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Switcher Climate Project: CO_2-neutral T-Shirt

Report Preliminary Study (Draft version 17 January 2006)

Daniel Lehmann Pollheimer

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SWITCHER®

switcher.com

Postal address
ecos, PO Box, CH-4001 Basel

Office and deliveries address
Bäumleingasse 22, CH-4051 Basel

Telephone
+41 (0)61 205 10 10

Fax
+41 (0)61 271 10 10

Email
mailbox@ecos.ch

Personal email address
firstname.surname@ecos.ch

Internet
www.ecos.ch

1 CO_2-Neutralisation of a Switcher T-Shirt (Summary)

Procedure of greenhousegas neutralisation

The neutralisation of the greenhouse gas (GHG) emissions related to any product usally should comprise the following steps:

1) **Value chain and system border:** Description of system (whole value) chain and determination of scope of analysis (system borders).
2) **Life Cycle Analysis** of the whole production supply chain focused on Energy use and emissions of GHG.
3) **Emission-Baseline:** Credible and transparent determination of GHG emissions based on authentic data of a specific year, in total and attributed to a specific unit of production.
4) **Valuation of Measures:** Compilation of already implemented or upcoming measures directly related (in-fence) to the value chain (stepwise or overall) that are not yet represented in the data of the LCA.
5) **Estimation of remaining amount to compensate:** The emission baseline less the implemented „in-fence"-measures yields the remaining amount of GHG emission that has to be compensated with „out-fence"-compensation projects to achieve a GHG-neutral product.

CO_2-Neutralisation of a Switcher T-Shirt

In this preliminary study this procedure was simplified in order to quickly get a first guess impression of the scale of discussion: For this reason the analysis:

- included only Carbon dioxide (CO_2) emissions,
- was limited to the primary value chain i.e. grey energy of the infrastructure and upstream emissions of raw materials (expect from cotton) were not included,
- is based on authentic data only when easily available and significant for the result and used values from literature if this was not the case.

CO_2-Balance sheet of Switcher T-Shirt

This results in the following CO_2-balance sheet for T-Shirt production by Switcher/PREM:

Number of T-Shirts [Mio.]:	**4**	**CO_2-Emission**	**Neutralisation**	**Cost of Neutralisation:**
sfr/tonne CO_2 (GS-CER):	20	of one T-Shirt (g)	sfr/T-Shirt	sfr
Current emission from T-Shirt production		5'169	0.10	413'488
Currently implemented measures (stepwise/overall)		1'687	0.03	134'961
Current net CO_2 emission to be neutralised		3'482	**0.07**	**278'527**
CO_2 emission reduction due to planned measures		-1'028	-0.02	-82'248
Remaining reduction per T-Shirt including planned measures:		2'453	**0.05**	**196'279**

The CO_2 emission related to the production of one T-Shirts amounts to 5.2 kg. Such a CO_2 emission of about 5 kg is also emitted eg. with:

- driving 30 km in medium-sized car,

- flying 27 km on short distance flight,
- a 60W light bulb not switched off for one week,
- taking 5 showers of 10 minutes.

The currently implemented measures – mainly fuel switch from state grid electricity to wind energy – result in a reduction of about 1.7 kg, that can be subtracted. Hence today (beginning 2006) the current net CO_2 emission that has to be neutralised is 3.5 kg per T-Shirt.

With an annual production of about 4 Mio T-Shirt and a market price for Gold Standard carbon credits (CER) of CHF 20 per Tonne the cost for CO_2 neutralisation amount 7 Rp (Swiss currency) per T-Shirt or CHF 280'000 for the whole production.

With the implementation of all planned measures forthcoming for 2006 the compensation requirements reduce to 2.5 kg or 5 Rp per T-Shirt or CHF 195'000 respectively.

In turn this remaining amount equals to the CO_2 emission due to the steam production with firewood in the dyeing unit of the T-Shirt production. This production step is apparently crucial for the concept of CO_2 neutralisation (c.f. below).

Model to neutralise CO_2 emissions

The model for the CO_2-neutralisation then consist of two parts:

1) **Decreasing the „CO_2 emission baseline“** of the T-Shirt value chain including the CO_2 emission of the production ***and*** measures (energy efficiency, wind, solar etc.) already commissioned. This baseline decreases with every further measures implemented in future in this regard („in fence“).
2) **Neutralising the remaining** CO_2 emission externally with compensation projects. These can be related to Switcher/PREM activities but are not directly related to the T-Shirt value chain („out fence“).

   To set up and finance such compensation projects an extra charge could be imposed on each sold T-Shirt as from Jan 2006. (e.g. 7 Rp as per 1.2006, 5 Rp as per 1.2007 according exemplified calculation). This extra charge goes to a fund, that can be used to set up CO_2 compensation projects according CDM or even Gold Standard.

Other companies also willing to neutralise the CO_2 emissions related to their products can be included in the scheme.

Measures to neutralise CO_2 emissions

The following measures are already implemented (and not yet included in the CO_2 balance sheet), planned for 2006 or are possible options to decrease the CO_2 emission baseline:

Implemented	**Effect [g per T-Shirt]**
• 15 Wind mills for power generation	1'687
Planned	
• 4-6 additional wind mills for power generation	578
• Decreased water consumption resulting in reduced consumption of firewood and power	372
• Solar steam generation	77
Options	
• Procurement of CO_2 neutral biomass for steam production (in-sourcing of biomass production)	2'576
• Power and heat cogeneration with biomass gasifier in dyeing unit (* either or)	2'576

The following measures could be options for compensation projects (cf. 32):

Farming	**Effect [g per T-Shirt]**
• Introduction of drip irrigation	400
Dyeing	
• Stand alone („out-fence") project to provide CO_2 neutral biomass to the textile industry in Tiruppur	2'576
Misc.	
• To be evaluated	

2 Way forward: Heading for a CO_2-neutral T-Shirt

21 Conclusions

- Although the established CO_2 balance sheet of the T-shirt production is of reasonable accuracy it is still only a first guess assessment of a preliminary study. A more detailled and therefore credible GHG-inventory is crucial for (communication) success and to avoid any risk of being blamed as „greenwasher".
- Commissioned and future measures related to PREM („in-fence") need not to be verified according CDM/GS because these procedures do not fit to the purpose. Nevertheless achieved emission reductions should be exernally verified. However for compensation projects („out-fence") it is indispensable to at least rely on these procedures.
- CO_2 emissions emanating from Switcher headquarter and shops (including flight travelling) can and should be compensated with CDM, i.e. CER/VER according Gold Standard for communication reasons.
- The heat production in the dyeing unit contributes most to the CO_2 emission of the T-Shirt production (2.5 kg/T-Shirt). Although some measures have been or will be taken the largest potential in regard of energy efficiency remains there.

- Firewood use for boiler heating is not sustainable because the origin of fuel is almost doubtful, even when replaced with other biomass because of forthcoming restrictions regarding firewood use for industrial purpose to be imposed by the state of Tamil Nadu.
- If biomass is used for steam production more efficient technologies should be taken into account eg. biomass gasifiers or/and power and heat cogeneration. Thus on site CO_2 emissions from dyeing can be reduced substantially.
- The use of biomass as a fuel can be considered as CO_2-neutral if origin and supply of the respective biomass is sustainable, i.e. the respective plants are recultivated regularly, the plantation are to the benefit of the local people and they do not cause ecological damage. If this could be achieved the CO_2 emission of the T-Shirt production can be reduced to halve.

22 Recommendations

221 External GHG-inventory and independent Labeling assures credibility

The first guess CO_2 balance sheet of this preliminary study fulfills the goal to display the scale of the CO_2 emission of the T-shirt production and and the proportion of the contribution of each single production step. However this assessment does not meet the demands for a credible and „waterproof" inventory of the CO_2 emissions (or GHG emissions respectively) related to the T-Shirt production, mainly because the inventory was not carried out by external and independent experts and therefore the assessment does not draw from authentic and verified data.

⇨ However with the addition of a good security margin it is possible to use the available estimation as a starting point for 2006, but it has to be clearly **declared as a tentative draft.**

⇨ An **advanced CO_2 (ore even GHG) emission inventory** should be done in 2006 by an independent organisation to assure credibility of the „baseline". This inventory can either rely on the existing ISO 14001 procedures, go in line with the envisaged energy audit at PREM or be self-contained. The development of a tailor-made methodology for a CO_2 (GHG) focussed and product oriented inventory based on existing procedure of Life-Cycle-Analysis should be envisaged. Such methodology can be used for other product, too. Partners and sponsors could be seco and/or SDC. First contacts are established in this regard.

⇨ A comprehensive methodology/labeling procedure should be developed in order to ensure credible, comparable and transparent validation of CO_2-free products. CO_2mpensate, a ecos and IWB (public utility Canton Basel-Stadt) joint-venture, is developing such a methodology and a respective **CO_2-**

neutral label might be issued by an independent entity that has to be established.

222 Compensation fund allows to launch CO_2-neutral T-Shirt soon

The current amount of CO_2 emission per T-Shirt (5 kg) less the already implemented and forthcoming „in-fence"-measures (1.6 kg) results in a remaining CO_2 emission of 2.5 kg per T-Shirt, that has to be neutralised „out-fence". This neutralisation should be done by CO_2-compensation projects according the Clean Development Mechanism of the Kyoto-protocol. These projects undergo a internationally approved validation and verification process to ensure that the resulting carbon credits (Certified Emission Reduction: CER) represent a real CO_2-reduction. To neutralise CO_2 emissions these CER's can be purchase to a market price (Currently about 20 sfr. per tonne for Gold Standard).

For the neutralisation of the Switcher T-Shirt two additional conditions have to be met:

1) The compensation projects should also be certified according the Gold Standard. Gold Standard is a quality label for CDM carbon offset projects established by environmental organisations headed by WWF International. In addition to the general CDM criterias Gold Standard additionally checks whether a project is in line with sustainability criteria, i.e. if it contributes locally to economic, social and ecological improvements.
2) Furthermore the compensation projects should be related to the Switcher/PREM activities. Of special interest for Switcher are projects regarding cotton farming.

Compensation projects fulfilling these requirements are not to hand at present. There are a few ideas for the development of such projects, but the minimal time span for such a development is at least 1-2 years. Nevertheless CO_2-neutralisation of the T-Shirt can be started and promoted soon, if the extra charge levied on the T-Shirts goes to a compensation fund, that can be used to set up CO_2 compensation projects according CDM/Gold Standard. For a certain period the T-Shirt production is not fully neutralised instantly, but it is assured that all T-Shirts are neutralised in due time, because the neutralisation „fee" nourishing the fund enables the development of the intended compensation projects. Until this projects are set up it it might be recommendable to use a provisional label e.g. „CO_2-neutral (in conversion)" instead of „CO_2-neutral" (following the example of the organic food label „Knospe" of BioSuisse) for communicational reasons, i.e. not to make assertion without substance.

223 Focus on steam production in dyeing unit to improve CO_2 balance

The production of steam in the dyeing and processing step contributes about half to the CO_2 emissions of the T-Shirt production. It is therefore useful to attach importance to this step for two reasons resulting in a twofold strategy:

1) **Assure CO_2-neutral biomass supply for dyehouse:** Currently the steam is produced by using up firewood associated with substantial emission of CO_2. In principle firewood can be considered as CO_2-neutral because the growing trees and shrubbery take up as much CO_2 as they release when its wood is burnt. Hence the assumption of CO_2 neutrality can only be claimed if the same amount of firewood is afforested in the same time. According to the information at hand the firewood used in the PREM dyehouse is procured from various sources of the free market: Origin and therefore ecological circumstances of production cannot be traced, i.e. is not assured that the firewood stems from sustainable production.
    - ⇨ Switcher/PREM to establish enough influence to their suppliers of firewood/biomass to guarantee a sustainable afforestation/farming. This could happen either by insourcing the firewood/biomass production or by setting up a stand-alone firewood/biomass production project under CDM/GS in Tiruppur.
2) **Strive for highly energy efficient steam and power production by biomass fueled cogeneration with state-of-the-art gasifier technology:** The current technique of steam production seems not to be state-of-the-art regarding energy efficiency. Some improvements are already scheduled for 2006 (reduction of water consumption, solar steam production). Nevertheless consultations with experts and literature research indicate that there might a big potential for a substantial reduction of energy consumption and subsequently of CO_2 emission, if the technology for steam production is changed to a heat and power cogeneration technology based on biomass (firewood, rice husk, coconut shell etc.) gasification. Because the state government of Tamil Nadu will no longer allow to use firewood for industrial purposes, it might be a good moment to look at such options now.
    - ⇨ Careful reconsideration of state-of-the-art technologies like power and heat cogeneration/biomass gasification for the dyehouse with respective experts.

Obviously one can argue, that it might be faster, easier and also less costly to pursue only the biomass path. This is certainly correct, but in the longer run the energy efficiency path opens the chance of reducing the CO_2-release at all and also includes less demand for biomass, less transports and reduced costs. Further analysis and cost-benefit analysis of both options is strongly recommended.

3 Annex

31 Comments on CO_2-balance sheet stepwise

311 Overview value chain T-Shirt production and system borders

The CO_2 balance is restricted to the primary value chain of the T-Shirt production. The secondary value chain of auxiliaries as well as grey energy e.g. energy used for buildings, machinery and other infrastructure was excluded. Authentic data was available for the value chain steps operated by PREM.

Step	included	excluded	Operator/responsibility
Upstream			
Farming	• Energy used for cultivation, irrigation etc.	• auxiliaries like fertilizers, herbicides etc.	Various farmers (Gujarat, Orissa, Mali)
Transport	• Fuel for vehicles		Various forwarders
Ginning	• Energy for machinery	• auxiliaries	Various ginning mills
Transport	• Fuel for vehicles		Various forwarders
PREM			
Spinning	• Power for spinning mills • Diesel for stand-by Gensets • Petrol for vehicles • Packing materials	• lubricants	PREM
Knitting	• Power for knitting machine • Diesel for stand-by Genset	• lubricants	
Dyeing/ Processing	• Power for machinery • Firewood for steam production • Diesel • Petrol for vehicles • Packing materials	• Dyes • Chemicals	
Confection	• Power for machinery • Diesel for ironing steam • Packing materials	• Stitching thread • Buttons, zips, tags	
Transport	• Fuel for vehicles		Various forwarders
Switcher			
Switcher/ headquarter/ distribution	• Power for light etc. • Heating • Flights of management		Switcher

312 Farming/Ginning (Upstream)

Currently there is are no data available regarding the farming and ginning step of the cotton used by PREM to produce the T-Shirt. Due to the various producers and the high variety of production measures (irrigation, grade of manual work, use of chemicals etc.) it is not possible to get such authentic data with reasonable effort.

This difficulty regarding energy use and (CO_2-) emission data related to cotton farming manifests also in the scarcy of any available data (literature, internet).

Three main important factors highly affect the amount of CO_2 emissions of cotton farming:

- Farming approach: Organic farming is somewhat better regarding only CO_2 but much better when including overall greenhouse potential, because the main greenhouse potential of cotton farming is due to use of chemicals like fertilizers, herbizides etc.
- Cultivation method: Mechanised farming produces much more CO_2 emissions than manual farming.
- Irrigation: About 75% of the global cotton harvest is produced in irrigated fields. This is also valid for the cotton used by PREM originated mainly from Gujarat as well as Orissa and Mali in Africa. Irrigation is often related to a substantial use of energy because the water has to be pumped to the fields. Improvements in the irrigation method (e.g. drip irrigation) can therefore also result in reductions of energy use and therefore CO_2 emission reduction. The reduction of water and energy use goes in line with a substantial reduction of production cost for the farmers.

For the purpose of this preliminary study it was assumed, that the cotton used by Switcher/PREM is mainly produced conventional, manually and with substantial irrigation. This corresponds with the data available for cotton production in China, i.e. with a value of 1 kg CO_2 emission per T-Shirt. For a T-Shirt made of organic cotton this value is reduced to 0.2 kg.

Two data sources could be investigated[1]:

Data source	**CO_2**	**CO_2 Equiv.**
	[kg/T-Shirt]*	
Oekoinstitut Freiburg i.Br./Germany		
Organic/Peru	**0.22**	**0.25**
Farming	0.04	0.05
Ginning	0.18	0.20
Conventional/China	**0.99**	**2.09**
Farming	0.19	0.46
Ginning	0.80	1.65
Conventional/USA	**2.84**	**3.91**
Farming	0.62	0.86
Ginning	2.22	3.04
Tampere University of Technology		
Conventional Farming and Ginning	**1.42**	

[1] Other sources seem to be available against fees: UNEP: Novotex LCA of T-Shirt ($50); ESU-Services: LCA of T-Shirt (Euro 500). It is doubtful whether they provide additional information.

313 Spinning (PREM Group)

Description

- 2 units for yarn spinning from cotton balls: ~ 12t/day
- Energy used mainly electricity for machinery. Diesel for standby genset.
- 50% of produced yarn is sold out

PREM Data

- First estimation by Manivasagam available
- This estimation corrresponds well with the authentic data compiled for the financial year April 2004 to March 2005 provided by Jerry/Manivasagam
- Data for lubricants/grease/paper etc. also available but not relevant. Only packing materials result in a minor contribution to the CO_2 emission

Step-specific measures

Operating

- More or less state-of-the-art machinery
- Electricity production by wind mills located on the PREM premises (Spinning and Knitting)

Planned or in implementation

- Additional wind mills (Spinning and Knitting)
- Solar heated kitchens in female worker hostel attached to spinning mill. No exact data available. This project could be considered as a „out-fence“ compensation project.

Options/ideas

- No further measures proposed because there is not much potential for improvements in energy efficiency any more.

314 Knitting (PREM Group)

Description

- 1 units for grey fabric knitting from yarn: ~ 6t/day
- Energy used mainly electricity for machinery. Diesel for standby genset

PREM Data

- First estimation by Manivasagam available
- This estimation corrresponds well with the authentic data compiled for the financial year April 2004 to March 2005 provided by Jerry/Manivasagam

Step-specific measures

Operating

- More or less state-of-the-art machinery
- Electricity production by wind mills located on the PREM premises (Spinning and Knitting)

Planned or in implementation

- Additional wind mills (Spinning and Knitting)
- No further measures proposed because there is not much potential for improvements in energy efficiency any more.

315 Dyeing/Processing (PREM Group)

Description

- 2 units for dyeing of fabric and finishing: ~ 6t/day
- Heat production with firewood: steam with high pressure heats circulating water

PREM Data

- First estimation by Manivasagam available
- This estimation corrresponds well with the authentic data compiled for the financial year April 2004 to March 2005 provided by Jerry/Manivasagam
- Particularly lacking is data of used chemicals. Could be substantially relevant for CO_2 emissions. Currently neither authentic nor literature data could be found

Step-specific measures

Operating

- Salt recovery: not specific for reduction of energy use/CO_2 emission but utmost relevant in regard of the environment in general
- Preliminary water treatment to recover dyes as solid waste (cf. prior point)
- Heat recovery system

Planned or in implementation

- Steam generation with solar parabolic panels (forthcoming 2006)
- Energy saving by reduced water consumption (forthcoming 2006)

Options/ideas

- Electricity and heat cogeneration eg. with biomass gasifier
- Assure CO_2 neutrality of used biomass (firewood, rice husk, coconut shells etc.) by „in-fencing“ biomass supply

316 Confection (PREM Group)

Description

- 4 units for confection, i.e. garment making/T-shirt production, embroidery, printing, packing und dispatch
- Mainly electric power

PREM Data

- First estimation by Manivasagam available
- This estimation corrresponds well with the authentic data compiled for the financial year April 2004 to March 2005 provided by Jerry/Manivasagam

- Data for stitching thread, buttons, zips, tags are not available. It is as likely as not that this contribution is not relevant. It was therefore left out

Step-specific measures

Operating

- Nothing known to author

Planned or in implementation

- Nothing known to author

Options/ideas

- No measures proposed because there is not much potential for improvements in energy efficiency.

317 Transport India

Includes transport of cotton to Tiruppur as well as transport of T-Shirts from Tiruppur to the Indian port (Chennai or Tuticorin) for shipping for Europe. A possible measure could be to hire freight forwarders using Biodiesel as a fuel in their trucks. It is doubtful whether this is a realistic idea in the given context.

318 Transport India-Switzerland (Switcher)

The contribution of this value chain step is not particulary big even with all flights of management between both countries included.

Nevertheless from a marketing point of view a compensation of the CO_2 emission of the flight would produce a nice story most notably if the compensation is directly related to a respective project in Tiruppur.

319 Switcher premises

Data of the energy consumption of headquarter, warehouse and shops is not available. Compared to the overall CO_2 emission of the T-Shirt production it might not be relevant. However it applies the same as for the flights: direct linked compensation would be a nice story: Full and credible compensation of "homemade" emissions with highest impact on sustainable development. It would also allow to communicate that already operating measures like the solar panels on the roof of the warehouse or abdication of air conditioning in the warehouse.

32 Options for CO_2-compensation projects (out-fence)

As a result of the preliminary study and the various investigations and site visits in India it became obvious that there are two particular projects or initiatives that would contribute most to CO_2 emission reduction and are closely related to the Switcher/PREM T-Shirt value chain:

- **Drip irrigation** in cotton farming would reduce water and therefore energy consumption related to cotton cultivation and goes inline with substantial

positive impacts for environment (saving water), economy (reducing cost of cotton cultivation) and society (capacity building and knowledge transfer).

- **Sustainable biomass production** for steam production in the dyeing/finishing step would halve the CO_2 emission of the T-Shirt production, contribute to a ecologically sound utilisation of the abundant local biomass and offer various opportunites for local people for small business and employement.

Other compensation projects e.g. generally related to the livelihood of the workers of PREM or to the benefit of Tiruppur in general are possible but need additional clarification effort on site.

33 Detailled CO_2 emission balance sheet

331 CO_2-emission balance sheet of SWITCHER/PREM T-Shirt

Value chain step	Energy Type	unit	annual total	per T-Shirt	Emissionfactor kg CO_2 per unit	CO_2-emission of one T-Shirt (g)	Remarks
Upstream to PREM/Switcher					**Total:**	**994**	
1. Farming						**195**	**Data source Ökoinstitut/D Assumption: Mainly manual farming**
2. Ginning						**800**	**Data source Ökoinstitut/D Assumption: Mainly manual farming**
PREM-Group					**Total:**	**4'089**	
3. Spinning	**Annual Production:**		1'639'014	Yarn [kg]	**Total:**	**613**	
	Power	MWh	5'603	1.14	0.51	586	Authentic data 2004
	Diesel	litre	44'166	0.01	0.27	2	"
	Petrol	litre	21'730	0.00	0.25	1	"
	Packing	kg	45'170	0.01	0.87	24	"
4. Knitting	**Annual Production:**		1'073'763	Cloth [kg]	**Total:**	**91**	
	Power	MWh	564	0.17	0.51	90	Authentic data 2004
	Diesel	litre	9'600	0.00	0.27	1	
5. Dyeing/Processing	**Annual Production:**		1'227'004	Cloth [kg]	**Total:**	**3'209**	
	Power	MWh	2'064	0.56	0.51	288	Authentic data 2004
	Diesel	litre	21'325	0.01	0.27	53	"
	Petrol	litre	37'349	0.01	0.25	82	"
	Firewood	kg	5'782'620	1.57	1.64	2'576	"
	Packing	kg	5'142	0.08	0.87	209	Authentic data 2004
6. Confection	**Annual Production:**		3'805'196	Garment [piec	**Total:**	**63**	
	Power	MWh	191	0.05	0.51	26	Authentic data 2004
	Diesel	litre	6'098	0.00	0.27	0	"
	Packing	kg	162'180	0.04	0.87	37	"
7. Transport					**Total:**	**113**	
Cotton delievery	Distance	km	1'500	0.5 t cotton	0.11/Tonne-km	75	Estimation, ok since not decisive
T-Shirt to port	Distance	km	1'500		0.11/Tonne-km	38	Estimation, ok since not decisive
Switcher					**Total:**	**85**	
8. Transport						**75**	
Shipping from India	Distance	km	10'360		0.015/Tonne-km	39	Estimation, ok since not decisive
Port to Switcher	Distance	km	500		0.11/Tonne-km	13	Estimation, ok since not decisive
Switcher to Customer	Petrol	litre	40'000	0.01	0.25	2	Estimation, ok since not decisive
Overhead travelling (25 flights India-CH)	Distance	km	8'000		5'400/flight	34	Estimation, ok since not decisive Authentic data preferable, nice story for compensation, e.g. Compensation of flights via GS-VER
9. Switcher premises						**10**	Estimation, ok since not decisive Authentic data preferable, nice story for compensation, e.g. Compensation of all emissions attributed to Switcher, Swiitzerland via GS-VER
Total CO_2-emission of T-Shirt production per T-Shirt [g]:						**5'169**	

332 Emission reduction measures SWITCHER/PREM (implemented and planned)

Value chain step	Energy Type	unit	annual total	per T-Shirt	Reduction %	CO_2-emission of one T-Shirt (g)	Remarks
Existing/commissioned Measures by 2005					**Total:**	**1'687**	
Stepwise Measures					**Total:**	**0**	
None						0	
Overall Measures					**Total:**	**1'687**	
15 Wind mills for power generation	Power	MWh	13'125	3.28	0.51	1'687	Fuel Switch, implemented
Remaining reduction per T-Shirt including implemented measures:						**3'482**	
Planned Measures					**Total:**	**1'028**	
Stepwise Measures					**Total:**	**450**	
Decreased water consumption	Power				13%	37	Dyeing, Energy Efficiency
Decreased water consumption	Firewood				13%	335	Dyeing, Energy Efficiency
Solar steam generation	Firewood				3%	77	Dyeing, Fuel Switch
Overall Measures					**Total:**	**578**	
Additional wind mills	Power	MWh	4'500	1.13	0.51	578	
Remaining reduction per T-Shirt including planned measures:						**2'453**	

333 Overview and Modell

Number of T-Shirts [Mio.]:	**4**	**CO_2-Emission**	**Neutralisation**	**Cost of Neutralisation:**
sfr/tonne CO_2 (GS-CER):	20	of one T-Shirt (g)	sfr/T-Shirt	sfr
Current emission from T-Shirt production		5'169	0.10	413'488
Currently implemented measures (stepwise/overall)		1'687	0.03	134'961
Current net CO_2 emission to be neutralised		3'482	**0.07**	**278'527**
CO_2 emission reduction due to planned measures		-1'028	-0.02	-82'248
Remaining reduction per T-Shirt including planned measures:		2'453	**0.05**	**196'279**

334 Exemplification

With a CO_2 emission of approx. 5 kg one can:

- drive 30 km with a medium-sized vehicle
- enjoy the light of a 60W-bulb for one week
- take 5 showers of 10 minutes
- fly 27 km in short distance fligh