Event Floricode 26 september 2023

HORTIVATION
TECHNICAL GREEN INNOVATION HOLLAND

TNO innovation for life

INTRODUCTIE HORTIVATION

“Stichting Hortivation richt zich op technische pre-competitieve innovatie en kennismanagement in de glastuinbouw. Hortivation heeft de ambitie om strategische innovaties te versnellen en samen met de aangesloten bedrijven de toppositie van Nederland op het vlak van schaalbare adaptieve & autonome teeltsystemen te waarborgen.”

HORTIVATION
TECHNICAL GREEN INNOVATION HOLLAND

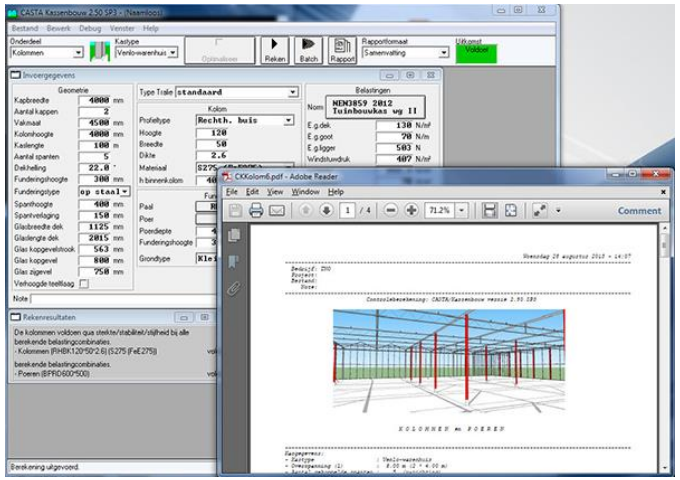
INTRODUCTIE HORTIVATION

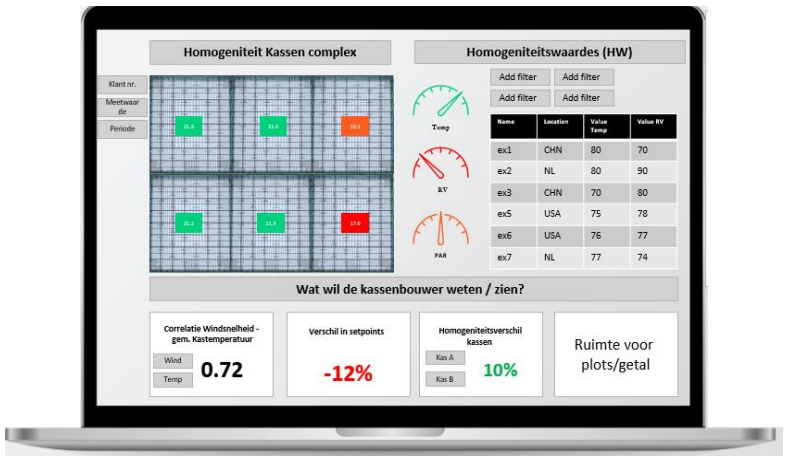
Activiteiten:

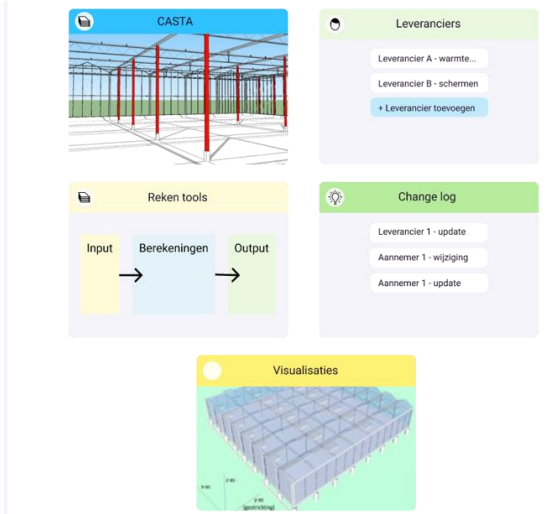
1. Software ontwikkeling en licentiering
2. Uitvoeren van toegepast onderzoek
3. Vaststellen van standaarden en afspraken
4. Hulp bij implementatie en activatie van nieuwe innovaties
5. Stimuleren en begeleiden van fundamenteel onderzoek

HORTIVATION
TECHNICAL GREEN INNOVATION HOLLAND

Applicaties Hortivation

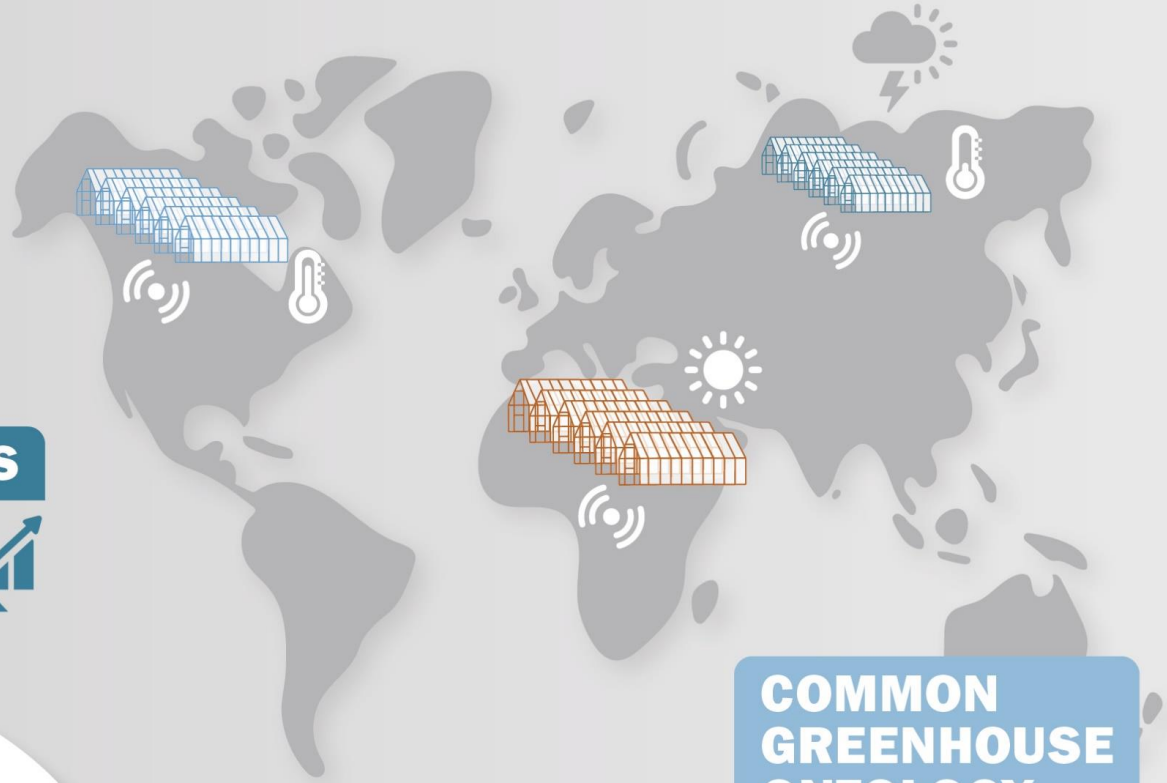






HORTIVATION HUB

DE DATAROTONDE VAN DE GLASTUINBOUW



UW EIGEN APPLICATIES

KIS | GTB | SIOM | CASTA | ...

DASHBOARDS

HORTIVATION HUB

DATABRONNEN

COMMON GREENHOUSE ONTOLOGY

Standaardtaal waardoor een veilige en eenvoudige uitwisseling van data mogelijk is.

YOU ONLY CONNECT ONCE

Slechts 1x met de Hortivation hub verbinden om flexibel een oneindig aantal vragen aan de databronnen te stellen en nieuwe informatie terug te geven.

CONNECT!

Blijf koploper in de glastuinbouw en sluit ook aan bij de Innovatieprogramma's van Hortivation.

Mail naar ***info@hortivation.nl*** of kijk voor meer informatie op www.hortivation.nl

RELEVANTIE DUURZAAMHEID

EXTERNE ONTWIKKELINGEN




- Groeiende wereldbevolking
- Klimaatverandering
- Verduurzaming en Energietransitie
- Beschikbaarheid Arbeid
- Geopolitiek

- Local for local
- Consolidatie van de bedrijven
- Materiaalschaarste
- Data en AI

SUSTAINABILITY

DOEL 2027:

Veilige en duurzame Nederlandse kassenbouw door standaarden, certificering en rekenmodellen. Er zijn tools ontwikkeld die bedrijven helpen zich aan te passen aan komende wetgeving (o.a. Green Deal 2030). Daarnaast helpt Hortivation bij de identificatie van kansen voor wereldwijde duurzame kassenbouw. Het gebruik van rekenmodellen en footprint analyses vermindert de milieu- impact van kassenprojecten (bouw + operatie) aanzienlijk.

SUSTAINABILITY

ROADMAP

1. SIOM combineren met economische sectordata om de verduurza-mingsstrategie te bepalen
2. In kaart brengen van de huidige en toekomstige regelgeving op het gebied van duurzaamheid
3. Kerngetallen Horti Footprint implementeren in KIS zodat toeleveranciers dit automatisch meeleveren
4. Footprint Analyse koppelen met Kas Prestatie Monitoring
5. Koppelen van publieke databronnen t.b.v. identificatie van energieproject en wereldwijd, o.a. door het delen van CO_2- en geothermie kansenkaart
6. SIOM gebruiken om de footprint van kassen (ontwerp en operatie) te minimaliseren (Kringlooptuin-bouw)
7. Adaptatie tot wetgeving: o.a. Zero Emission, Green Deal

BEREKENEN FOOTPRINT KAS

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Mentimeter vraag

- Vraag: ik ken de footprint van mijn bedrijf of producten!
- Antwoordmogelijkheden:
  - Nee
  - Ja, van mijn bedrijf
  - Ja, van mijn producten
  - Ja, van mijn bedrijf en producten

Mentimeter vraag

- Vraag: over 3 jaar ken ik de footprint van mijn bedrijf of producten!
- Antwoordmogelijkheden:
  - Nee
  - Ja, van mijn bedrijf
  - Ja, van mijn producten
  - Ja, van mijn bedrijf en producten

Berekenen footprint – SIOM

Capital goods in FloriPEFCR

	eenheid	waarde
oppervlakte glazen tuinbouw kas aanwezig	ha	1
aanwezigheid verwarmingssysteem in deze kas	%	100%
aanwezigheid watergifte systeem in deze kas	%	100%
aanwezigheid enkel scherm systeem in deze kas	%	100%
aanwezigheid dubbel scherm systeem in deze kas	%	0%
teeltgoten in de kas (bijv bij aardbeienteelt), totale lengte	m	1000

Berekenen footprint – SIOM

File Level Strategies License Help

Retrieve meteo

Meteo request OK, 15 parameters from 12 stations

Calculate

Calculation request OK and saved

Post-processing

<A> Project

Project name	Description
Test project for SIOM-PP_v1	Test project for SIOM-PP v-001

<C> Construction

<A> Semi-closed system

<A> Crop

<A> Heating

<A> Ventilation

<N> Screens

<A> Carbon dioxide

<A> Cooling

<A> Artificial lighting

<A> Growing system

<A> Water Management system

<A> Photovoltaics

<D> Photovoltaics

Select PV installation	Solar panel width		Solar panel height		Panel columns per section [-]
PV on greenhouse roof	1	m	1.65	m	1

Panel rows per section (north) [-]	Panel rows per section (south) [-]
0	1

<A> Artificial lighting

Lighting strategy	Dimmable top lights [W/m2]
TNO - Toplights	Yes

Top lights HPS	Top lights HPS power		PAR electrical fraction top lights HPS	Conversion factor PAR top lights HPS
Yes	55	W/m2	0.36	5

Top lights LED	Top lights LED power		PAR electrical fraction top lights LED	Conversion factor PAR top lights LED
Yes	45	W/m2	0.55	5.4

Interlights LED	Interlights LED power		PAR electrical fraction interlights	Conversion factor PAR interlights
Yes	45	W/m2	0.55	5.4

Berekenen footprint – SIOM

<A> Water Management system

Rain water source	Rain water collect factor	Rain water storage type	Rain water basin is covered
☑ Rain water	0.95	Water basin	Yes
Water basin volume	**Water basin depth**	**Rain water basin flow**	**Rain water basin priority**
2000 m3/ha	2.5 m	40 m3/h/ha	1
Rain water basin initial fill factor	**Rain water basin leakage factor**		
0.5	0.001		

Irrigation and drain water	Ratio of evaporation to water use	Irrigation water EC	EC water supplied to fertigation unit
☑ Irrigation & drain	0.9 -	2.2 mS/cm	1 mS/cm
Drain factor	**Drain water EC**	**Volume of drain water tank**	**Drain tank discharge strategy**
0.3 -	2.007 mS/cm	91 m3/ha	Volume fraction
Volume fraction discharged	**Discharge drain water frequency**	**Days before first discharge**	**Apply leaching strategy**
0.25	1 day	1 day	No

Desalination by reverse osmosis

☐ Reverse Osmosis

Water disinfection system	Type of water disinfection system	Capacity of disinfection system	Radiation dose of UV [mJ/cm2]
☑ Water disinfection	UV Low Density	2.5 m3/h/ha	250
Energy used by disinfection system	**Max operation hours per day**	**Volume of disinfected water tank**	**Start disinfection process factor**
0.71 kWh/m3	20 h	91 m3/ha	0.5

<A> Cooling

Cooling strategy

TNO - Fogging

Pad and fan	Pad location	Pad thickness	Height of pad
Yes	Width - 1sided	0.2 m	1.5 m
Max. ventilation rate Pad&Fan	**Select pad length**		
108 m3/m2/h	Wall length		

Fogging	Flow capacity fogging	Spray ratio	Efficiency of evaporation
Yes	250 g/m2/h	0.2 -	0.95 -
Fogging for humidification	**Fogging for humidification strategy**		
Yes	TNO		

Active cooling	Electrical cooling power	COP active cooling	SHR active cooling
Yes	120 W/m2	3 -	0.65 -

<A> Heating

Heating strategy	Fuel type	Heating value fuel	Density fuel
TNO - Heating pipes	Gas	35.1 MJ/m3	0.8 kg/m3
Charging temperature	**Initial power source**		
90 °C	Boiler		

Boiler	Boiler power	Boiler efficiency
Yes	150 W/m2	0.9 -

CHP	CHP power	CHP thermal efficiency
Yes	200 W/m2	0.5 -

Buffer	Buffer capacity	Buffer diameter
Yes	200 m3/ha	8 m

Heating pipes	Maximum pipe length	Maximum pipe temperature	Pipe diameter
Yes	100 m	56.85 °C	0.05 m

Growing pipes	Max growing pipe length	Growing pipe diameter
Yes	100 m	0.03 m

Berekenen footprint – SIOM

<A> Cooling

Cooling strategy

TNO - Fogging

Pad and fan	Pad location	Pad thickness	Height of pad
Yes	Width - 1sided	0.2 m	1.5 m

Max. ventilation rate Pad&Fan	Select pad length
108 m3/m2/h	Wall length

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Berekenen footprint – SIOM

Impact category	Impact category Indicator (unit of measure)	Description
Climate change, total	Radiative forcing as global warming potential – GWP100 (kg CO_2 eq)	Increase in the average global temperature resulting from greenhouse gas emissions (GHG)
Ozone depletion	Ozone Depletion Potential – ODP (kg CFC-11 eq)	Depletion of the stratospheric ozone layer protecting from hazardous ultraviolet radiation
Human toxicity, cancer	Comparative Toxic Unit for humans (CTUh)	Impact on human health caused by absorbing substances through the air, water, and soil. Direct effects of products on humans are not measured
Human toxicity, non-cancer	Comparative Toxic Unit for humans (CTUh)	
Particulate matter	Impact on human health (disease incidence)	Impact on human health caused by particulate matter emissions and its precursors (e.g. sulfur and nitrogen oxides)
Ionising radiation, human health	Human exposure efficiency relative to U-235 (kBq U-235 eq)	Impact of exposure to ionising radiations on human health
Photochemical ozone formation, human health	Tropospheric ozone concentration increase (kg NMVOC eq)	Potential of harmful tropospheric ozone formation ("summer smog") from air emissions
Acidification	Accumulated Exceedance – AE (mol H^+ eq)	Acidification from air, water, and soil emissions (primarily sulfur compounds) mainly due to combustion processes in electricity generation, heating, and transport
Eutrophication, terrestrial	Accumulated Exceedance – AE (mol N eq)	Eutrophication and potential impact on ecosystems caused by nitrogen and phosphorous emissions mainly due to fertilizers, combustion, sewage systems
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (kg P eq)	
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (kg N eq)	
Ecotoxicity, freshwater	Comparative Toxic Unit for ecosystems (CTUe)	Impact of toxic substances on freshwater ecosystems
Land use	Soil quality index, representing the aggregated impact of land use on: Biotic production; Erosion resistance; Mechanical filtration; Groundwater replenishment (Dimensionless – pt)	Transformation and use of land for agriculture, roads, housing, mining or other purposes. The impact can include loss of species, organic matter, soil, filtration capacity, permeability
Water use	Weighted user deprivation potential (m^3 world eq)	Depletion of available water depending on local water scarcity and water needs for human activities and ecosystem integrity
Resource use, minerals and metals	Abiotic resource depletion – ADP ultimate reserves (kg Sb eq)	Depletion of non-renewable resources and deprivation for future generations
Resource use, fossils	Abiotic resource depletion, fossil fuels – ADP-fossil (MJ)	

Berekenen footprint – SIOM

Sustainability indicators (1)

- Determine the amount of activity with SIOM
- Convert activity to their respective emissions:

$$emission = activity \cdot emission\ factor$$

- Convert emissions to an equivalent emission:

$$impact = emission \cdot classification\ factor$$

- Divide by the dry matter yield for performance:

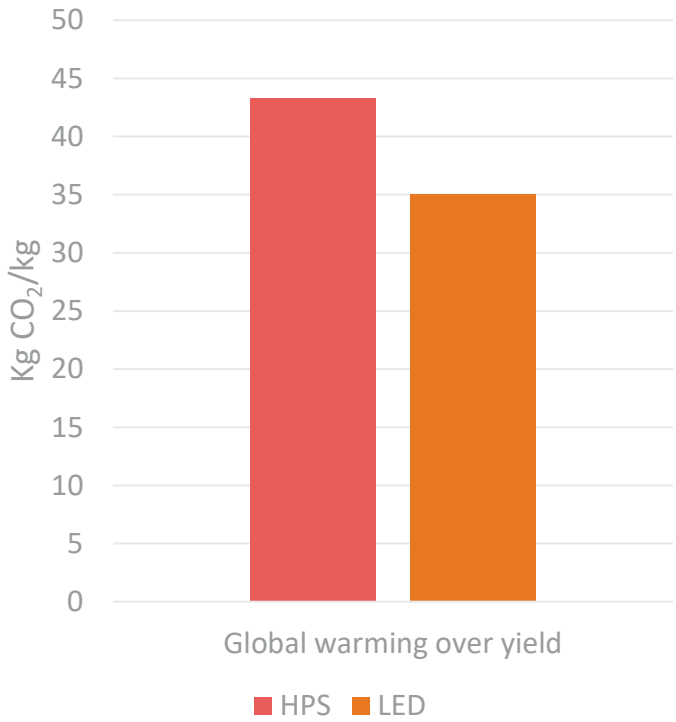
$$Performance = \frac{equivalent\ emission}{dry\ matter\ yield}$$

Environmental theme	Compounds	Classification factor
Global warming	CO_2	1 eq CO_2
	N_2O	310 eq CO_2
	CH_4	21 eq CO_2
Acidification	SO_2	1 eq SO_2
	NO_x	0.7eq SO_2
Eutrophication	NO_x	0.13 eq PO_4

Activity	Emission	Emission factor
Gas use [m3/m2]	CO_2	1.776 kg/m3
	NO_x	1.42E-3 kg/m3
	N_2O	7.2E-5 kg/m3
	CH_4	9.5E-5 kg/m3
Electricity use [kWh/m2]	CO_2	0.834 kg/kWh
	NO_x	1.35E-3 kg/kWh
	N_2O	1.26E-5 kg/kWh
	CH_4	9.0E-6 kg/kWh
	SO_2	3.9E-4 kg/kWh
CO_2 injection [kg/m2]	CO_2	1 kg/kg
Photosynthesis [kg/m2]	CO_2	1 kg/kg
Water use [m3/m2]	Water	1 m3/m3

Berekenen footprint – SIOM

- HPS en LED vergelijking
- Zelfde PAR output, configuratie en strategie
- LED heft 20% lagere impact op global warming

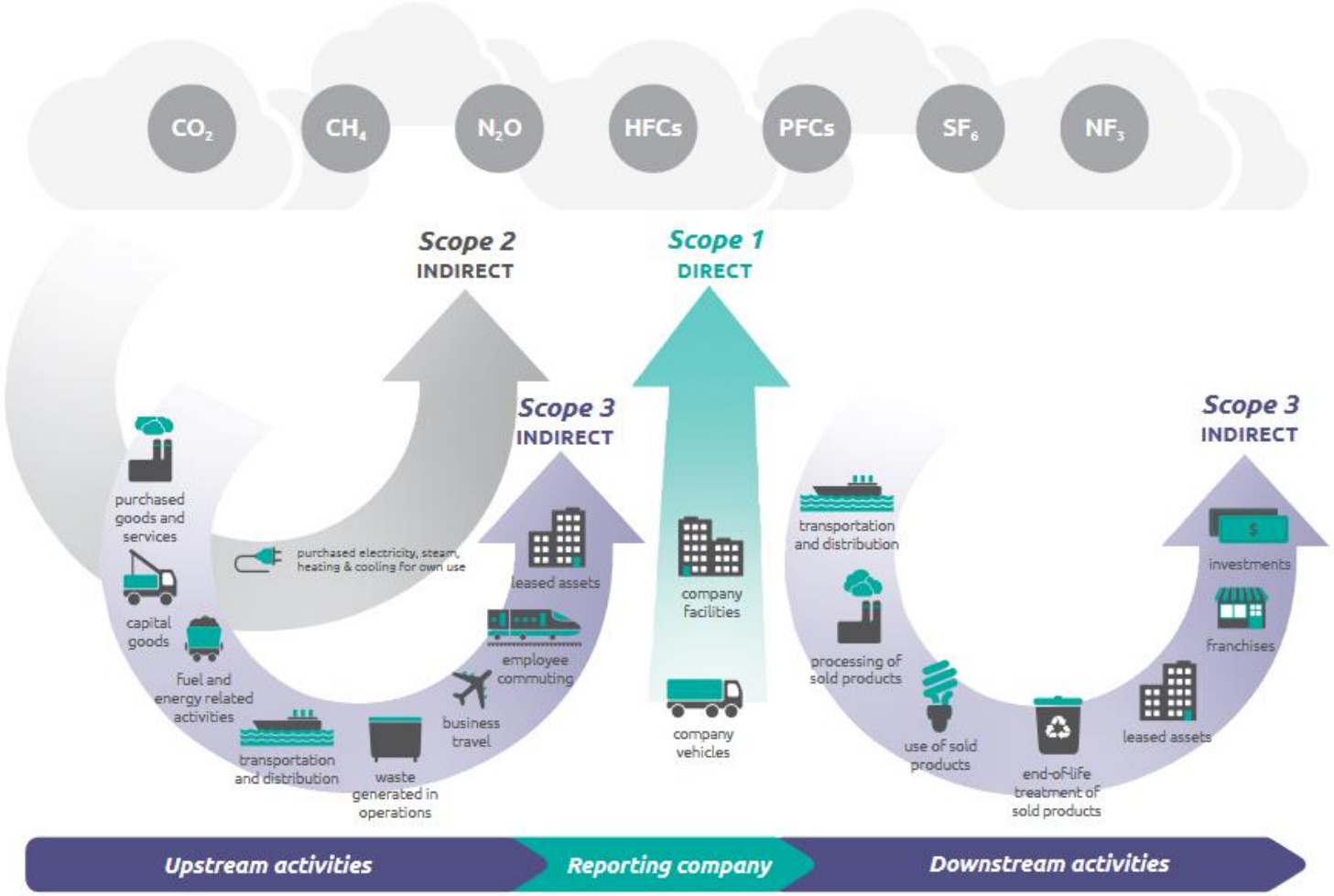


	HPS	LED
Dry matter yield [kg/m2]	4.5	4.5
Fuel [m3/m2]	35.5	42.3
Electricity [kWh/m2]	148.3	89.9
Global warming [kg CO_2 / m2]	194.6	157.1
Acidification [kg SO_2 / m2]	0.23	0.16
Eutrophication [kg PO_4 / m2]	0.032	0.024
Global warming over yield [kg CO_2/kg yield]	43.3	35.0
Acidification over yield [kg SO_2 /kg yield]	0.052	0.036
Eutrophication over yield [kg PO_4/kg yield]	0.0073	0.0053

RELEVANTIE KETENSAMENWERKING

Scope emissies

Figure [I] Overview of GHG Protocol scopes and emissions across the value chain



Bron infographic: https://ghgprotocol.org

Scope 4 – vermeden emissies

Open Field Production

Food Production & Sustainability Facts

250 L
Water usage [2]
per kg lettuce

3,9 kg
Crop yield [2]
per m² / y (lettuce)

Energy from the sun = Free

2000
Food miles [3]
in transportation

References:
1. Ainit Sirir, Dani Nadel, Iris Groman-Yaroslavski, Yoel Melamed, Marcelo Sternberg, Ofer Bar-Yosef, Ehud Weiss (2015). The Origin of Cultivation and Proto-Weeds, Long Before Neolithic Farming. Public Library of Science (PLoS One 10) no. 7.
2. Barbosa, G.L., Gadelha, F.D.A., Kublik, N., Proctor, A., Reichelm, L., Weissinger, E., Wohlleb, G.M., Halden, R.U. (2015). Comparison of land, water, and energy requirements of lettuce grown using hydroponic vs. conventional agricultural methods. International journal of environmental research and public health, 12(6), 6879-6891.
3. Kozai, T., Niu, G., & Takagaki, M. (Eds.). (2015). Plant factory: an indoor vertical farming system for efficient quality food production. Academic Press.

Greenhouse Production

Food Production & Sustainability Facts

20 L
Water usage [1]
per kg lettuce

41 kg
Crop yield [1]
per m² / y (lettuce)

500-1000
Food miles [2]
in transportation

Depending on the location and season

References:
1. Barbosa, G.L., Gadelha, F.D.A., Kublik, N., Proctor, A., Reichelm, L., Weissinger, E., Wohlleb, G.M., Halden, R.U. (2015). Comparison of land, water, and energy requirements of lettuce grown using hydroponic vs. conventional agricultural methods. International journal of environmental research and public health, 12(6), 6879-6891.
2. http://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:From_farm_to_fork_-_food_chain_statistics#Food_transport_within_the_EU

Bron infographic: PlantLab

Scope teler

Scope 1	Scope 2	Scope 3
• Verbruik kas (verbruik fossiele brandstoffen kas; verbruik electriciteit kas; meststoffen; steenwol) • Verbruik brandstof wagenpark	• Verbruik van ingekochte electriciteit • Electrisch verbruik wagenpark	• Zakelijke reizen • Woon-werkverkeer • Upstream emissies (electriciteit; fossiele brandstoffen; electrische voertuigen; hybride voertuigen; bouw kas (staal; aluminium; glas; beton; transport) • Distributie

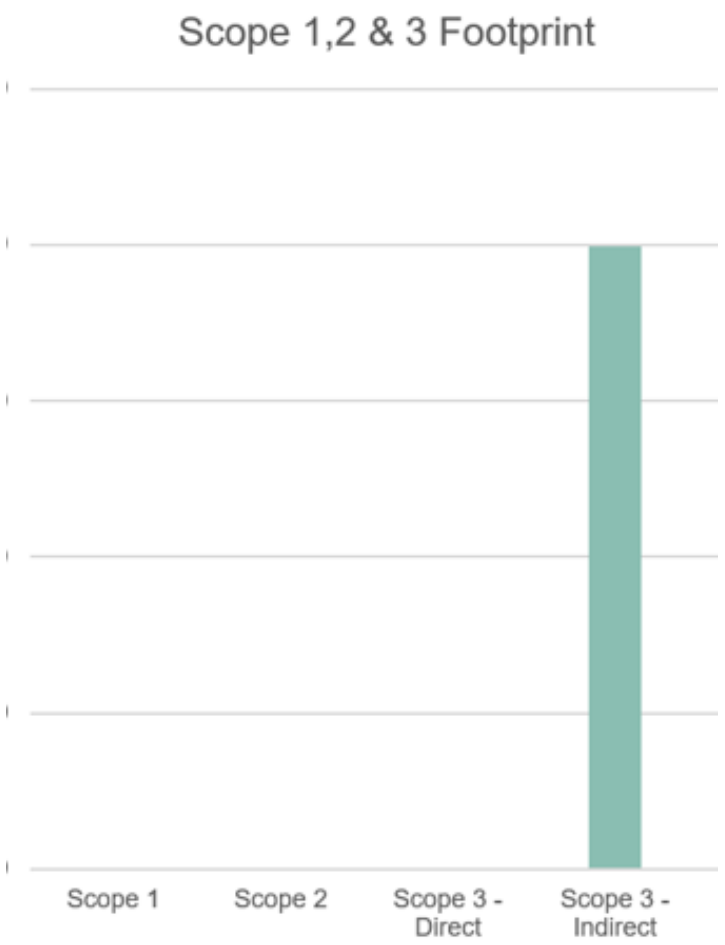
Scope kassenbouwer

Scope 1	Scope 2	Scope 3
• Verbruik fossiele brandstoffen (aardgas) • Verbruik brandstof wagenpark	• Verbruik van ingekochte electriciteit • Electrisch verbruik wagenpark	• Zakelijke reizen • Woon-werkverkeer • Upstream emissies (electriciteit; fossiele brandstoffen; electrische voertuigen; hybride voertuigen) • Verbruik kas (verbruik fossiele brandstoffen kas; verbruik electriciteit kas; meststoffen; steenwol; transport; distributie) • Bouw (staal; aluminium; glas; beton; transport; verbruik tot aan consument..)

Mentimeter vraag

- Vraag: hoeveel procent van de footprint wordt bepaald door scope 3 emissies?
- Antwoordmogelijkheden:
  - 10%
  - 33%
  - 50%
  - 99%
- 99% is het juiste antwoord

Indicatieve scope



Bron grafiek: geanonimiseerde footprintberekening kassenbouwer

TAKE AWAY

1 2 3 4

- Als ik de footprint van mijn product of bedrijf wil kennen, heb ik data van ketenpartners nodig.
- Als ik de footprint van mijn product of bedrijf wil verbeteren, heb ik samenwerking met ketenpartners nodig.

DANK VOOR UW AANDACHT!