

SorpOrkuStuðullinn SOS (The Waste Energy Coefficient WEC)

Þýðingar á ensku í svigum (translations to English in brackets)

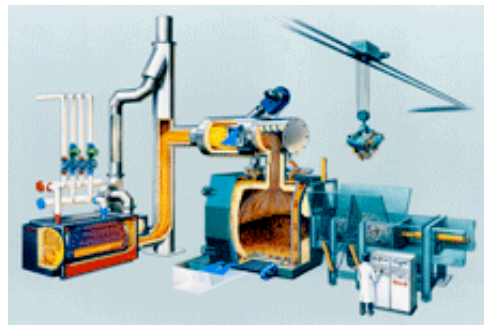
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Förgun á úrgangi með brennslu (Waste Incineration)

Stöðug brennsla og áfangabrennsla - samanburður (Continuous and Intermittent Incineration - Comparison)

Viðfest afrit af Excel reikniritum sýna muninn á orkuvinnslu og jafnvirði orkueyðslu í kWh við förgun á úrgangi með tveimur brennsluaðferðum; stöðugri brennslu og áfangabrennslu. Gildin— $L=30\%$ fyrir leiðni-, geislunar- og reykþöp í báðum aðferðunum og $R=25\%$ fyrir endurhitun brennsluhólfanna eftir kælingu við áfangabrennslu—eru fengin úr mælingum á Hoval sorporkubúnaði með áfangabrennslu á Kirkjubæjarklaustri. Mælingarnar gerði Hilmar Gunnarsson stöðvarstjóri á KbKlaustri og þær voru **afar vel útfærðar**.

(Attached copies of Excel spreadsheets show the difference between recovered energy and the heat equivalent of spent energy in two concepts for waste disposal by incineration; continuous and intermittent. The values— $L=30\%$ for losses through convection, radiation and exhaust in both concepts and $R=25\%$ for losses through reheating of the combustion chambers after they have been cooled down in intermittent incineration—were obtained through tests on a Hoval intermittent incineration plant, installed by us at Kirkjubæjarklaustur some time ago. The tests were performed by Hilmar Gunnarsson plant manager at KbKlaustur; they were **indeed well executed**).



Sorporkustöð fyrir stöðuga brennslu (tv) og áfangabrennslu (th)
(Waste Incinerators with Heat Recovery, continuous (l) and intermittent (r) operation)
Sláðu á myndirnar til að stækka þær (hit the pictures to enlarge them)

Fyrsta reikniritið (Dæmi 1) sýnir að í stöðugri brennslu nemur endurvinnsla orku **3.570 kWh/tonn** og er jafnvirði **2.297 kWh/tonn** eytt við förgunina. Framleiðsla umfram eyðslu er **1.273 kWh/tonn** og munurinn—þe SorpOrkuStuðullinn—**SOS=35,7%**. Síðara reikniritið (Dæmi 2) sýnir að endurunnin orka er **2.295 kWh/tonn** í áfangabrennslu og jafnvirði **2.488 kWh/tonn** er eytt í förgunina. Orkuþörfin er **193 kWh/tonn** meiri að jafnvirði en endurunnin orka og því verður SorpOrkuStuðullinn neikvæður sem nemur **SOS=-8,4%**.

(The **first spreadsheet** (Example 1) shows that recovered energy amounts to **3.570 kWh/mTon** in continuous incineration and the heat equivalent of **2.297 kWh/mTon** is spent on the disposal. Hence, recovery in excess of spending is **1.273 kWh/mTon** and the difference—Waste Energy Coefficient—**WEC=35,7%**. The **second spreadsheet** (Example 2) shows that **2.295 kWh/mTon** are recovered in intermittent incineration, while the heat equivalent of **2.488 kWh/mTon** is spent in the process. Here, the heat equivalent of energy spent on the disposal is **193 kWh/mTon** more than the recovered energy and, therefore, the difference—Waste Energy Coefficient—is negative to the tune of **WEC=-8,4%**).

Gildin L og R fyrir töp eru ekki nákvæmlega hin sömu fyrir samskonar búnað frá öllum framleiðendum. Það er þó ekki afgerandi, því leikur með tölurnar sýnir að hagræðing þeirra til að bæta niðurstöðurnar hefir óveruleg áhrif. Staðreyndin er einfaldlega að **áfangabrennsla samræmist ekki hugmyndafræði þessarar nýju aldar um orkumál, en það gerir stöðug brennsla**.

(The values L and R are not exactly the same for the same kind of equipment from different manufacturers. However, this is not determining, since toying with the numbers shows that adjusting them to improve the results gives nominal results only. The fact is that **intermittent incineration is not compatible with ideologies concerning energy in this new Century, whereas continuous incineration is**).

Hér er einnig að finna ástæðuna fyrir að Hoval hætti að framleiða sorporkubúnað með áfangabrennslu, sem var **afar notendavænn og vinsæll fyrir að vera auðveldur að vinna með**. Þetta kemur skýrt fram af afrekaskrá fyrirtækisins—<http://www.ingvar.is/Sorp/AfrekHoval.doc>—sem sýnir að 450 vélar og samstæður voru afgreiddar víðsvegar um heim á sautján árum (1987 til 2003); **ein samstæða aðra hverja viku**.

(This is also the very reason for Hoval terminating the production of their intermittent waste incinerators, which were **user-friendly indeed and well known for being easy to operate**. This appears clearly from the company's reference list—<http://www.ingvar.is/Sorp/AfrekHoval.doc>—showing that some 450 units and packages were delivered all over the World during seventeen years (1987 through 2003); **one package every other week**).

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SorpOrkuStuðullinn SOS (the Waste Energy Coefficient WEC)

Stöðug brennsla með orkunýtingu (continuous incineration with heat recovery):

Framleiðslugeta (possible recovery of heat):

Forsendur (prerequisites):

Magn af sorpi á kg af olíu (quantity of waste per kg of oil)	N =	10 kg
Verg orka í sorpi (gross energy in waste)	Q =	4.0 kWh/kg
Verg orka í 1 kg af olíu (gross energy in 1 kg of oil fuel)	O =	11.0 kWh/kg
Orkunýting (rate of recovery)	P =	70.0% %

Jafna (equation): $H = (NxQ + O)xP/N$

Verg orka frá úrgangi (gross energy from waste)	NxQ =	40.0 kWh/kg
Orka frá eftirbrennslu (energy from afterburner)	O =	11.0 kWh/kg
Nýting (rate of recovery)	P =	70.0% %
Endurunnin orka (recovered heat):	H =	3.57 kWh/kg

Sorporkustuðullinn SOS (the waste energy coefficient WEC):

Forsendur (prerequisites):

Leiðni-, geislunar- og reykþöp (losses through convection, radiation and exhaust)	L =	30.0% af H (of H)
Töp vegna endurhitunar brennsluhólfa (losses due to reheating of combustion chambers)	R =	0.0% af H (of H)
Meðalvegalengd fyrir aðflutning á einu tonni - fram & tilbaka (average distance for transport of one mton - return trip)	W =	60 km
Olíueyðsla við aðflutning á úrgangi (oil consumption for fetching waste)	F =	0.045 kg/tonnkm
Samanlögð nafnafköst á rafdrifnum búnaði (total nominal power of electrically powered equipment)	E =	60 kW
Nafnafköst stöðvarinnar (nominal capacity of the facility)	C =	10 tonn/24klst

Jafna (equation): $SOS = WEC = HH - O \times 1000/N - H \times L \times 1000 - H \times R \times 1000 - W \times F \times 11 - E \times 24 \times 0,667/C$

Endurunnin orka (recovered heat) **HH = 3,570 kWh/tonn**

Eytt í vinnsluna (used in the process):

Orka til eftirbrennslu (energy for thermo reactor)	OO =	1,100 kWh/tonn
Töp L á búnaði (losses L on equipment)	LL =	1071.0 kWh/tonn
Töp R; kólnun & endurhitun (losses R; cooling & reheating)	RR =	0.0 kWh/tonn
Eldsneyti til aðflutninga (fuel for transport)	FF =	30 kWh/tonn
Raforkuneysla (electric power consumption)	EE =	96 kWh/tonn
Samtals (total):	Samtals (total):	2,297 kWh/tonn

Eftir stendur (the remainder): **1,273 kWh/tonn**

Sorporkustuðullinn SOS (the waste energy coefficient WEC): **35.7 %**

SorpOrkuStuðullinn SOS (the Waste Energy Coefficient WEC)

Áfangabrennsla með orkunýtingu (intermittent incineration with heat recovery):

Framleiðslugeta (possible recovery of heat):

Forsendur (prerequisites):

Magn af sorpi á kg af olíu (quantity of waste per kg of oil)	N =	10 kg
Verg orka í sorpi (gross energy in waste)	Q =	4.0 kWh/kg
Verg orka í 1 kg af olíu (gross energy in 1 kg of oil fuel)	O =	11.0 kWh/kg
Orkunýting (rate of recovery)	P =	45.0% %

Jafna (equation): $H = (NxQ + O)xP/N$

Verg orka frá úrgangi (gross energy from waste)	NxQ =	40.0 kWh/kg
Orka frá eftirbrennslu (energy from afterburner)	O =	11.0 kWh/kg
Nýting (rate of recovery)	P =	45.0% %
Endurunnin orka (recovered heat):	H =	2.30 kWh/kg

Sorporkustuðullinn SOS (the waste energy coefficient WEC):

Forsendur (prerequisites):

Leiðni-, geislunar- og reykþöp (losses through convection, radiation and exhaust)	L =	30.0% af H (of H)
Töp vegna endurhitunar brennsluhólfa (losses due to reheating of combustion chambers)	R =	25.0% af H (of H)
Meðalvegalengd fyrir aðflutning á einu tonni - fram & tilbaka (average distance for transport of one mton - return trip)	W =	60 km
Olíueyðsla við aðflutning á úrgangi (oil consumption for fetching waste)	F =	0.045 kg/tonnkm
Samanlögð nafnafköst á rafdrifnum búnaði (total nominal power of electrically powered equipment)	E =	60 kW
Nafnafköst stöðvarinnar (nominal capacity of the facility)	C =	10 tonn/24klst

Jafna (equation): $SOS = WEC = HH - O \times 1000/N - H \times L \times 1000 - H \times R \times 1000 - W \times F \times 11 - E \times 24 \times 0,667/C$

Endurunnin orka (recovered heat) HH = **2,295 kWh/tonn**

Eytt í vinnsluna (used in the process):

Orka til eftirbrennslu (energy for thermo reactor)	OO =	1,100 kWh/tonn
Töp L á búnaði (losses L on equipment)	LL =	688.5 kWh/tonn
Töp R; kólnun & endurhitun (losses R; cooling & reheating)	RR =	573.8 kWh/tonn
Eldsneyti til aðflutninga (fuel for transport)	FF =	30 kWh/tonn
Raforkuneysla (electric power consumption)	EE =	96 kWh/tonn
Samtals (total):	Samtals (total):	2,488 kWh/tonn

Eftir stendur (the remainder): **-193 kWh/tonn**

Sorporkustuðullinn SOS (the waste energy coefficient WEC): **-8.4 %**