

KASSIM the Game

A serious game for education and research

Wageningen University & Research



KASSIM: A model-based educational tool



Helps students understand complex processes such as

- Impact of screens on crop temperature
- Heating demand based on outside weather
- Transpiration effects under high humidity conditions

Using the KASPRO model as simulation engine, including

- Different covering materials and screens
- LED lighting, air treatment
- Climate control similar to practise

Web-based user friendly app for all educational levels

Funded by LTO Glaskracht and the Dutch Ministry

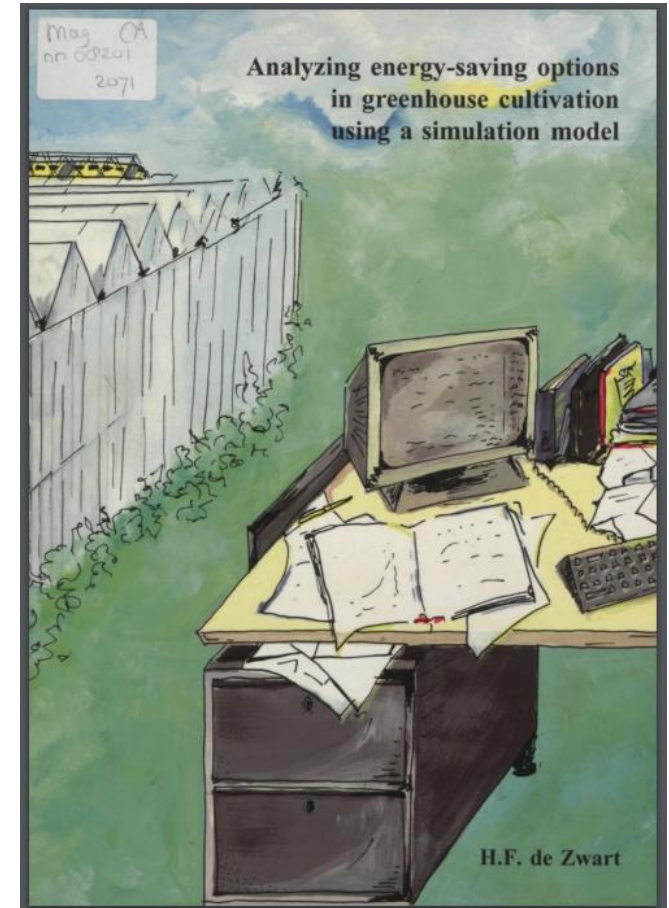
KAPRO as simulation engine

Simulate greenhouse climate, crop growth and energy consumption of greenhouses

In relation to the outside climate, equipment, cultivation, and climate controller settings.

Developed by Wageningen Research (De Zwart, 1996)

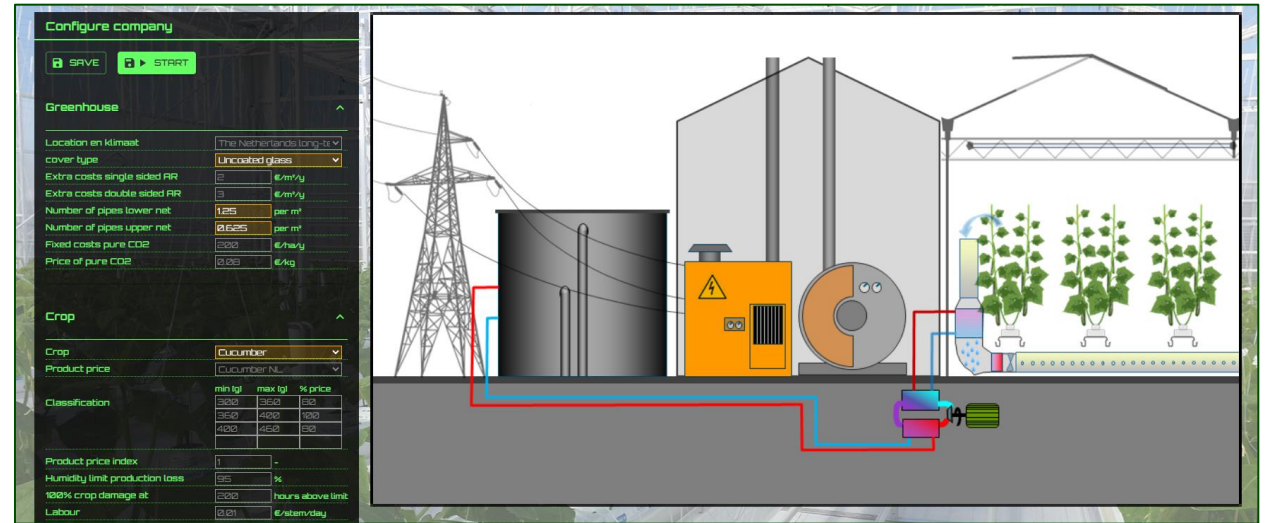
Build upon >25 years of research, technical developments and practical experiments



KASSIM the Game

A serious game for realistic virtual growing of vegetable crops

- Simulating an entire growing season
- Playfully growing tomatoes or cucumbers in the most economical effective way
- Optimizing climate control, crop management and energy trading
- With high scores and strategy comparison
- Using KASPRO as simulation engine



KASSIM the Game

The game starts with configuring a greenhouse company, including energy supply, cooling and dehumidifications, screens and illumination

The screenshot displays the KASSIM THE GAME interface for a 'cucumber' crop. The left sidebar contains configuration options for heating, cooling, and screens. The main area shows a schematic diagram of a greenhouse energy system.

Verwarming & energie

Volume warmtebuffer	100	m ³ /ha
Kosten	2	€/m ³ /ha/j
Alleen ketel	<input type="radio"/>	
Warmte-kracht (WKK)	<input checked="" type="radio"/>	
Elektrisch vermogen	50	W/m ²
Kosten	75	€/ha/j
Geothermie	<input type="radio"/>	
Kosten	10000	€/m ³ /ha/j
Windenergie	0	kW/ha
Kosten	0.1	€/Wpeak/j
Zonnepanelen	0	kW/ha
Kosten	0.1	€/Wpeak/j
Prijs aardgas	0.5	€/m ³ all-in
Aardgas voor WKK	0.3	€/m ³ all-in
Prijs elektriciteit	EPEX SPOT	

Koeling & ontvochtiging

Alleen luchtramen	<input type="radio"/>	
Geforceerde ventilatie	<input type="radio"/>	
Capaciteit	8	m ³ /m ² /u
Kosten	25	€/m ² /jr
Interne ontvochtiging	<input checked="" type="radio"/>	
Kosten	5	€/m ² /jr

Schermen & belichting

Scherm 1	<input checked="" type="checkbox"/>	
Tijdsduur	Opti-cooldown clear 05	

The schematic diagram illustrates the energy flow in a greenhouse. It shows an external power source (a power line tower) connected to a large black storage tank. A red line indicates the flow of energy from the tank to a yellow boiler unit. The boiler is connected to a circular heat exchanger. From the heat exchanger, a red line leads to a dehumidification unit (a blue and purple box) which is connected to a cooling system (a blue and purple box) that circulates water around the plants. A blue line indicates the flow of energy from the boiler to the dehumidification unit. A green line indicates the flow of energy from the dehumidification unit to the cooling system. The cooling system is connected to a pump and a fan. The fan is connected to the plants in the greenhouse. The plants are shown in a greenhouse with a white screen and a blue light source.

KASSIM the Game

In steps of typically 1 or 2 weeks, game players simulate a cultivation from planting until harvest, where at each step they can experiment with control and crop management parameters, using the weather forecast and indicators for climate, energy and crop status.


cucumber

▶ PROBEER
DEFINIEF nag 10 pogingen

TEELTPARAMETERS
CONFIGUREER BEDRIJF

Energiebeheer

WKK regeling: Op warmtevraag

Elek.prijs WKK Inschakelen: 0.08 €/kWh verkoop

Schermen

Max PAR som: 50 mol/m²

Scherm t: temperatuur sluiten: 10 °C

Scherm t: straling sluiten	T buit.	W/m ²
<input type="checkbox"/>	100	<input type="checkbox"/>
<input type="checkbox"/>	10	<input type="checkbox"/>

Gewasmanagement

Streefwaarde LAI: 3 m²/m²

Stengeldichtheid: 25 #/m²

Rangehouden vruchten: 50 %

Toppen na: 300 dagen

Dagsten op maandag:

Dagsten op dinsdag:

Dagsten op woensdag:

Dagsten op donderdag:

Dagsten op vrijdag:

Teelt: 1 sep. - 1 aug.

Periode: 27 okt. - 10 nov.

10 kg/m²

56.4 kg/MJ

-0.8 €/m²

Weersverwachting



27 okt	28 okt	29 okt	30 okt	31 okt	01 nov	02 nov
12°C / 10°C	14°C / 10°C	15°C / 12°C	13°C / 10°C	13°C / 10°C	15°C / 10°C	13°C / 9°C
4 m/s	6 m/s	11 m/s	7 m/s	6 m/s	8 m/s	13 m/s
203 J/cm ²	311 J/cm ²	434 J/cm ²	332 J/cm ²	430 J/cm ²	343 J/cm ²	154 J/cm ²

Elektriciteitsprijs (€/kWh)

Productprijs (€/kg)

GRAFIEK CUMULATIEF **GRAFIEK PERIODE**



Geogst versgewicht

Koploper

huidige periode

Vergelijken met: koploper

LAI (m²/m²)

Plantbelasting (vruchten/m²)

Geogst versgewicht (kg/m²)

Geogste vruchten (#)

Gemiddeld vruchtgewicht (gram/vrucht)

Minimum vruchtgewicht (gram/vrucht)

Maximum vruchtgewicht (gram/vrucht)



Game shows actual crop status

3D crop model, based on

- Leaf area index
- Number of fruits
- Fruit weight

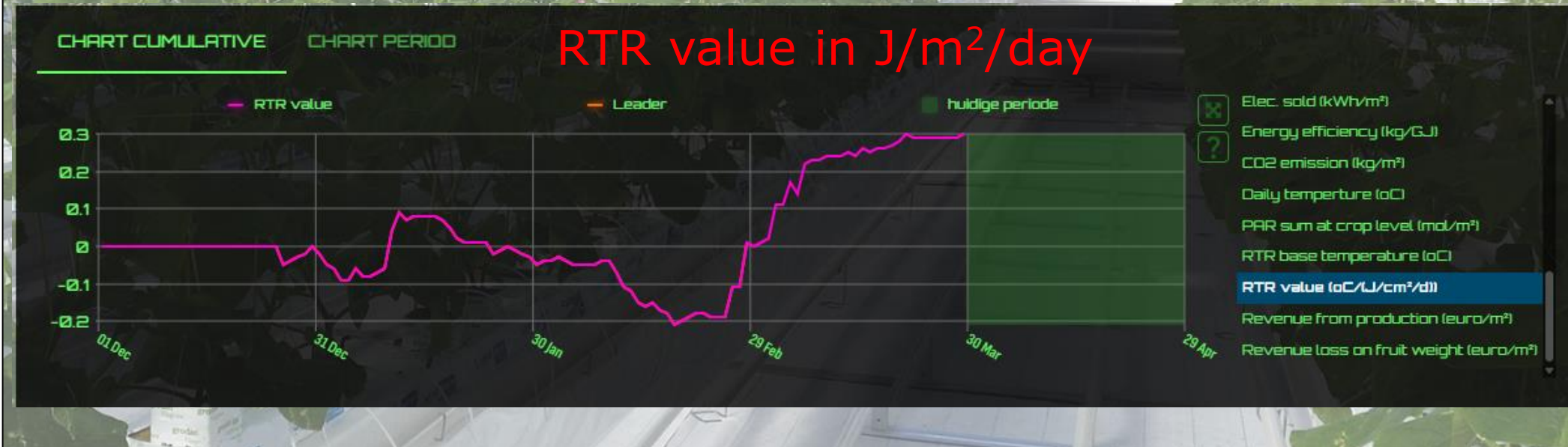
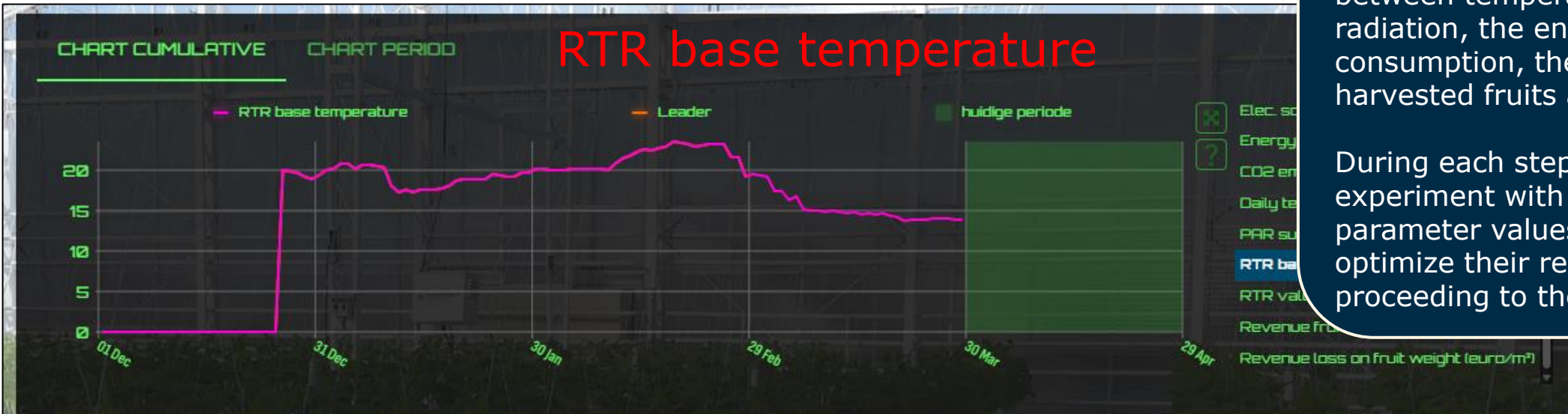


The actual crop status is shown as a 3D visualization, based on the number of leaves, number of fruits and fruit weight. These images are created beforehand by a 3D crop model and add more feeling to the game.

Growing on indicators like RTR

During game-play, a large list of indicators is shown, like the ratio between temperature and radiation, the energy consumption, the number of harvested fruits and total costs.

During each step, players can experiment with different parameter values and try to optimize their results before proceeding to the next step.



High scores

powered by WAGENINGEN UNIVERSITY & RESEARCH

ABORT AND PLAY AGAIN BACK TO THE GAME ? ≡ klaasje ▾

Highscores

Player	Progress (%)	Points	Production (kg/m ²)	Balance (€/m ²)	Efficiency (kg/MJ)	Attempts needed (%)
klaasje	20	0	0	-9.02	0	10
pietje	20	0	0	-10.89	0	10
jantje	20	0	0	-10.89	0	20

At any moment a high score is available where players can check their competitors and see who is winning.

After completing the game, they get an overview of their results and input parameters, compared with those of the winner. This gives valuable insights in the best cultivation strategy.

Compare with rivals/winner and download results

Results

The game is over. Compare your results with those of other players.

Compare with **jantje**

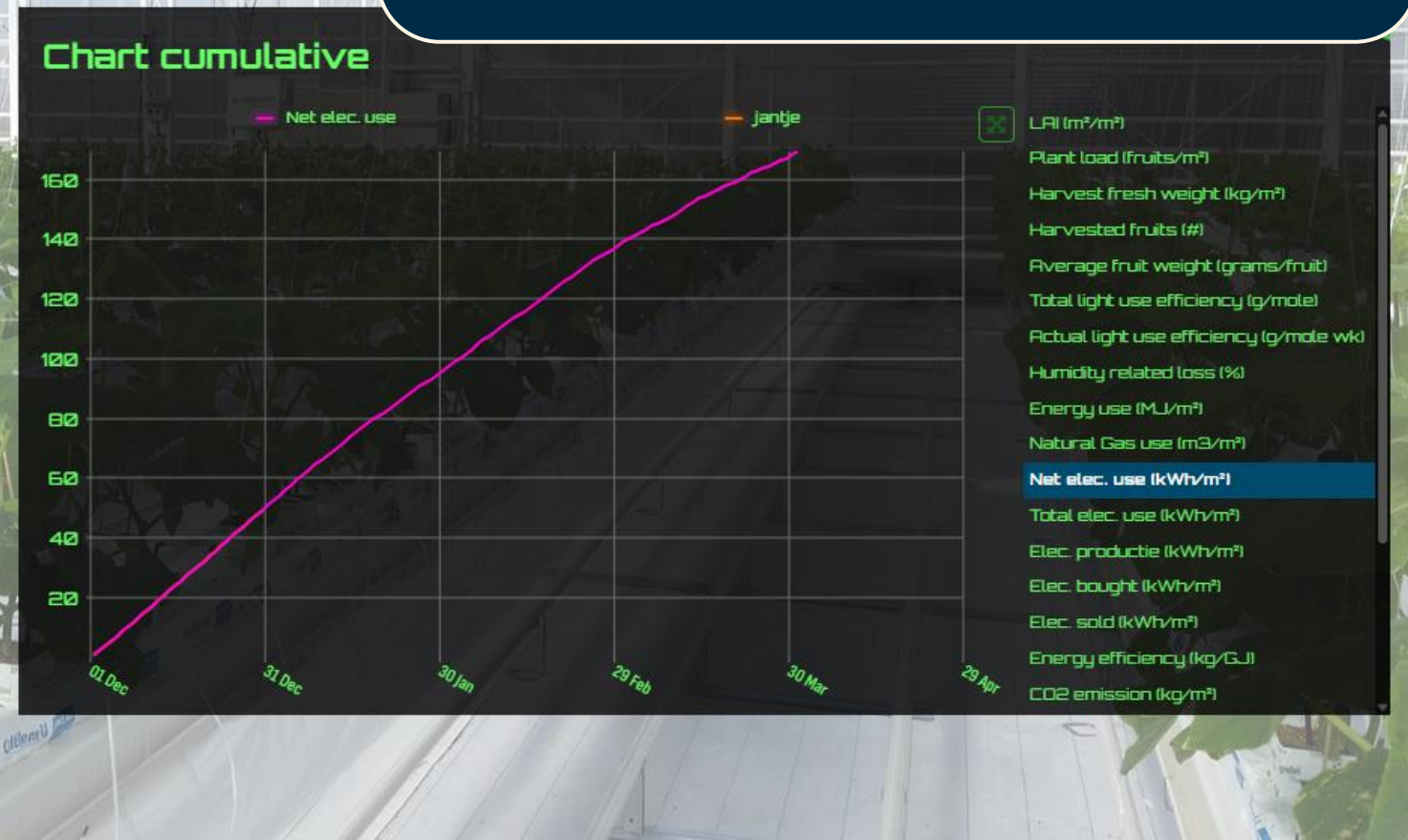
DOWNLOAD RESULTS

When the game is completed, players can compare each of the outputs (key performance indicators) to other players and learn what the winner did better.


All result are downloadable in Excel format for further analyses.

Final results

	you	jantje
Performance		
Progress (%)	100	20
Score (points)	76	0
Average number of attempts (%)	12	20
Production (kg/m ²)	12.07	0
Energy efficiency (kg/MJ)	14.96	0
Energy		
Natural gas (m ³ /m ²)	6.2	1.9
Elec. net (kWh/m ²)	170	50
Elec. bought (kWh/m ²)	170	50
Elec. sold (kWh/m ²)	0	0
Climate & crop		
Average temperature (oC)	20	18.9
Average daytime temperature (oC)	22	20.1
Average night temperature (oC)	18.7	18.4
PAR sum (mol/m ²)	2502	610
Dosed CO ₂ (kg/m ²)	0.22	1.68
Light use efficiency (g/mole)	5	0
RTR base temperature (c)	13.8	19
RTR value (oC/LJ/cm ² /d)	0.3	0



Waterstromenmodel (WSM)



[To the app](#)

[Apply for an account](#)

With the Waterstreams model (WSM), the water usage from various sources, discharge of nitrogen and phosphates can be calculated for a hydroponic cu simulates the discharge, the investments required to reduce effluent and em emission regulations. It also provides insights into the impact of the quality c water, and the expansion of storage tanks. The WSM was developed for gree funded by the 'Kennis op Maat' program and the Foundation for Applied Wa *N.b. registration offers the option to save scenarios and is only available for Du*

[Click for more information](#)


Greenhouse Energy Guide



[To the app](#)

More information about KASSIM the Game and other apps can be found on the app portal of Wageningen Research Greenhouse horticulture.

Kassim



KASSIM

[High tech complex](#)

[High tech basis](#)

[Low tech](#)

[New: Vertical farm](#)

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Kassim is an interactive learning tool that provides a clear overview of the en horticultural greenhouse. A powerful simulation model, developed for scientitc rese calculates all relevant variables based on the weather, greenhouse climate settings a to the principles of 'Het Nieuwe Telen'.

Kassim has been developed for green education and the greenhouse horticulture se Nederland, and the Ministries of Economic Affairs and Agriculture, Nature and Food *N.b. registration offers the additional option of customizing the complexity and is only available for teachers working in Dutch education. Processing a registration can take some days.*

[Click for more information](#)

Kassim The Game

Kassim the Game is an online serious game in the field of energy-efficient and cost-effective cultivation of crops in greenhouses.



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