

www.ormecon-nanotech.com

Estimation of the Environmental Impact of OMUN

Ormecon GmbH, Germany

Estimation of the Environmental Impact of OMUN



United States Environmental Protection Agency Study

- Only meaningful study to date
- Information given on energy, metal and water demands
- Information on toxicity and safety issues
- Comparison with HASL as baseline

- Only takes into account the metal which is deposited onto the PCB.
- Does not take into account the metal lost to drag out
- Does not take into account the environmental impacts associated with mining the metals

MIPS Concept of the Wuppertal Institute, Germany

- Takes into account **all** aspects of the mining and processing of the raw materials
- Includes environmental impacts
- Individual metals are considered separately if more than one metal is deposited
- Loss from drag out is included

www.ormecon-nanotech.com



**United States Environmental
Protection Agency Study**

Estimation of the Environmental Impact of OMUN



Technology (see question 2)	Worker Risk (see question 4)		Environmental Risk (see question 5)	Performance (see question 6)	Cost (see question 7)	Resource Use (see question 8)	
	Inhalation Risk (# of chemicals)	Dermal Risk (# of chemicals)	# of Chemicals with Aquatic Risk Indicator >1	Surface Finish-Related Anomalies	\$/260,000 sq.ft.	Water Use (gall/260,000 ssf)	Energy Use (Btu/260,000 ssf)
HASL (NC) BASELINE	1	2	4	=	\$94,200	322,000	56,700,000
HASL (C)	✓	=	✓	=	=	✓	✓
Ni/Au (NC)	X	X	✓	=	X	X	X
Ni/Pd/Au (NC)	X	X	✓	=	X	X	X
Imm. Silver (C)	✓	✓	✓	=	✓	✓	X
Imm. Tin (C)	✓	✓	✓	=	✓	✓	X
Imm. Tin (NC)	✓	✓	✓	=	✓	X	X
OSP (C)	✓	X	✓	=	✓	✓	✓
OSP (NC)	=	X	✓	=	✓	✓	✓

- (C) Conveyorized process
- (NC) Non-conveyorized process
- ✓ Indicates improvement over baseline
- X Indicates a negative change from baseline
- = Indicates the alternative is equal to or within 5% of the baseline



Summary of the EPA Study

- Even HASL has a large water consumption
- ENIG has the highest water demand
- Immersion Silver and Immersion Tin have the lowest metal consumption
- ENIG and HASL have a similar (higher) consumption
- Generally the energy consumption can be regarded as follows

HASL > ENIG > Im Sn \cong Im Ag > OSP

- Interestingly ENIG is the most widely used alternative finish but the most environmentally damaging and has the highest material demands (and toxicity risks)



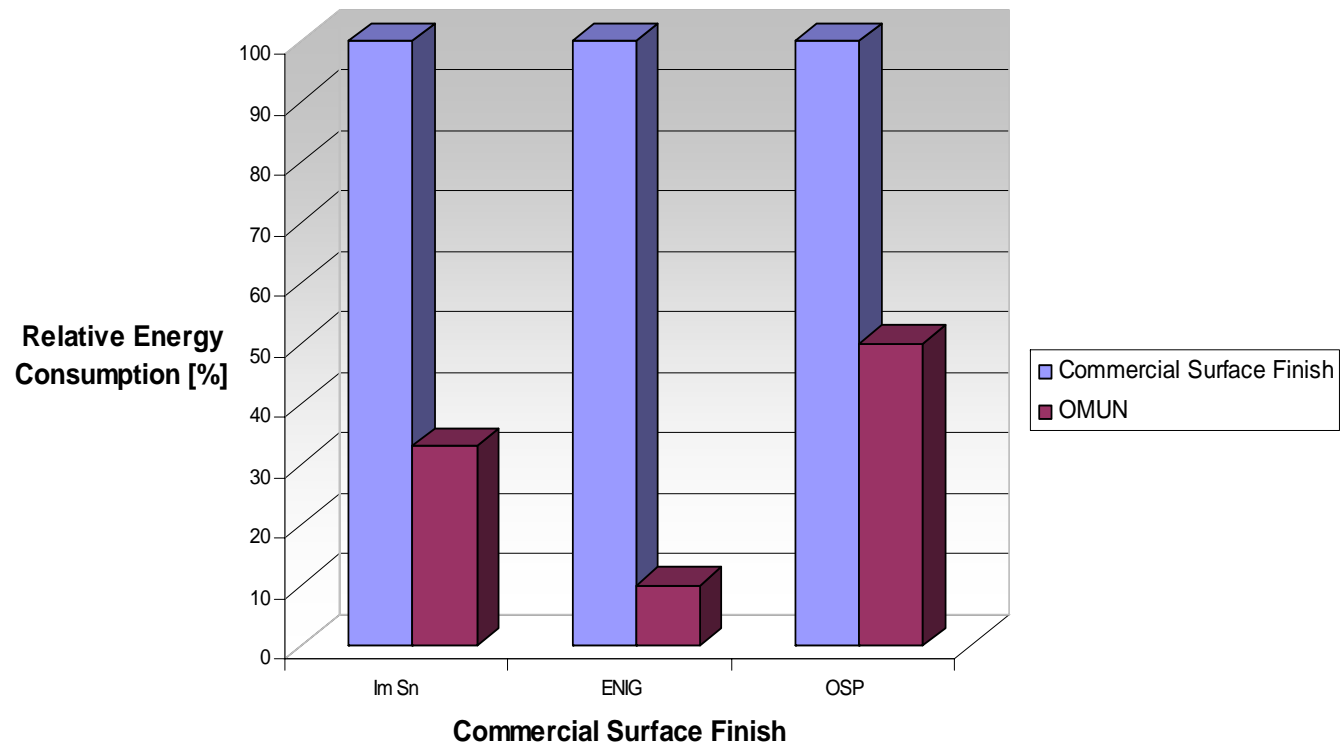
Energy Consumption of OMUN Compared with Commercial Surface Finishes

- It is difficult to obtain a complete assessment of the energy consumption because the energy demand to extract the metal is disproportionately larger than the energy demand for final surface finish manufacturers.
- By estimating the necessary energy requirements for final surface finish production, it can be seen that
 - compared to a process which has on average a high energy consumption (e.g. ImSn), the new Nanofinish needs only ~ 33% of this energy demand. This is a saving of a good 65%
 - compared to ENIG, which uses the most energy, the new Nanofinish needs only ~ 10% of this energy demand, a saving of ~ 95%
 - compared to OSP, which until now have been the most economical to run, there is a saving of ~ 50%.

Estimation of the Environmental Impact of OMUN



Energy Consumption of OMUN Compared with Commercial Surface Finishes





A Summary of OMUN Compared with Commercial Surface Finishes

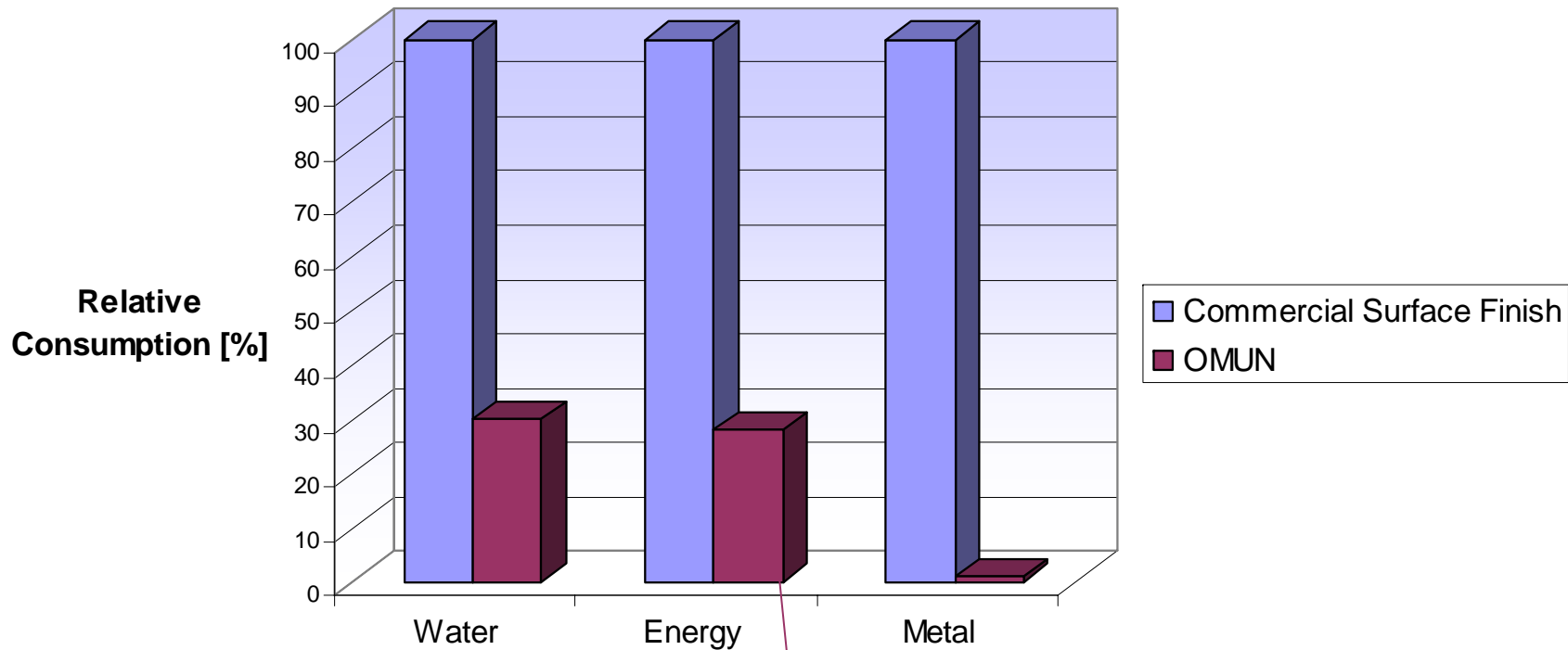
If concentrating only on final surface finish production, the new technology could numerically save the following:

- A reduction of 70% in the water demand (approx. 8 million tonnes)
- A reduction of 50 – 95% in the energy demand
- A reduction of 99% in the metal demand (approx. 8.500 tonnes).

Estimation of the Environmental Impact of OMUN



Comparison of OMUN with Commercial Surface Finishes



Average value based on 50 – 95% saving

www.ormecon-nanotech.com



**Environmental Impact using the MIPS Concept from
the Wuppertal Institute, Germany**

Estimation of the Environmental Impact of OMUN



Gesamtmenge Leiterplatten weltweit in m ²		200,000,000					
Endoberfläche	Marktanteil 2005	Stoff	Schichtdicke (in µm)	absolute Menge (in Tonnen)	Menge inkl Verluste (in Tonnen)	MIPS spezif	MIPS absolut
HASL	40%	Sn	13.5	1080	1080		0
	40	Ag	1	8000	8000		0
	40	Cu	1	8000	8000	179	1,432,000
ENIG	25%	Ni	5	250	750	141	105,750
	25%	Au	0.1	5	15	540,000	8,100,000
ImAg	8%	Ag	0.5	8	24	7,500	180,000
ImSn	4%	Sn	1	8	24	8,486	203,664
OSP	23%	organisch	0.5	23	69	5	345
Gesamt	100%						
				Gesamt		10,021,759	
alternativ: OMUN		organisch	0.05	10	30	5	150
		1% Ag	0.005	1	3	7,500	22,500
				Gesamt alt		22,650 0.23%	

Impact for commercial processes
= 10 million tonnes

Bernhard Wessling:
Annahme: alles bleifrei (im Detail noch sehr viel bleihaltig, künftig nicht mehr)

Bernhard Wessling:
Gesamtschichtdicke ca 15 µm; bleifreie Lote enthalten ca 90% Sn, 5% Ag, 5% (unterschiedlichste Formulierungen)

Bernhard Wessling:
Gesamt-HASL-Anteil (zur Berechnung auch für die anderen Metallbestandteile angegeben)

Bernhard Wessling:
analog

Impact for OMUN
= 22 650 tonnes

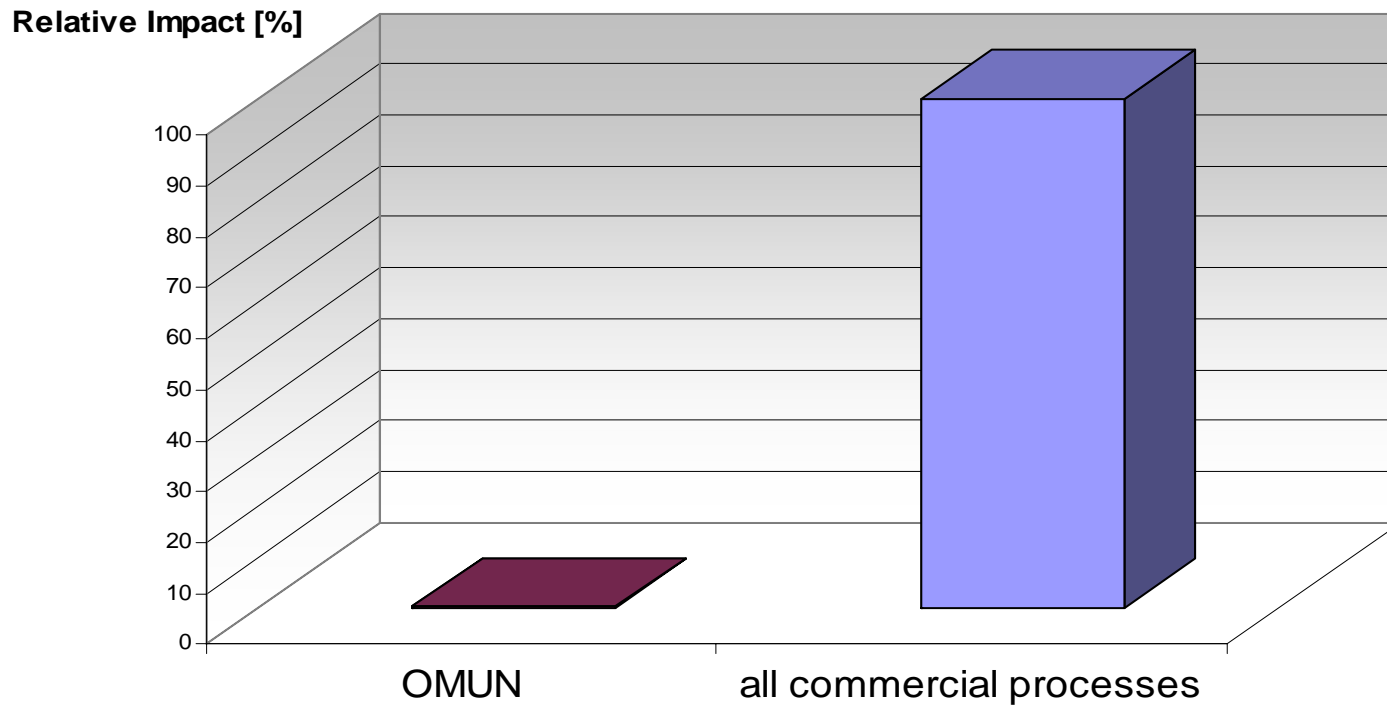
theoretical case

If all PCBs were produced with the new surface finish, the impact on the environment could be reduced to ~ 0.23% of today's value.

Estimation of the Environmental Impact of OMUN



Relative Environmental Impact [%]



theoretical case

If all PCBs were produced with the new surface finish, the impact on the environment could be reduced to ~ 0.23% of today's value.

Estimation of the Environmental Impact of OMUN



Total Impact According to MIPS

