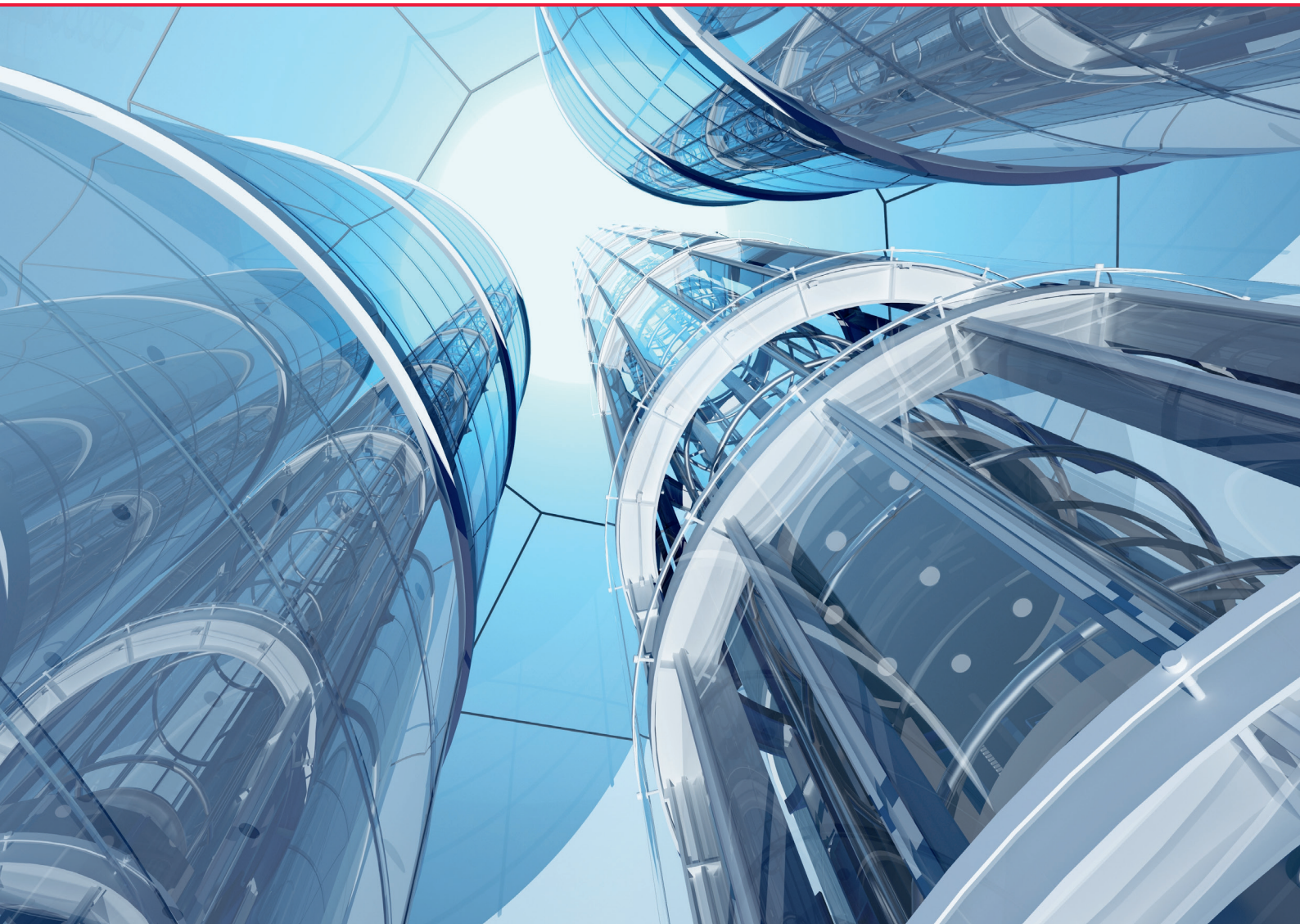
BUCHER
hydraulics

Hydraulic Elevators are Energy Efficient and Future-oriented

Facts, arguments and explanations

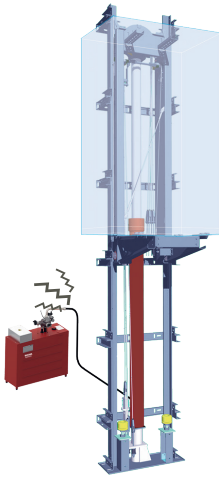


The Advantages of Hydraulic Elevators

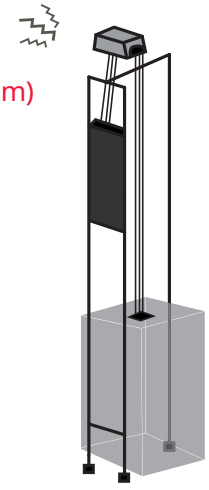
Overview

	Hydraulic elevators	Traction elevators (with no machine room)
Noise	– Noise source can be placed in the machine room far away from the shaft e.g. in the basement floor	– Noise source is normally placed in the pit head, the noise is loudest in the top floor (attic flat!)
Design and space	– Smaller space requirement in the shaft – Flexible machine room location – A great deal of design freedom for architects – No constraints on doorways or the shape of the car	– Smaller car due to the considerable space needed for the sheave assembly and counterweight, alternatively a larger shaft cross-section and head height – Architectural design scope is very restricted
Safety	– Emergency evacuation procedures are very simple and completely safe – Much safer when used in earthquake zones – Safety during service and repair work, since there is no moving counterweight	– Complicated, and in some respects hazardous, emergency evacuation procedures – In an earthquake, the danger from drive components or the counterweight falling on the car
Maintenance and service	– Low-maintenance drive technology – No wear on pulleys and ropes – Replacement parts are seldom needed – Free choice of maintenance companies – Drive is easy accessible	– Long repair and maintenance times – Heavy wear on traction sheave and ropes – With manufacturer-dependent systems, the operator is „locked in“ for maintenance and repairs; independent service providers are shut out – Complicated work procedures, and hazardous working situations
Installation	– Simple and economical assembly – Hydraulic elevators are particularly suitable for projects where retrofitting is involved	– The drive system in the shaft head is difficult to access and assembly work is hazardous
Costs	– For buildings with up to five floors, the cost effectiveness of hydraulic elevators is virtually unbeatable	– Very high costs for service and replacement parts

Hydraulic elevators



Traction elevators (with no machine room)

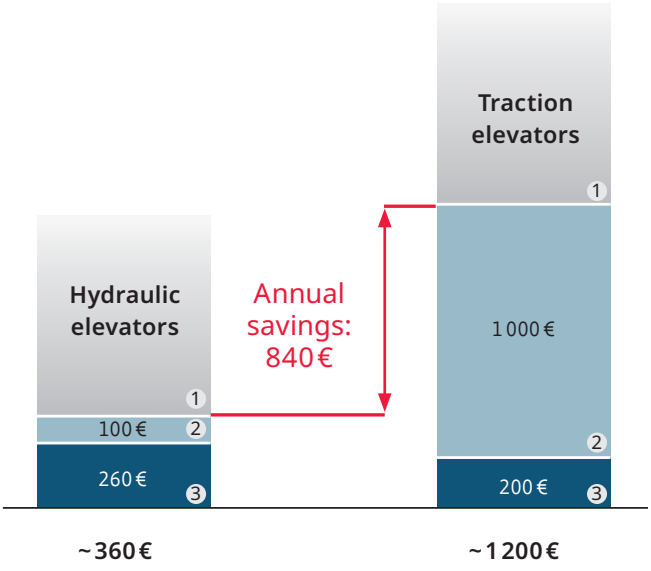


Save Costs with Hydraulic Elevators

Based on a study on power consumption and savings potential with elevators and of the known maintenance costs of hydraulic and traction elevators, the result is over €800 annual savings for a hydraulic passenger elevator in an apartment building.

This study is the foundation of below-mentioned calculation of energy costs for an elevator in an apartment building in which 40 000 trips are taken per annum, i.e. approx 100 trips daily.

Annual costs



1 **Drive independent costs**
(maintenance of control systems, doors, car and emergency evacuation services,...)

2 **Maintenance of drive system**

3 **Energy costs**

Total

Bases of calculation

3 Energy costs	Hydraulic elevators	Traction elevators
Drive consumption	650 kWh [a]	250 kWh
Standby	650 kWh [b]	750 kWh
Total	**1 300 kWh**	**1 000 kWh**
at 0.20 €/kWh	260 €	200 €

Energy costs are made up of the consumption for trips and for standby times.
[a] By a factor of 2.6 higher power consumption than traction elevators with a typical load factor
[b] One quarter of savings with a hydraulic elevator is the result based on dispensing with the inverter
Source: Swiss Federal Office of Energy, study by the S.A.F.E. Schweizerische Agentur für Energieeffizienz (Swiss Agency for Energy Efficiency), final report on power consumption and savings potential with elevators.

2 Maintenance of drive system	Hydraulic elevators	Traction elevators
	Change of oil and seals every 15 yearse	Change of ropes and sheaves every 10 years
Labour and materials	1 500 €	10 000 €
Annual share	100 €	1 000 €

With a hydraulic elevator, oil and seals must be changed every 15 years. Materials are obtainable on the open market for hydraulics.
With a traction elevator, ropes and sheaves must be changed on average every 10 years. The parts required are proprietary and expensive.

Hydraulic Elevators Ensure Quick Arrival

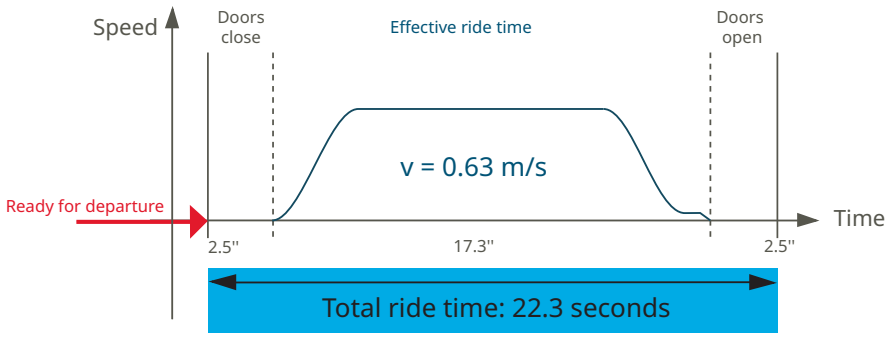
Important is the total ride time

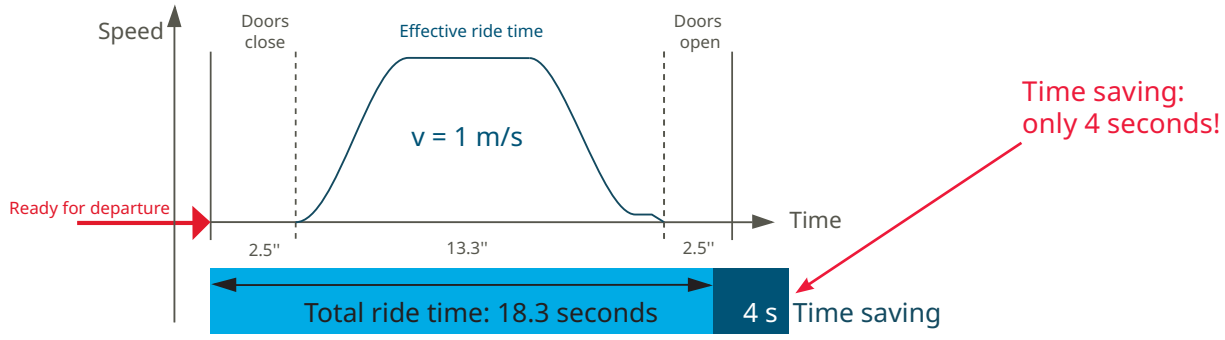
Would you fly by airplane to the nearest town?
Your travel speed would be very high, but check-in, security, and downtime at the airports make up most of the travel time, so the high ticket price would not be justified.
Riding an elevator is similar: When the travel is short, max. speed is only reached for a short time. A typical „stop and go“ ride up to 6 floors hardly ever justifies a higher max. speed than 0.63 m/s.

58 % higher max. speed (v) only results in an 18 % reduction in ride time!

The Department of Energy therefore recommends:
„For houses with up to 6 floors/ stops, 0.63 m/s nominal speed is normally sufficient“ *

Comparison for a 4-stop system with 9 m travel:





* Source: Swiss Federal Office of Energy, study by the S.A.F.E. Schweizerische Agentur für Energieeffizienz (Swiss Agency for Energy Efficiency), final report on power consumption and savings potential with elevators

With Hydraulic Elevators You Ride Safe

Hydraulic elevators are safe in all phases of operation:
Safe installation and service, high earthquake resistance and simple emergency rescue without backup power. All this is good to know, if you do not want to compromize safety in any way.

The new requirements for protection against uncontrolled movement of the cabin (A3 standard) are easy to fulfill with a hydraulic elevator.

The safety of your elevator

Phase	Advantages with hydraulics
Riding behaviour	– Comfortable and safe riding feeling – Stopping accuracy ± 3 mm – Smooth starting and stopping
Installation	– Hydraulic elevators are safer to install – No heavy drives to be installed overhead – No counterweights (no risk of collisions or uncontrolled upward movement)
Service / Repair	– All work on the drive can be done while standing safely – No risk to service staff from counterweights – No replacement of heavy shieves and ropes required – Drive service can be done with shaft doors closed, minimising the risk to the public of an accidental fall
Rescue / Evacuation	– Fast rescue downwards, independent of load – Simple procedure does not require trained staff – No danger from counterweights in multiplex systems
Fire	– Fast evacuation downwards is standard (with traction MRLs, smoke rising up the shaft can hinder access to the rescue elements on the top floor)
Earthquake	– The shaft head does not carry heavy loads (drive is on the ground) – No risk of dangerous counterweight oscillations

Additional advantages:

– Minimum service requirements ensure cost-effective operation
– Large planning flexibility allows for an efficient and inexpensive solution to your transportation needs
– Highest ride comfort and low noise emissions with a machine room will satisfy the most demanding users

Design freedom, adaptability and low space requirement make hydraulic elevators ideal for installation in residential buildings, such as shown here for opening up an attic.

Hydraulic elevators are also particularly suitable for projects where retrofitting is involved, as shown here in an art nouveau building. They match the existing architectural style perfectly and adapt flexibly to their surroundings, thanks to the free choice of door orientation.

The world's tallest hydraulic elevator glides through the middle of the largest cylindrical aquarium in the world. These superlatives can be found in the Moscow shopping center "Oceania Mall". The aquarium is 24 meters tall, 10 meters wide and filled with 900,000 liters of water.

Hydraulic Elevators Are Flexible

Hydraulic elevator drives by Bucher Hydraulics have proven successful over many years and in many ways:
Freedom of design for architects, non-proprietary technology, simple installation, ease of maintenance, long service life and the most modern valve technology.

Hydraulic Elevators Are Powerful

Reach highest number of rides with variable frequency drive

Bucher Hydraulics variable frequency drive products have been on the market for over 10 years. The benefits of this technology are many:

- High number of rides thanks to shorter ride times
- Maximum availability in high use, high load applications, such as shopping centres, hospitals, sports stadiums, railway stations, airports etc.
- Low heat build-up allows for up to 200 rides/hour without oil cooler
- Low noise for a better environment

Our competitors offer similar technology, but in a more restricted scope:

Other hydraulic solutions with variable frequency drives (competitors)

Typically only available for home elevator or passenger elevators
Complex start-up with adaptations specific to the site
Ride in down direction and levelling accuracy can be unsatisfactory and depend strongly on load, temperature and pump characteristics
Complex to handle, limited ride curve adjustability
Not easily available as an upgrade
Lower power input goes together with lower speed / performance
Insufficient integration of hydraulics, VF drive and elevator technologies
Electronics still susceptible to friction, load and temperature variations

Original Bucher Hydraulics variable frequency drive technology

BUCHER hydraulics

Available for the complete application range from simple passenger elevators to large goods elevators
Short and easy start-up thanks to pre-programmed site paramters
Excellent ride quality under all load and temperature conditions
Simple parameter adjustment on site if required
Upgrade of existing installations possible without touching the controller (using Bucher Hydraulics MULTIkit)
Hydraulic counterweight allows for reduced power connection without compromising speed or performance
Technology leader for the integration of hydraulics, VF drive and elevator technologies
Proven technology, thousands of systems in service worldwide since over 15 years

Examples of realized projects:

- Railway stations:
  Network-Rail (UK), Deutsche Bahn
- Airports:
  Frankfurt, Pudong Airport (Shanghai)
- Others:
  IKEA, Kaufland-Group, Daimler, Messe Frankfurt

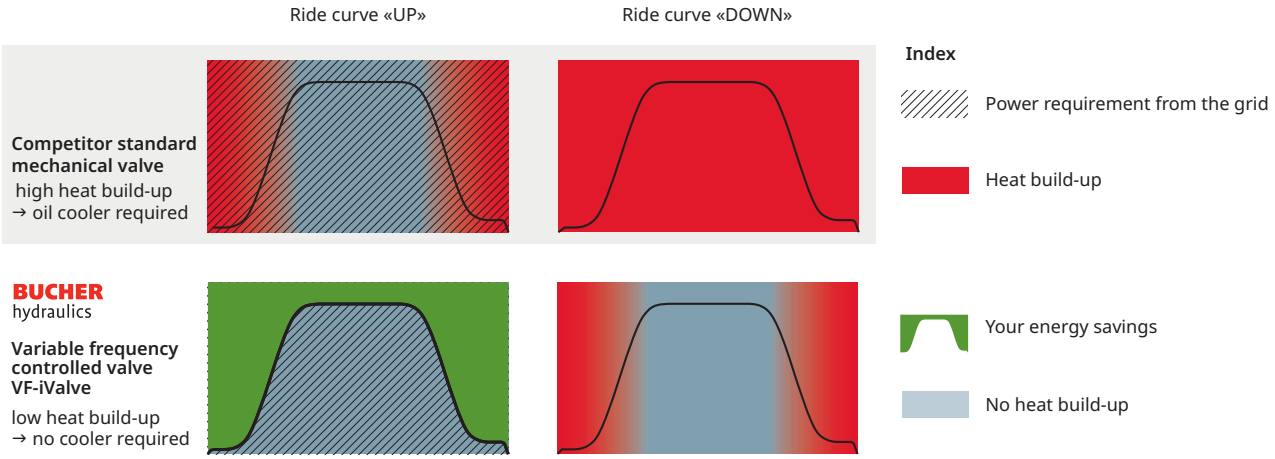
Hydraulic Elevators with Variable Frequency

For highly used elevators an oil cooler is an imperfect compromize - it is much better without!

Variable frequency drive instead of oil cooler

With variable frequency you can reach easily high numbers of travels without oil cooler.
Reduce waste heat by using:
- Electronic valve technology
- Efficient drive technology
- Variable frequency drive technology

Avoid unnecessary heat build-up



Example*:

Heat gain:	3.7 kW	1.6 kW
Required cooling:	2.3 kW	0 kW
Rides possible without cooling:	45 rides/h	140 rides/h
Power consumption per year:	14310 kWh	6160 kWh
Energy costs per year:	EUR 1820	EUR 778
Your saving per year:		**EUR 1042**

Investment cost:

Oil cooler:	EUR 800	VF drive:	EUR 3000
HVAC costs to the building**:	EUR 3450	VF-valve technology:	EUR 800
Total:	EUR 4250	Total:	EUR 3800
Your savings per year:			**EUR 450**

Your benefits:

- Up to 200 starts/h without cooler
- Saves up to 80 % drive energy
- Up to 10 dBA quieter
- Shorter ride times with a faster start
- Reduced power connection requirement when combined with a hydraulic counterweight
- Reduced wear thanks to lower oil temperatures
- Cost-effective installation with minimal HVAC costs

* 1000 kg contract load, 4 stops, speed 0.63 m/s, 120 rides/h during 9 hours per day

** Cost for HVAC equipment to exhaust heat from the building: Assumption = 1500.- EUR per kW cooling load

Hydraulic Elevators Are Energy Efficient

The defining factor is the correct definition of the usage category

To use the available energy most efficiently, you need to know how the elevator is going to be used: Elevators in usage category 1 are standing for 99 % of the time, an airport elevator is running all the time!

Energy efficiency therefore primarily means finding the right drive solution for the specific application. Bucher Hydraulics has the optimum energy efficient drive for every usage category.

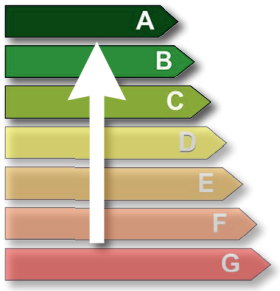
Usage category	Usage frequency (effective ride time per day)	Typical application	Important for good energy efficiency	Recommended solution
1 - 3	very low (12 to 90 min)	small residential or office building, small goods elevator	low standby power consumption	Comfort Line
3 and higher	medium (90 to 360 min)	large residential or office building, public buildings, large goods elevator	low drive consumption	Comfort Line / Eco Line
4 and higher	high (180 to 360 min)	shopping eentre, railway station, airport	low drive consumption	Eco Line

Example:
For a medium sized residential building an elevator is required with a comfortable ride but which will not be used very often. For high energy efficiency low standby power consumption is key, therefore the best product for the drive is the Comfort Line.

If the elevator is not used frequently, then look for low standby consumption; if the elevator is highly used, low drive consumption is important.

Facts:

- Typically over 50 % of overall elevator power consumption is used during standby
- Cost effective measures can reduce standby requirement still further:
  - LED lighting vs. older lighting technologies
  - No permanent door power
  - Timer function for lighting and electronics
- Hydraulic drives use less standby power than traction drives



Hydraulic Elevators Are Eco-friendly

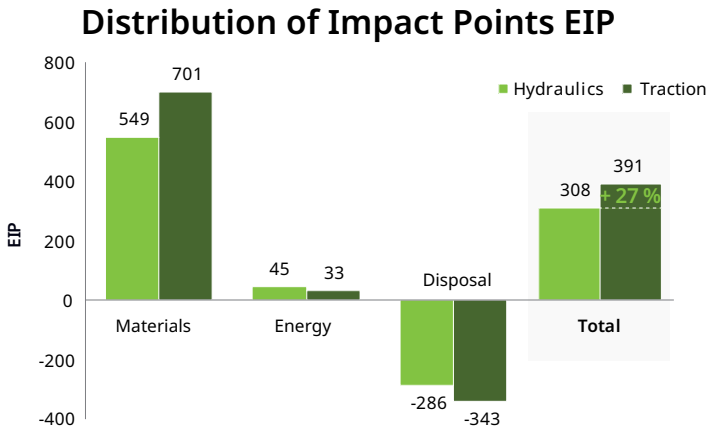
Ecological footprints of traction and hydraulic elevators compared

A well-known Swiss Technical University has made - together with Bucher Hydraulics – an interesting study about the ecological footprint of a hydraulic and a traction elevator.

Result:
A traction elevator needs a bit less energy during the ride, but has a stronger polluting effect over its lifetime!

This study was performed using the Life Cycle Assessment (LCA) method. The data collected allow for a sustainability comparison between a gearless traction MRL drive system and a hydraulic drive system with electronic control. The basis is a standard passenger elevator for an apartment building for 8 people, 1.0 m/s over 15 m. Measurement and qualification are done using Eco Indicator Points (EIP), also known as (environmental) impact points. They cover all kinds of environmental impacts such as climate change, health problems,land use or availability of resources.

Comparison of the impact points for the hydraulic, and for the traction drive system:



Standard passenger lift for 8 persons in a residential building, 1 m/s with 15 m hoisting height, usage category 1, usage duration: 20 years

Conclusions:

- The hydraulic drive system is **more sustainable** than the traction drive system
- Complete replacement of a hydraulic elevator with a traction elevator does not make ecological sense: A **partial modernization** is often the more sustainable approach
- The impact of energy use during the whole lifetime is **far smaller** than the environmental impact of the manufacture and installation

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