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Efficiency Optimization of a Real Settlement

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The aim of the investigation:

- a real community of Dornbirn in Vorarlberg, Austria,
- How can we make a successful future urban development,
- how should we make building layouts for a efficient future community?

blue line: investigated area
green line: green area





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Dornbirn in Vorarlberg, Austria,

- various factors were investigated and their effects analyzed
- “Energy Certification of Communities” software (co-developed and provided by the Lower Austrian Land Government, Department of Spatial Planning and Regional Policy)
- costs in Euro per living unit and year
- effects of developments on the CO₂ emission, affected by traffic



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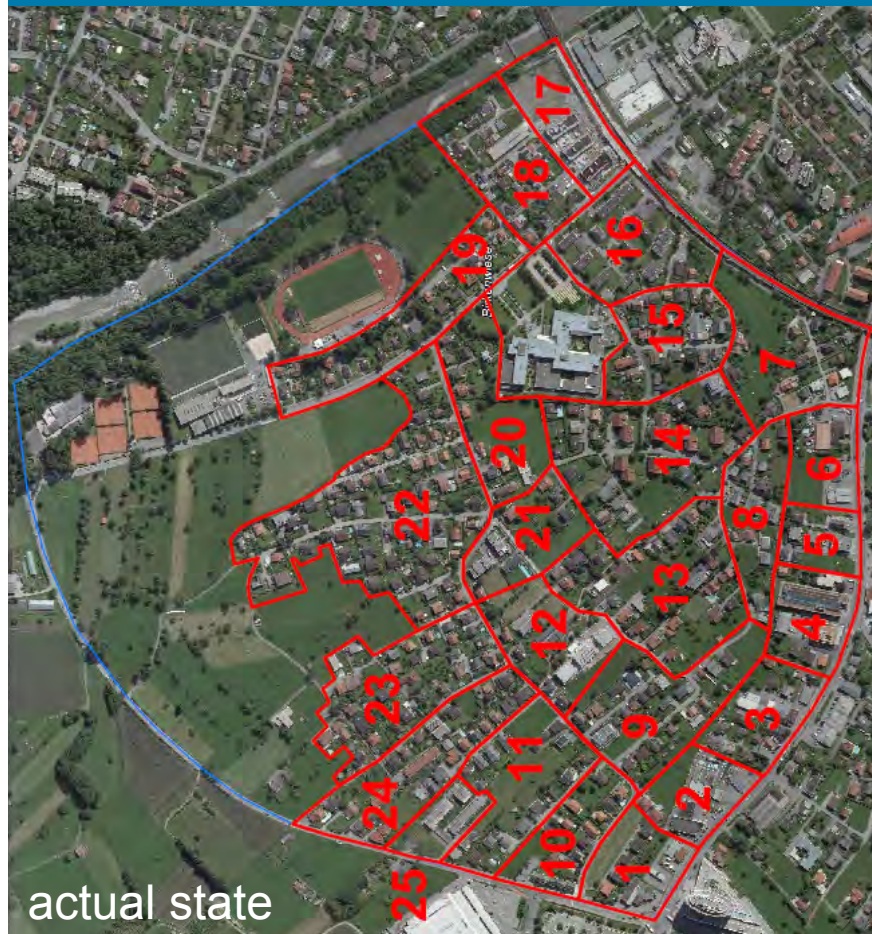
Following points are included in the calculations:

- Partial areas – (Land areas and living units: same topography, not separated by streets, rivers, ways...)
- Developmental costs (interior costs: length of the pipeline for supply and disposal, exterior costs: traffic development, water supply, waste/rain water management, street lighting, gas pipeline and also local and district heating system)
- Quality of open spaces (every subarea gets its own evaluation: recreational areas, noise source...)
- Connectivity and transportation (distance to town center, local supplies, kindergarten and primary schools)
- Locations and buildings (topography and buildings types)

The region has a total area of 828,630.18 m²

transport routes have a total length of ca. 9,045.24 m with an average width of 6 m

Subareas: number, area and the living units



Number	area [m ²]	LU	number	area [m ²]	LU
1	13,558.53	5	14	38,754.16	32
2	12,286.44	4	15	19,711.56	19
3	14,385.85	12	16	24,115.90	35
4	13,385.73	8	17	16,174.01	30
5	8,614.08	7	18	23,471.45	22
6	11,672.08	2	19	26,665.13	25
7	28,001.01	14	20	20,926.58	16
8	15,859.10	35	21	15,655.63	15
9	27,376.71	27	22	57,638.62	61
10	14,918.31	16	23	28,490.56	36
11	23,707.36	20	24	25,471.53	28
12	18,226.37	15	25	7,564.69	18
13	34,625.68	37			

Energy pass of the actual state

Bewertung

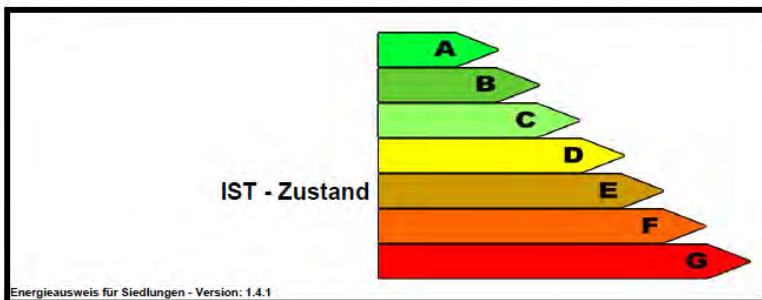
Gemeinde:	Dornbirn		
Katastralgemeinde:	Dornbirn		
Projektname:	IST - Zustand		
Erschließungskosten je WE / Jahr*	2.223,45 €	G	0,40
CO ₂ -Emission Verkehr / WE / Jahr**	0,26 t	D	0,25
Qualität der Lage und Bebauung (Faktor)	2,86	B	0,35
Freiraumqualität (fließt nur in Wochenend-Verkehr ein)		C	0,00
Klassifizierung		E	1,00

* Mittelwert; Lebensdauer des Hauses = 100 Jahre

** Fahrten zum Arbeitsplatz nicht berücksichtigt

*** CO₂-Ausstoß wenn die gesamten Baulandreserven in Niederösterreich mit den Kennzahlen des vorliegenden Projekts bebaut werden

**** Mehrkosten auf NÖ Gesamt im Gegensatz zur Bebauung der gesamten Baulandreserven mit den Kennzahlen der Mustersiedlung



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Ausgestellt durch: Breu Raphaela

am 10.04.2013

Weighs:

-0.40

-0.25

-0.35

rating of the energy efficiency class regarding to development is “**G**”, (lowest level in the rating system).

sum of CO₂ emission of traffic/LU/year of 0.26 t /LU/year: is rated of “**D**” level.

quality of location and development: rated of “**B**” level

regarding to quality of open space: is rated “**C**” (existence of private green spaces and low source of noise within 150 m)

actual state in class “**E**”



Alternative 1:

two new subareas:

- 1) with 17,886.89 m² and 16 LU
- 2) with 27,969.23 m² and 28 LU are added

new building areas need connection to the transport system - construction of a new street (length 567 m).

100,000 m² of reserve housing area
reducing the reserve housing area to ca.
57,000 m²

alternative 1 in class “C”

Bewertung

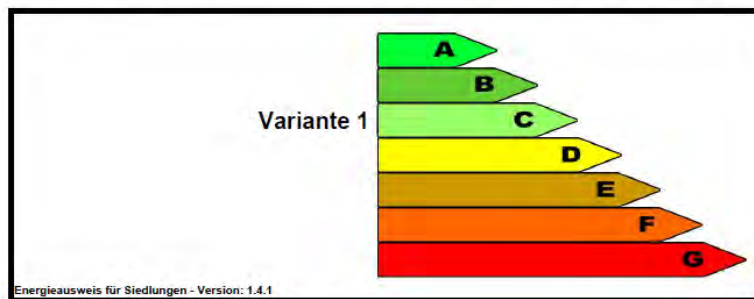
Gemeinde:	Dornbirn		
Katastralgemeinde:	Dornbirn		
Projektname:	Variante 1	Bewertung	Ge- wicht- ung
Erschließungskosten je WE / Jahr*	645,02 €	D	0,40
CO ₂ -Emission Verkehr / WE / Jahr**	0,25 t	D	0,25
Qualität der Lage und Bebauung (Faktor)	2,79	B	0,35
Freiraumqualität (fließt nur in Wochenend-Verkehr ein)		C	0,00
Klassifizierung		C	1,00

* Mittelwert; Lebensdauer des Hauses = 100 Jahre

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*** CO₂-Ausstoß wenn die gesamten Baulandreserven in Niederösterreich mit den Kennzahlen des vorliegenden Projekts bebaut werden

**** Mehrkosten auf NÖ Gesamt im Gegensatz zur Bebauung der gesamten Baulandreserven mit den Kennzahlen der Mustersiedlung



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there is still a green area and an ideal expansion of the housing state (no modification in the cityscape)

small increase of living units has no influence on the improvement of the energy level of the development

539 → 583 living units

constant growth of population - calculated with a triple expansion

development costs decreases per LU from 88,376 to 25,000 euro/year: energy efficiency increases and is now at the “D” level

Energy pass of alternative 2

build a central school or shopping center

Alternative 2:

change the CO₂ emission and the quality of location and development

Bewertung

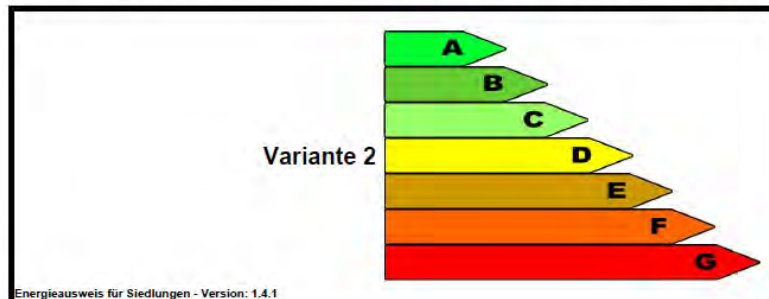
Gemeinde:	Dornbirn		
Katastralgemeinde:	Dornbirn		
Projektname:	Variante 2	Bewertung	Ge- wicht- ung
Erschließungskosten je WE / Jahr*	2.223,45 €	G	0,40
CO ₂ -Emission Verkehr / WE / Jahr**	0,08 t	B	0,25
Qualität der Lage und Bebauung (Faktor)	2,86	B	0,35
Freiraumqualität (fließt nur in Wochenend-Verkehr ein)		C	0,00
Klassifizierung		D	1,00

* Mittelwert; Lebensdauer des Hauses = 100 Jahre

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**** Mehrkosten auf NÖ Gesamt im Gegensatz zur Bebauung der gesamten Baulandreserven mit den Kennzahlen der Mustersiedlung



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following factors can be changed, including length of different subareas

Weekday:

- To town center
- To closest local supply
- To playground/green area
- To kindergarten
- To primary school
- To closest public transport station

Saturday, Sunday and holiday:

- To green area > 1500 m²
- To recreational or cultural facility
- To sports area or playground > 500 m²



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almost every subarea is at
least 1500 m away from the
city center,
a reduction of 500m is
assumed.

local supply are ca.1500 m
away.
better results could be
achieved through making sure
they are only 1000 m



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Conclusion:

- different variants were analyzed
- Initially, the existing green spaces would be partly removed to reduce the developmental costs.
- Another factor is to build a central school or shopping center. In this case, the individual transportation routes would be shorter and the CO₂ emissions would decrease.

Other variants were also investigated and evaluated.

Results show that energy efficiency can be improved by all of this variants, but more than two efficiency levels cannot be achieved.



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Thank you for your attention!

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