
Current and future situation of pig stunning

Presented to: "Animal welfare at the time of killing subgroup"

Agenda

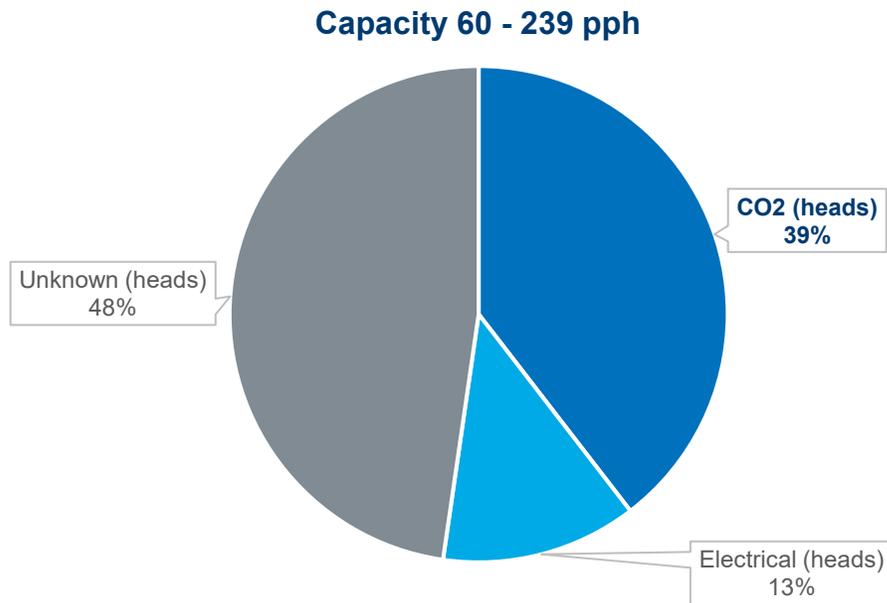
1. Present situation
2. What will happen if EU does not act
3. What happens if EU phases out CO2 stunning
4. Marel's vision



Present situation

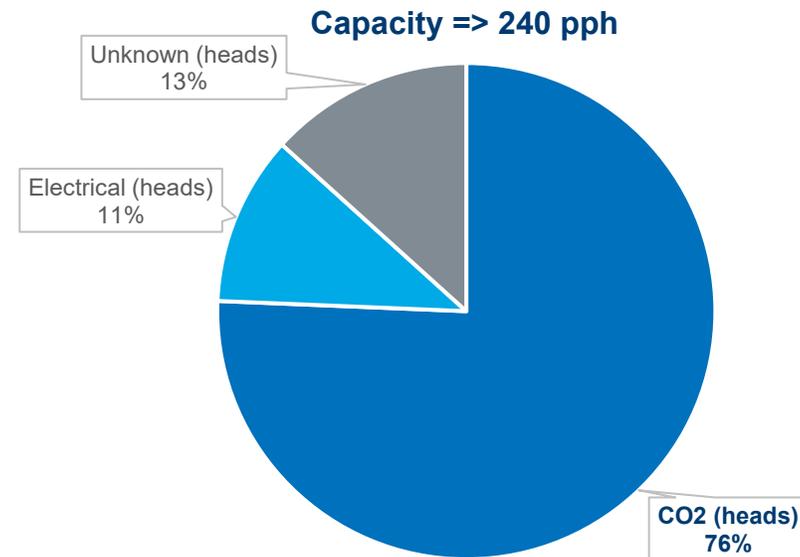
Stunning of pigs in Europe

Total number of pigs per year stunned by CO2 in Europe: 182 mill pigs



CO2 – Diplift and older type installations:

- Total est. installed base: 36 installations

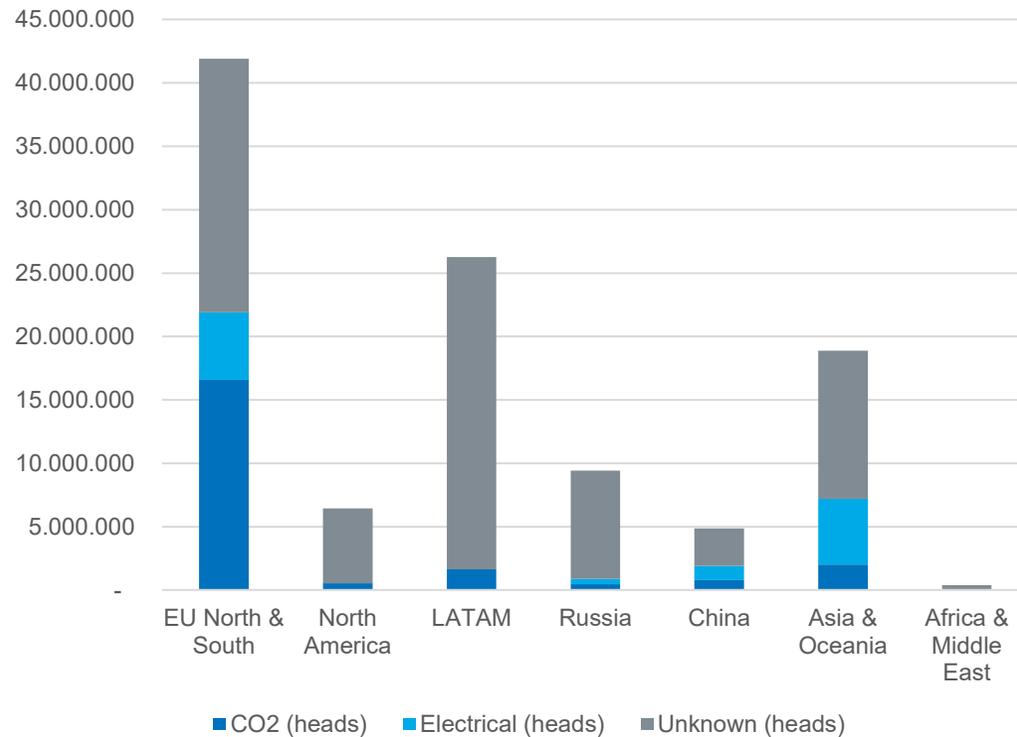


CO2 – backloader type installations

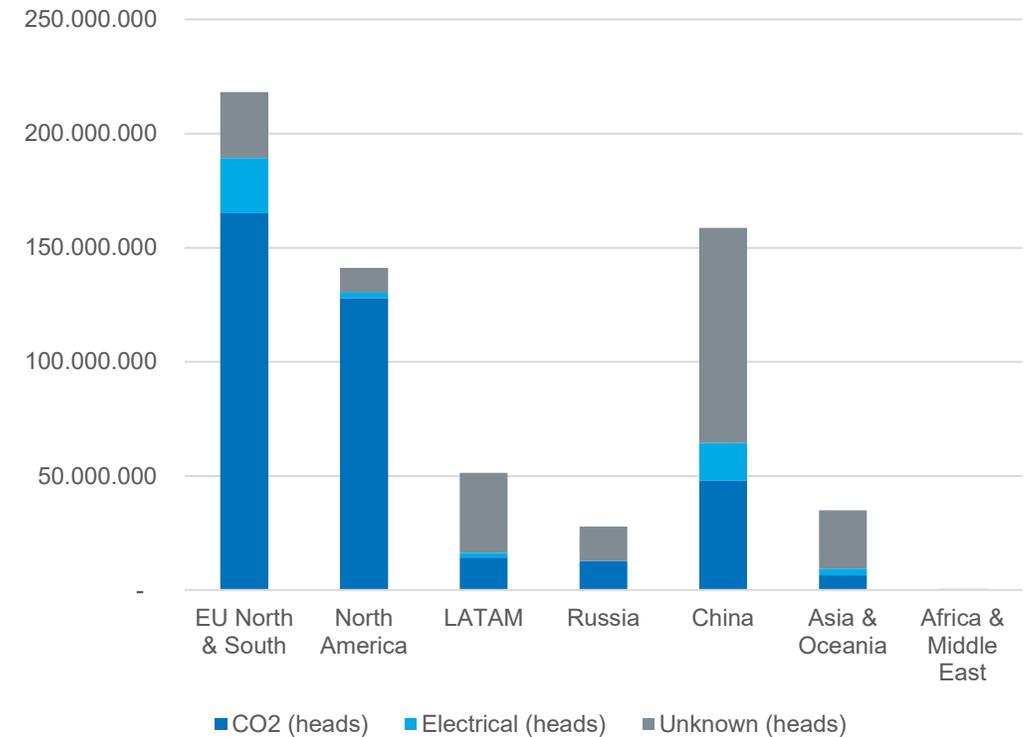
- Total est. installed base: 155 installations

Stunning – Europe vs regional markets

Attainable heads equals capacity 60-239



Attainable heads equals capacity => 240

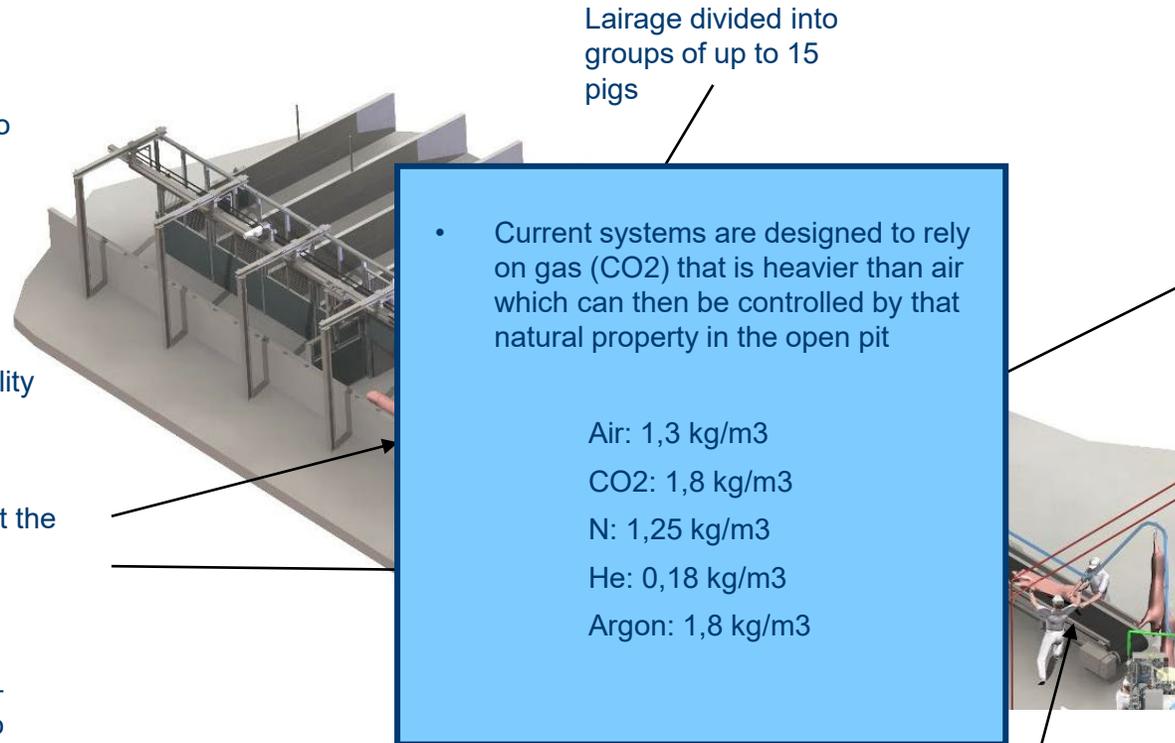


Please note that there is
 - still a large share of heads that is not attainable, because of the low capacity ranges/ backyard farming
 - less insight regarding stunning method in lower capacity ranges and/ or developing regions, resulting in more "unknown"
 Therefore it's possible that electrical, percussive etc stunning represent a large proportion of the stunning methods although this isn't seen in the overview

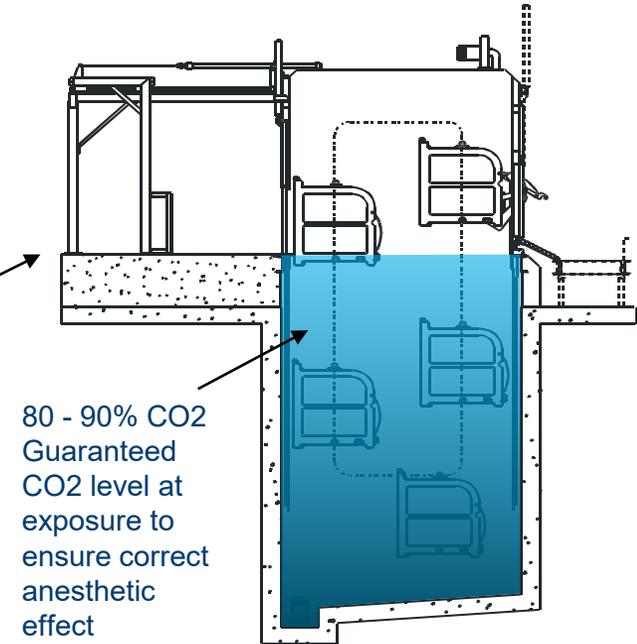
Current CO2 stunning systems

Automated driving of pigs in groups of up to 15:

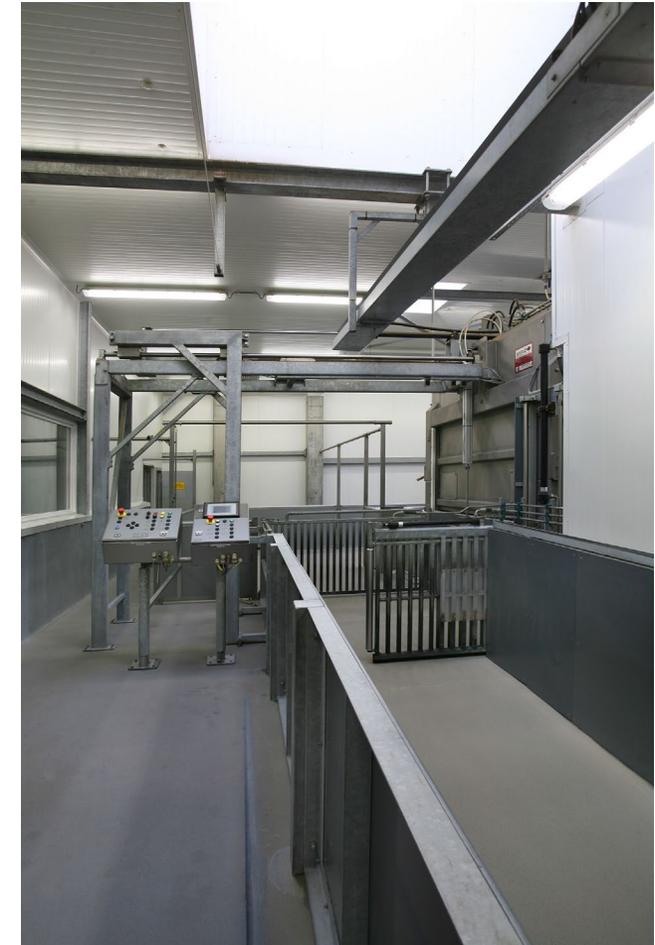
- Group handling to encourage natural behaviour of the hogs
- Minimum human contact
- Low noise
- Uniform and neutral surfaces / low visibility of equipment / correct lighting
- Continuous movements
- Automatic driving, correctly driven to suit the hogs speed
- Fully adjustable speed and pressure of moving gates
- Visibility: Bars allow pigs to see ahead – utilize the natural curiosity of the hogs to move forward
- Mechanical design and close tolerances ensures minimal risk of squeezing and bruising



- Completely relaxed bodies allows for better sticking quality and horizontal de-bleeding – improved yield and animal welfare
- Anesthetic effect of CO2 stunning allows for sufficient stun-to-stick time

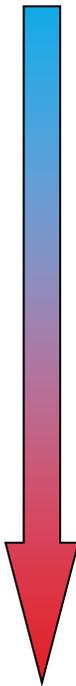


CO2 stunning installation



CO₂ as anesthetic media

Phases of anesthesia by CO₂

- 
- Conscious movement
 - Dizzy / uncertain movements
 - Loses balance / lies down
 - **Excitation (unconscious)**
 - Regular respiration (thoracic)
 - Cilia reflex (lash reflex)
 - Cornea reflex
 - Superficial gasping respiration (diaphragm)
 - **DEATH - circulatory collapse**

150 sec
stuntime

Effect of CO₂ during the stunning process

- Formerly used for human anesthesia
- CO₂ absorbed in blood from lungs 20 times faster than O₂
- pH in blood and brain decreases rapidly from approx. 7.4 to 6.6
- This pH fall disables the normal brain function
- Consciousness is lost within approx. 20 sec
- CO₂ is a natural metabolic waste product in man and animal
- Completely RELAXED carcasses
- 150s in 90% CO₂ results in less than 5% of pigs being able to recover

What will happen if EU does not act

What will happen if EU does not act

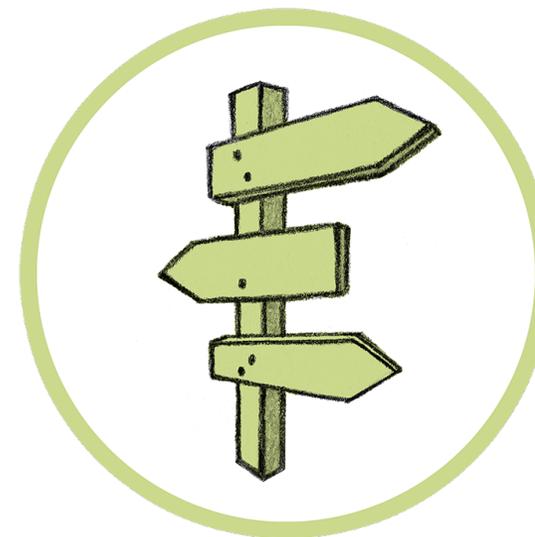
- There are currently no acceptable alternatives to CO2 stunning besides electric stunning
- The market will continue to use CO2 as main stunning method
- The discussion about CO2 stunning will arise from time to time – as seen before, and also seen in e.g. Australia & South Africa – but will fade away again
- NGO's will try to influence the use of CO2, but without any widespread success
- Research into alternatives will continue, but with limited push
- Small continuous improvements to current technology



What will happen if EU phases out CO2 stunning

Alternatives to CO2 stunning

- The only real alternative at the moment is electric stunning
- Other types of gasses are allowed according to EC-1099/2009, but so far have been found lacking in terms of
 - A sustainable process
 - Technical solution
 - Animal welfare
- So what is the impact of switching to electric stunning?



EXPLORING ALTERNATIVES

Equipment cost

- **Price electric stunner 250 – 650 pph:**
 - 650K EUR including shipping and installation
 - 350K EUR for modification to building, lairage and line
 - **Total price < 650 pph: 1 mill EUR**
 - **Total price for > 650 pph: 2 mill EUR**

- **CO2 backloader installations:**
 - **Total est. installed base: 155 installations**
 - **Estimated that 50% or more are above 650 pph (conservative)**

- **Total cost for equipment change-over to electric stunning in EU: 232 mill EUR**



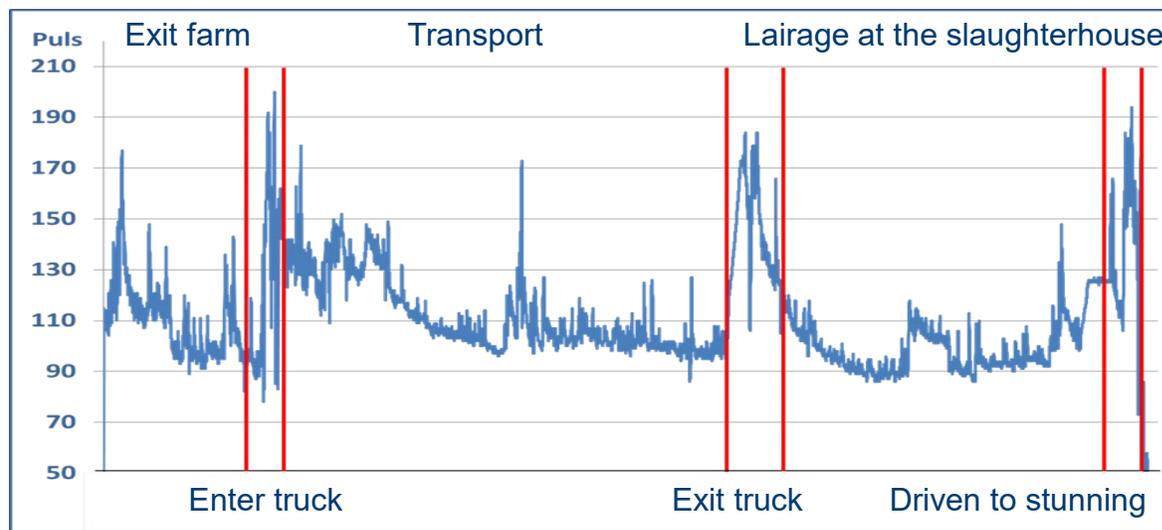
alamy

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www.alamy.com

Stress factors at the day of slaughtering



EKG measurements at the day of slaughtering



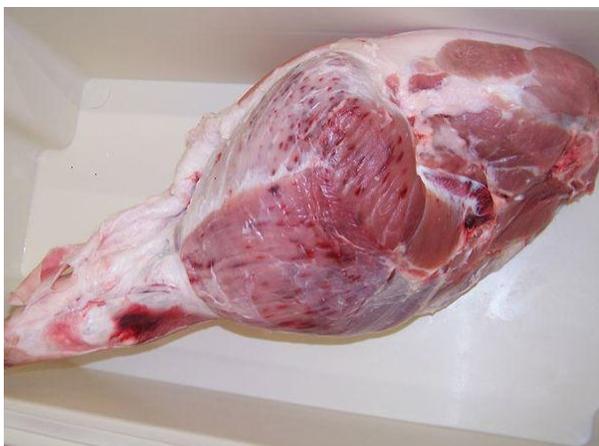
After an event it take up to 30-40 minutes for a pig to cope with the new situation.

Meat quality – overview of common issues

Ham bruises

Caused by stress

Often related to hard driving, but can also occur when exposed to high concentration of CO₂ in combination with stress



Loin & neck bruises

Caused by impact

Often related to impact from mechanical vertical gates, but can also occur from improper use of driving tools (hitting)
Bleeding in the neck from electrodes by electric stunning



Tender Loin bruises

Caused by slipping

Often occurs when unloading is improperly arranged, but also occurs from hard driving



PSE

Caused by stress / stunning method

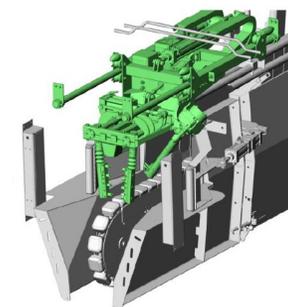
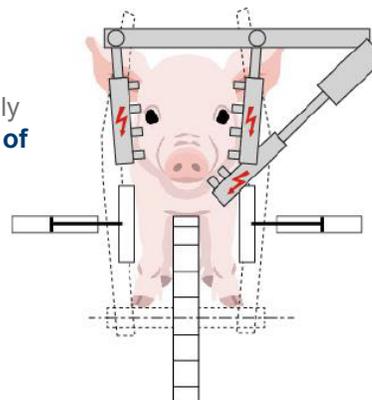
Related to hard driving and electric stimulation of the muscle
(multi factor cause – here viewed in relation to stunning only)



Current electric stunning systems

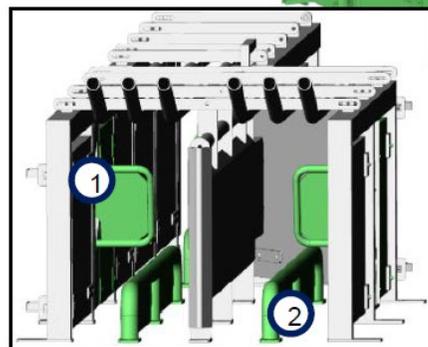
Capacity 250 – 650 pph

- The pig is driven into the restrainer through a sloped runway.
- The floor under the pig gradually slopes down, so that **the belly of the pig is supported by the central conveyor belt**



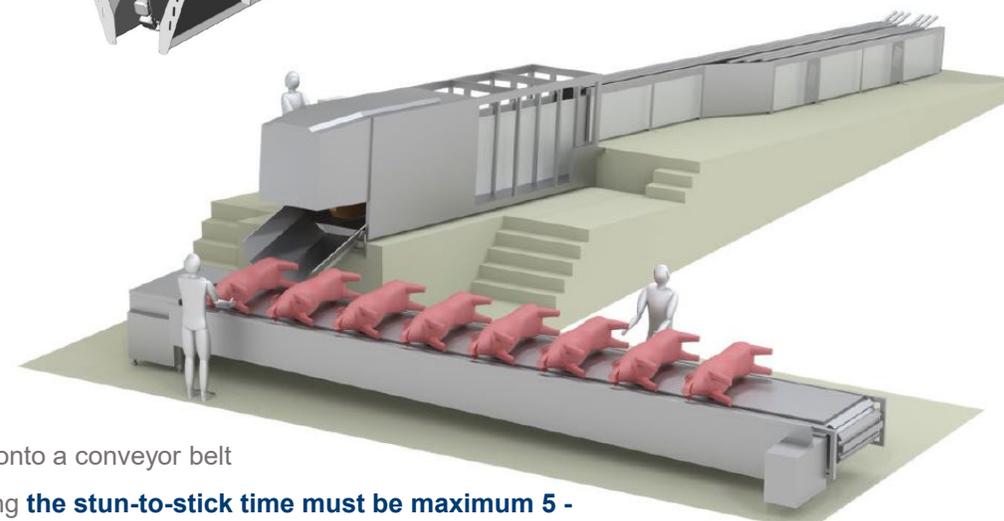
- The electrodes are placed on neck and heart
- Certain percentage of pigs are not stunned but only paralyzed
- Consciousness is lost within 1 sec (instant)

- From the stable, the pigs are driven manually towards the runway in larger groups
- Before entering the runway the group of **pigs must be broken down to single file**
- **The pigs enter the runway one by one.**
- The runway is a confined space with **surroundings that does not support natural behavior.**
- A tube between the legs of the pig prevents the pig from sitting or lying down



Electric prodder is used on average 50% of the pigs to enter the race, driven forward and enter the stunner

- The pigs slide out of the restrainer onto a conveyor belt
- Due to the nature of electric stunning **the stun-to-stick time must be maximum 5 - 10 seconds**
- **The sticking is therefore performed when the pig is lying down which can affect the sticking quality, yield and animal welfare**



Layout electric stunning



Electric stunning vs CO2 stunning



Meat quality issues – general numbers

General numbers for the occurrence of meat quality issues

Product / area	Electrial stunning	CO2 stunning
Ham	12%	<1%
Loin silver side	6%	0%
Loin bone side	10%	0%
Tenderloin	5%	<1%
Broken back	1%	0%
PSE, Ham	9%	2%

General numbers for the impact on yield

Product / area	Weight	Electrial stunning Trim	CO2 stunning Trim
Sticking	590 g	19% / 112,1 g	3% / 1,8 g
Tenderloin	140 g	5% / 7 g	3% / 4,2 g
Loin (silver/fat)	520 g	6% / 31,2 g	0,8% / 4,2 g
Loin (bone)	200 g	10% / 20 g	0% / 0 g
Ham (inner/outer)	160 g	12% / 19,2 g	2% / 4,2 g
Neck	160 g	5% / 8 g	0% / 0 g
Brocken back	2300 g	1% / 23 g	0% / 0 g
Total yield loss per pig		220,5 g	13,4 g

Note!

General numbers are based on average from surveys done on various cases

Actual level of bruising is different from case to case depending on:

- Capacity
- Layout
- Quality of operation
- Breed
- Technical solution

Meat quality issues - case

Actual numbers from a case from recent years where customer switched from electric to CO2 stunning – 1,25 million pigs/year capacity

Bruises	Value EUR / kg	Total EUR / year	Yield loss kg
Ham	6.00	91.500	24.000
Loin – bruises/PSE	0,8 – 3,30	867.600	64.000
Tenderloin – bruises/PSE	0,8 – 2,60	260.200	8.750
Brocken back – bruises/PSE	2,50	178.000	28.750
Sticking	0,5 – 2.00	667.200	140.125
Neck	2,60	42.000	10.000
Driploss	-	55.000	
Total		2.161.500	275.625

Corresponding to a value of 1,73 EUR / pig

Excluding manpower for trimming and downgrading of “uneven” products



Export of pig meat

EU's Export to 3rd Countries

Fordelt på produkter

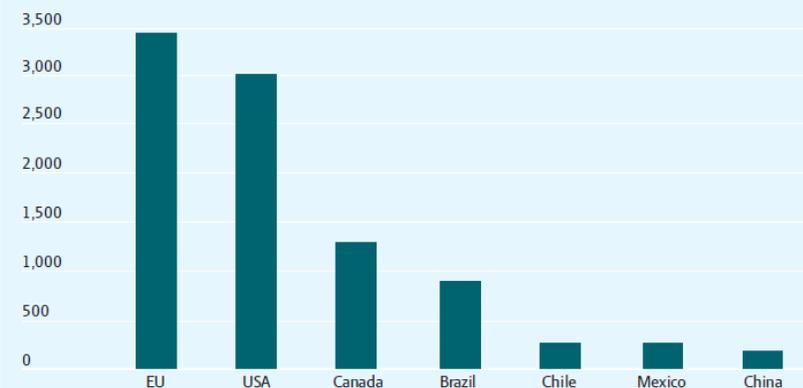
Tonnes (product weight)	2016 EU-28	2017 EU-28	2018 EU-28	2019 EU-28
Live pigs	10,524	14,795	19,427	11,585
Fresh/frozen pigneat	2,138,993	1,976,437	2,054,832	2,608,974
Bacon	34,421	38,524	41,130	43,605
Other processed products	161,485	167,337	170,206	182,235
By-products	1,657,034	1,523,713	1,449,558	1,647,230
Total	4,002,457	3,720,806	3,735,153	4,493,629

Source: Eurostat

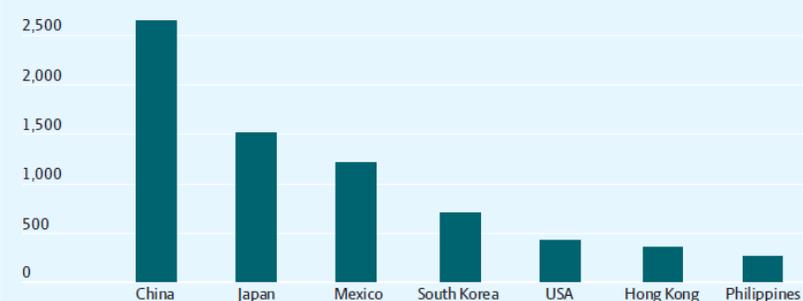
By country

Import countries			Export countries		
Tons	2018 EU-28	2019 EU-28	Tonnes	2018 EU-28	2019 EU-28
China	1,343,730	2,337,253	Germany	854,045	861,209
Hong Kong	386,926	390,225	Spain	743,878	818,120
Japan	314,758	246,018	Denmark	527,596	522,190
Philippines	274,516	217,098	France	253,326	227,346
South Korea	230,369	212,842	Netherlands	447,153	459,181
USA	151,841	117,632	Poland	243,455	241,245
Ukraine	85,841	93,743	UK	135,481	146,300
Australia	83,891	89,588	Ireland	96,034	99,518
Montenegro	104,935	86,226	Belgium	92,413	73,157
Angola	14,414	6,810	Italy	101,304	99,924
Russia	2,717	1,732	Hungary	84,773	34,966
Belarus	741,215	694,462	Austria	42,138	43,019
Others	3,735,153	4,493,629	Others	99,200	109,838
EU-28	3,720,806	3,723,943	EU-28	3,720,796	3,736,013

Largest exporters in 2019
1,000 tonnes



Largest importers in 2019
1,000 tonnes



The above exports and imports are stated in tonnes slaughter weight and include fresh, chilled or frozen pigneat and processed pigneat but does not include offal of swine or live pigs.

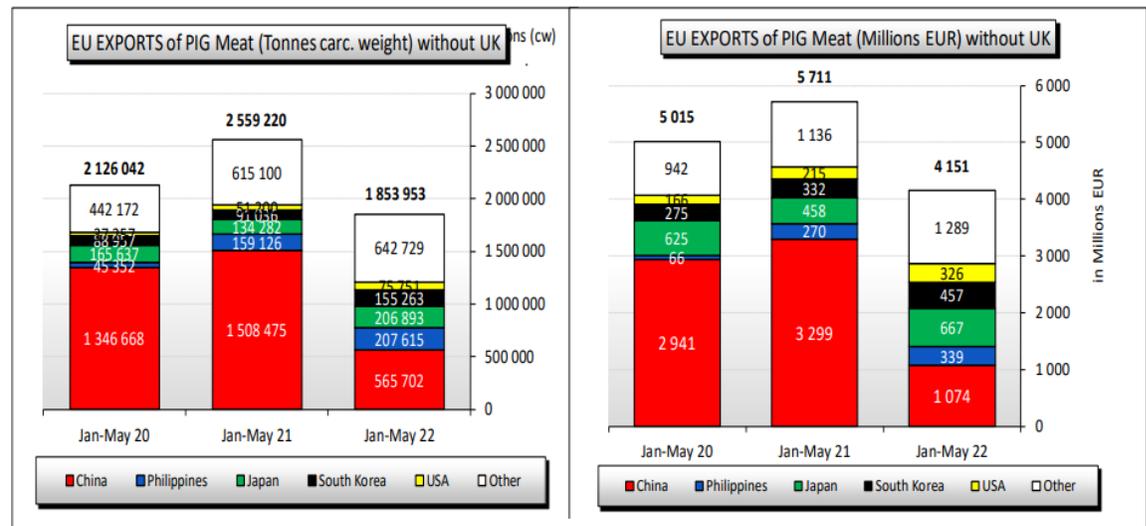
Impact on export by electric stunning

- In the EU abattoirs focus on export to high value markets like Japan and China, and followed by countries like South Korea, Philippines, Hong Kong and the US. In total 3.723.943 Tons a year.
- The biggest export EU countries are Spain, Germany, France, Denmark and Poland, covering approx. 80% of the EU export to third countries.
- **The countries exporting pig meat in general use CO2 for stunning of pigs while alternatives like electric stunning will cause downgraded meat** due to the stunning method causing blood splash, bruises and PSE-meat.
- **Countries like the US, Canada, Brazil also use CO2 for stunning of pigs and can produce a much better meat quality than the EU, if we change to e.g. electric stunning**, which means a considerable amount of the EU production can not be sold to high value any more.
- It can influence the export heavily and also the number of employees in the industry.
- **Worst case: All export is lost – app 2.65 mill tonnes per year / 6 bill EUR**
- **Best case: Export according to loss in yield and meat quality on affected products is lost**

TRADE

EU EXPORTS Pig Products

EU exports of selected PIG products
Trade figures (COMEXT – tonnes carcass weight)



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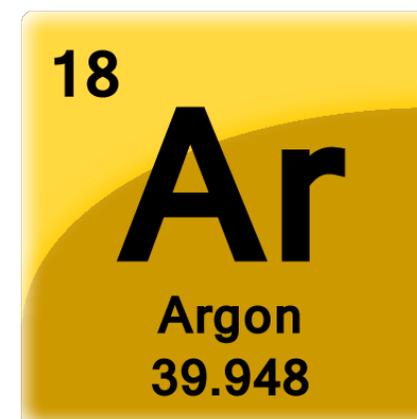
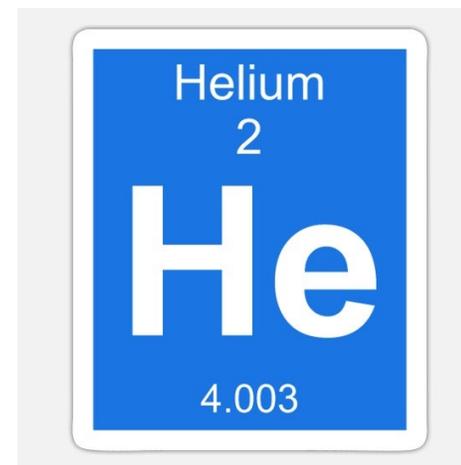
Total impact – Switching to electric stunning

Factor	Investment [EUR]	Cost YOY [EUR]
Drop in meat quality and yield per year		441 mill
Impact on export per year		600 – 6.000 mill
Cost of equipment	232 mill	
Total cost for the industry in EU	232 mill	1.041 – 6.441 mill



Alternative gasses

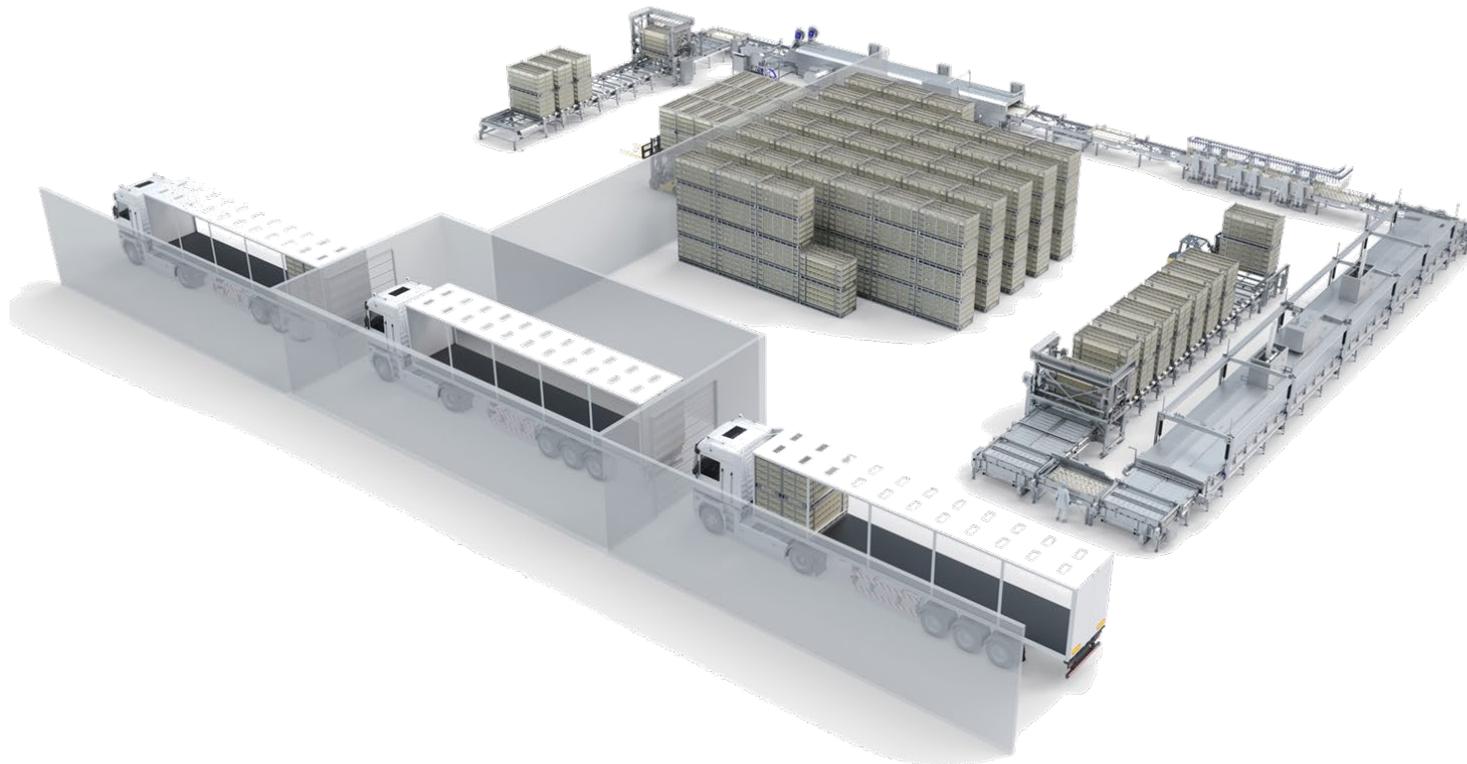
- Helium, Argon, Nitrogen etc
- 20 years of research already => development will be facing:
 - *Technical issues*
 - Capacity
 - Ensuring stunning quality
 - Improving the stunning process to an acceptable level
 - *Business case issues*
 - Cost of operation
 - Meat quality
 - Yield
 - *Animal welfare issues*
 - Anoxia
 - Excitations
 - Stun to stick time



Marel's vision

Marel's vision – the future of pig stunning

"Our vision is to implement a similar solution as is used for stunning of Poultry, while respecting that poultry and pigs are different kind of animals"



- Automatic transport of animals – don't rely on animals walking by themselves
- Multi stage CAS process
- Elimination of the excitation phase
- No aversion
- Full openness to public (consumers) is possible – animal wellbeing secured
- Attractive value proposition for end-users

Thank you
