprcha tak vyvoláva zmenu vašich pocitov a pomáha vám udržiavať zdravú emocionálnu rovnováhu.



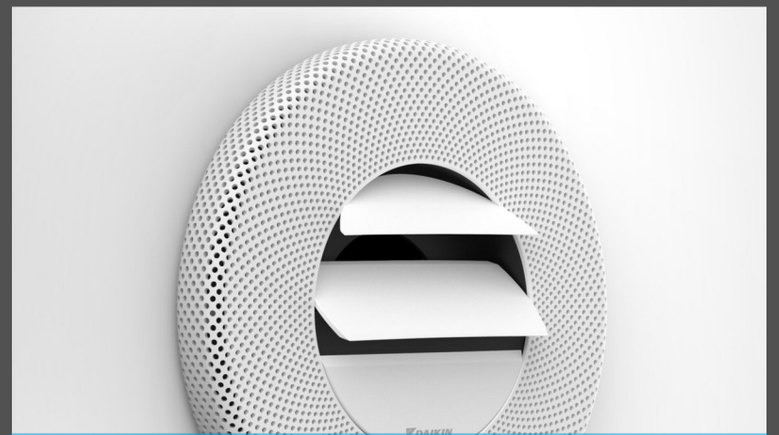
Čistička vzduchu prepojená
s existujúcou klimatizáciou

Kanón aromatizovaného
vzduchu s detekciou pohybu



Čistička vzduchu do auta

Vonkajšia kimatizačná jednotka
Risora Unitary s intergrovaným
výparníkom



Vnútorná klimatizačná jednotka
Risora Unitary s intergrovaným
výparníkom vo vonkajšej jednotke

Kompaktná klimatizačná
jednotka

Ďakujem za pozornosť