

## Attitudes and Behaviour of German Homebuyers towards Sustainable Housing - A stated Preferences Approach

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## Problem under investigation - Solutions?

Ex. (1): High Land Consumption



Ex. (2): CO2 Emissions through Buildings (Germany, 2004)

Priv. Households Real Estate		Industry Real Estate	
Heating	129	Heating	54
Warm Water	23	Warm Water	13
		Cooling / Air Cond.	17
Light	6	Light	13
Electronics	48	Process Energy	20
Else	2	Machinery	16
<b>Total</b>	<b>208</b>	<b>Total</b>	<b>133</b>

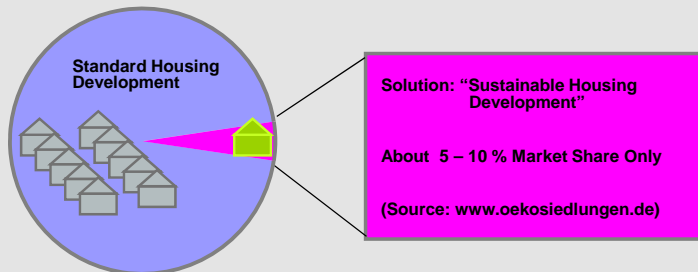


Quelle: McKinsey&Company, 2007; Institut der deutschen Wirtschaft Köln, 2008 (numbers in thousand tons)

Focus of investigation – Situation

Ex. (1): Housing Investment Structure in Germany

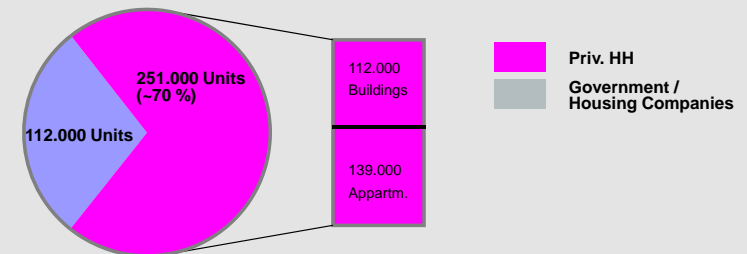
Market Share of Sustainable New Housing Developments  
(Germany 2005)



Focus of investigation – Situation

Ex. (2): Housing Investment Structure

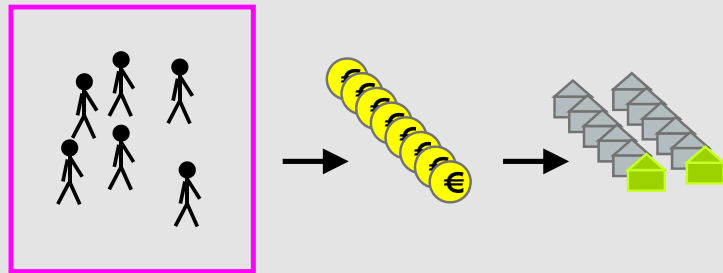
Structure of Investments in Housing: 353.000 New Housing Units  
(Germany 2005)



Private Households are the main investors into housing development

### Research Approach

#### Housing Investment Structure in Germany



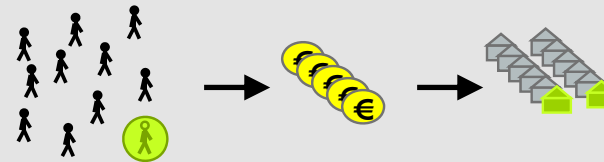
Private Households are the main investors into housing development:

"The pattern of urban development is the result of numerous individual decisions."  
(T. Sieverts: "Die Zwischenstadt"; 2005)

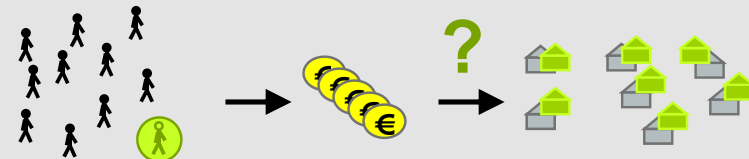
### Research Approach

Hypotheses (1):  
Low "Green Housing" (Supply) reflects "Green Thinking" (Demand)

(vgl. Fuchs, O. und Schleifnecker, T.; 2001)



Hypotheses (2):  
More "Green Housing" (Supply) although low "Green Thinking" (Demand)



?? "Appropriate Mix of Sustainable and Standard Housing Concepts ??

## Housing Development - Operational Definition

Attributes of the empirical model: Representation in a CAD film sequence/detail screen sequence		
Attribute	Characteristics	Design of the visualisation in the questionnaire
(1) Density	1. High 2. Medium 3. Low	→ 43 sites in total (GS)* 1. Approx 80% RH and DH; 10% GW 2. Approx 40% RH and DH; 40% EFH 3. Approx 60% dense EFH; 20% low density EFH; 20% DH
(2) Quality of green spaces	1. Good green spaces 2. Medium green spaces 3. Few green spaces	1. Quantitatively good green spaces (approx 1 GB/1 KB per GS)**; Green space concept: tree-lined avenues on both sides of main roads. 2. Good green spaces (approx 1 GB/1 KB per GS); but no green space concept 3. Only single green spaces, no green space concept
(3) Centre	1. None 2. Centre 3. Centre with function	1. Centre GS is built on, no design of space (no centre) 2. Design of centre as a space with hedgerows, 1 GB, 1 KB, benches. 3. Design of centre as space with shops, hedgerows, 1 GB, 1 KB, benches.
(4) Internal infrastructure provision	1. Streets for cars 2. Traffic-calmed infrastructure	1. Streets for cars throughout development, garages directly at buildings 2. 3 communal parking lots (→ car parking space nearer than 50m); 3 streets with pedestrian paths, adjoining buildings without garages, 20 parking spaces per communal parking lot.
Attributes of the empirical model: Textual representation		
Attribute	Characteristics	Textual representation in the questionnaire
(5) Distance to local transportation	1. Bad frequency 2. Medium frequency 3. High frequency	1. The housing development does not have a good connection to local transportation (connections only 3 times a day) 2. The housing development is relatively well connected to local transportation (connections 5 - 6 times a day) 3. The housing development has very good connections to local transportation (connections 7 - 9 times a day)
(6) Technical installations for resource protection	1. No installations 2. Technical installations	1. The housing development has no technical installations for the protection of resources. 2. The housing development has various technical installations for the protection of resources (e.g. solar panels)
(7) Representation of social classes	1. No differentiation in housing on offer 2. Good differentiation in housing on offer	1. Housing development B has a very uniform population structure (e.g. regarding income and age of the residents) 2. Housing development A has a mixed population structure (e.g. regarding income and age of the residents) 3.
(8) Costs (The costs are represented as relative values compared to the other alternatives)	1. Comparable building costs 2. 10% higher building costs 3. 10% lower building costs	1. Housing development A costs the same as housing development B. 2. Housing development A costs 10% more than housing development B. 3. Housing development B costs 10% less than housing development A.

Key:  
\* GS = Site; GW = Block of flats; RH = Row/Terraced house; DH = Semi-detached house; EFH=Detached house \*\* GB = Large tree; KB = Small tree

## The Internet Questionnaire: Housing Model (example)



### Visualisation

- Density (low)
- Quality of green spaces (low)
- Internal transport development (streets)
- Centre (no centre)

### Rahmenbedingungen Siedlung A:

- (1) Siedlung A ist schlecht an den öffentlichen Nahverkehr angebunden (1 - 2 mal täglich).
- (2) Siedlung A verfügt über keine technischen Anlagen zum Ressourcenschutz (z.B. Solaranlagen).
- (3) Siedlung B besitzt eine sehr einheitliche Bevölkerungsstruktur (z.B. hinsichtlich Einkommen und Alter der Bewohner).
- (4) Siedlung A kostet 10% mehr als Siedlung B.

### Text:

- Frequency of local transportation (low)
- Technical installations for resource protection
- Representation of social classes
- Costs

## The Internet Questionnaire: Choice Based Conjoint

Bitte treffen Sie Ihre Auswahl so, als wären die dargestellten Alternativen auf jeder Seite die Einzigen, die Ihnen zur Wahl stehen!

### Siedlung A

Bitte beachten Sie bei der Planung:

- Die Anzahl der Häuser
- Die Grünanlagen
- Die Art der Freizeitanlagen
- Das Zentrum

**Radioalternativen Siedlung A**

- (1) Siedlung A ist schöner, so das öffentliche Nahverkehrsmittel schneller (1 = fast täglich)
- (2) Siedlung A verfügt über hochwertigere Anlagen aus Kunststoff (z.B. Spielplatz)
- (3) Siedlung A besitzt eine sehr reichhaltige Freizeitanlagen (z.B. heimische Exkursions auf über 400 Hektar)
- (4) Siedlung A besitzt 10% mehr als Siedlung B.

### Siedlung B

Bitte beachten Sie bei der Planung:

- Die Anzahl der Häuser
- Die Grünanlagen
- Die Art der Freizeitanlagen
- Das Zentrum

**Radioalternativen Siedlung B**

- (1) Siedlung B ist sehr gut an das öffentliche Nahverkehrsmittel angeschlossen (1 = fast täglich)
- (2) Siedlung B verfügt über qualitativ hochwertige Anlagen aus Kunststoff (z.B. Spielplatz)
- (3) Siedlung B besitzt eine abwechslungsreiche Freizeitanlagen (z.B. heimische Exkursions auf über 400 Hektar)
- (4) Siedlung B besitzt 10% weniger als Siedlung A.

Welcher Siedlung bevorzugen Sie?

"Ich bevorzuge Siedlung A"	"Ich halte beide die beiden Alternativen für gleich"	"Ich bevorzuge Siedlung B"
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Weiter >>**

## (1) Method: Research on Choice – The Discrete Choice Experiment

- Multivariate problem → Interviewee makes choices between alternatives

- Construction (probabilistic) :  $U_i = V_i + \epsilon_i$

$$\text{Prob (j chosen)} = \text{prob} (V_i + \epsilon_i > V_j + \epsilon_j; \forall j \in C)$$

(1) U: Utility

(2) V: Vector of attributes

(3) e: Error: (probabilistic element)

(4) Analysis: *Discrete Choice Models*

(5) Output: Part worth utilities for each attribute

- Attributes of „Sustainable New Town Planning“:

- Density of the planning solution
- Quality of the green
- Central place/shopping facilities
- development (motor vehicles/assembly parking)
- Frequency of public transport
- Sustainable technical solutions
- Social structure of the inhabitants
- Costs of the planning solution

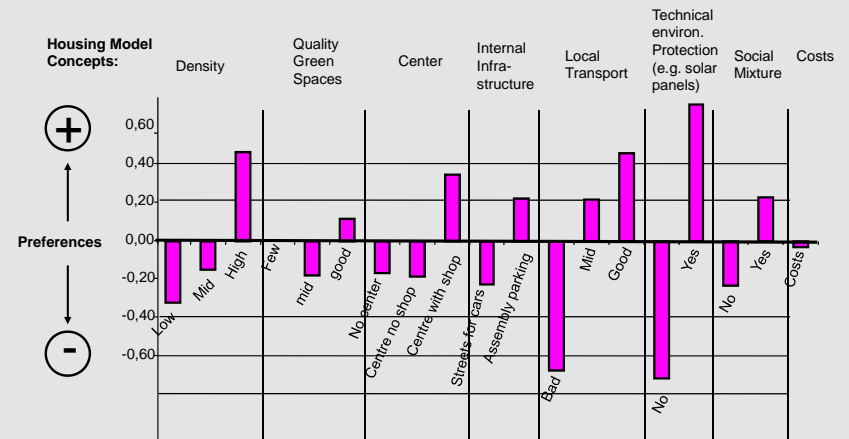
### (1) Choice Model Results:

Latent Gold Choice Output

Multinomial Model Results (n=402):											
Class Size	Model for all respondents		Model for segmentation: Environmental Awareness								
	coeff.	s.e.	z-value	low environmental awareness	high environmental awareness	t-comp.					
<b>attributes</b>	<b>coeff.</b>	<b>s.e.</b>	<b>z-value</b>	<b>0.818</b>	<b>0.193</b>						
density	low	0.17	0.06	2.79	0.25	0.07	3.43	-0.59	0.83	-0.71	1.00
	mid	-0.06	0.06	-0.88	-0.03	0.07	-0.39	-0.27	0.40	-0.67	0.59
	high	-0.11	0.06	-1.82	-0.22	0.07	-2.98	0.86	0.66	1.29	-1.61
quality of green	poor	-0.13	0.06	-1.99	-0.16	0.08	-2.13	0.11	0.34	0.52	-0.78
	mid	-0.02	0.06	-0.30	-0.03	0.07	-0.43	-0.33	0.51	-0.64	0.57
	high	0.15	0.06	2.57	0.19	0.07	2.76	0.22	0.46	0.48	-0.06
centre	no centre	-0.07	0.06	-1.09	-0.06	0.07	-0.77	-0.31	0.31	-0.99	0.79
	centre - no shop	-0.03	0.06	-0.44	0.01	0.07	0.18	-0.34	0.46	-0.76	0.77
	centre with shop	0.09	0.06	1.30	0.04	0.08	0.54	0.63	0.43	1.52	-1.40
development	motor vehicle development	0.12	0.04	3.10	0.17	0.05	3.28	-0.42	0.37	-1.13	1.57
	assembly parking	-0.12	0.04	-3.10	-0.17	0.05	-3.28	0.42	0.37	1.13	-1.57
Public transport	low frequency	-0.90	0.07	-13.00	-0.91	0.08	-11.28	-1.25	0.58	-2.15	0.59
	mid frequency	0.35	0.06	5.90	0.36	0.07	5.17	0.40	0.34	1.19	-0.12
	high frequency	0.35	0.06	9.24	0.55	0.07	7.42	0.83	0.39	2.19	-0.77
technical solutions	no technical solutions	-0.30	0.04	-11.50	-0.44	0.06	-7.89	-1.33	0.50	-2.66	-1.78
	technical solutions	0.30	0.04	11.50	0.44	0.06	7.89	1.33	0.50	2.66	1.78
social structure	No mixed social structure	-0.16	0.04	-3.84	-0.14	0.05	-2.93	-0.43	0.24	-1.83	1.20
	mixed social structure	0.16	0.04	3.84	0.14	0.05	2.93	0.43	0.24	1.83	-1.20
costs	low costs linear	-0.09	0.05	-1.85	-0.10	0.06	-1.82	-0.05	0.26	-0.20	-0.20
	none alternative A or B chosen	0.22	0.04	5.86	0.63	0.11	5.55	-0.99	0.46	-2.13	3.39
	Alternative N/A chosen	-0.22	0.04	-5.86	-0.63	0.11	-5.55	0.99	0.46	2.13	-3.39
<b>Model for Choices</b>											
	Intercept				0.76	0.22	3.51	-0.76	0.22	-3.51	4.96
<b>Covariates</b>											
	HK_Econ				-0.26	0.11	-2.48	0.26	0.11	2.48	-3.51

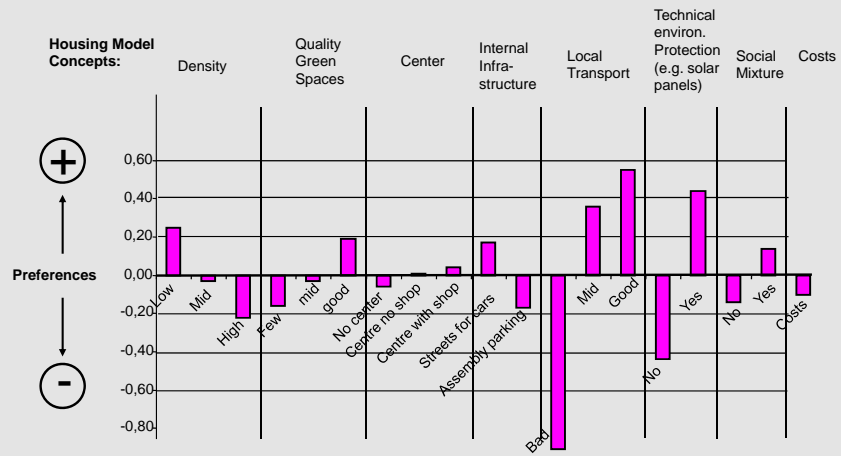
### (1) Findings:

"Environmentalists": 20 % of sample

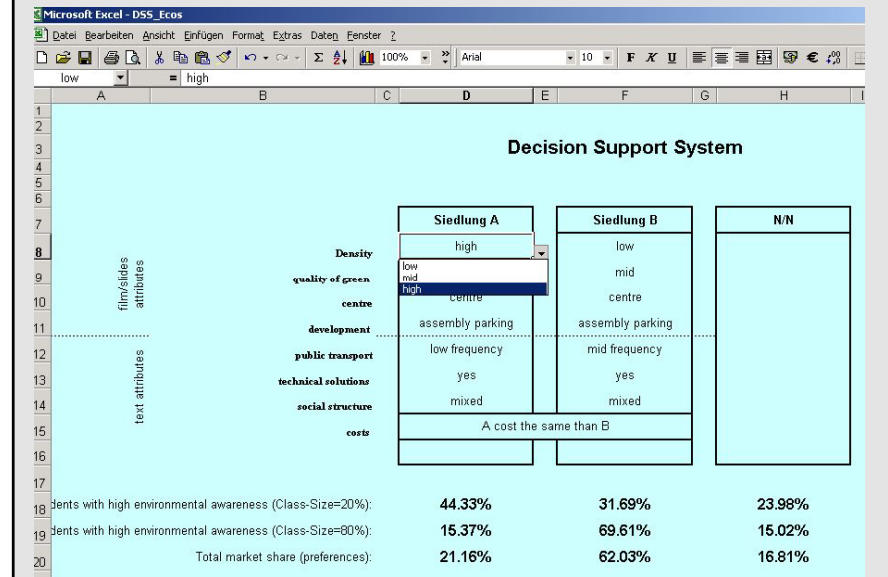


## (2) Findings:

"Non - Environmentalists": 80 % of sample



## (3) Findings: DSS based on Chocie Model Results



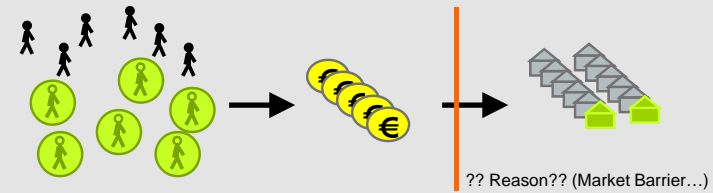
Under which circumstances would private households accept to live in a higher density built environment?

attributes	Status Quo	Scenario 1: „Higher Density“	Scenario 2: „Higher Density and higher quality of greens“	Scenario 3: „Higher density, higher quality of greens and centre with shop.“
density	low density	high density	high density	high density
quality of green	low quality of green	low quality of green	high quality of green	high quality of green
centre	no centre	no centre	no centre	centre with shop
development	motor vehicle developm.	assembly parking	assembly parking	assembly parking
public transport	low frequency	high frequency	high frequency	high frequency
technical solutions	no	yes	yes	yes
social structure	not mixed	not mixed	mixed	mixed
Costs	higher costs than scenario B	lower costs than SQ	lower costs than SQ	lower costs than SQ
Marktanteile:		SQ Sc. 1 N/N	SQ Sc. 2 N/N	SQ Sc. 3 N/N
„respondents with high environmental awareness“:		3% 91% 6%	3% 92% 5%	1% 97% 2%
„respondents with low environmental awareness“:		51% 28% 11%	41% 47% 9%	42% 49% 9%
Total:		41% 49% 10%	36% 55% 9%	34% 59% 7%

→ Design of sustainable town planning - AND - maintain high acceptance

(1) Conclusion

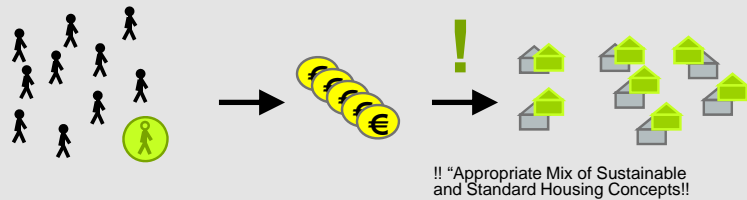
Conclusion (1): “Green Thinking” (Demand) not reflected by “Green Building (Supply)



20 %sample size instead of 5 % market share!

## (2) Conclusion

Conclusion (2): Even “Non-Environmentalists” would accept to live in higher density built environments – provided the “right” mix of planning concepts



## (3) Conclusion

1 Support local planning authorities with information on demand side (latent demand)

2 Traditional regulative planning tools (regional planning, communal master planning) do not react easily to societal trends → trad. Instruments should be expanded to include social sciences methods to develop strategies

3 Support Real Estate developers with information on demand side (latent demand)

4 Green spaces and social infrastructure are crucial elements for less (land-)consumptive housing developments → employ landscape planners and urban planners (interdisciplinary)

5 KfW loans to be readjusted (again) → growing demand

6 Apply more instruments to reduce land consumption, e.g. mandatory obligation to compensate for environmental impact (federal German building code) → instruments of nature conservation to reduce land consumption in housing (significant effects in Bavaria)