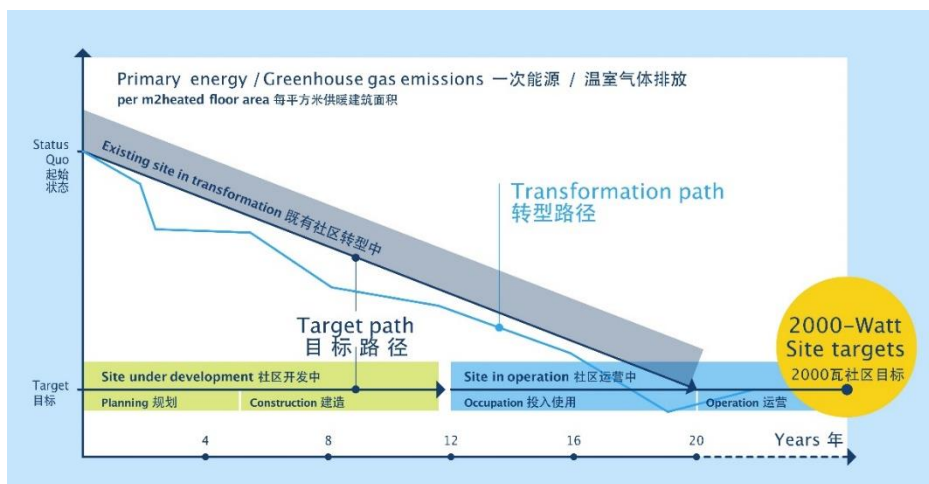


ZERO EMISSION BUILDINGS IN CHINA

A Sino-Swiss Collaboration for Climate Responsive Building and District Development

中国零碳建筑

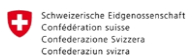
中瑞合作促进气候适应性建筑和社区发展



Zero Emission Districts (ZED) and the 2000-Watt-Certificate

零碳社区及瑞士 2000 瓦社区认证

A project financed by



Implemented by





First certified 2000-Watt-Site called “Erlenmatt West” in Basel, Switzerland. It is build on a former freight rail terminal and consists of a good mix of uses, but mainly dwellings, a strong community and a green outer space.

“埃伦马特西区”位于瑞士巴塞尔，是首个获得 2000 瓦社区认证的项目。它建设在前铁路货运枢纽站上，社区为混合功能，以居住建筑为主，同时拥有宽敞的社区和绿色户外空间。

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版本 1.0

Zero Emission Districts (ZED) and the 2000-Watt-Certificate

零碳社区及瑞士 2000 瓦社区认证
瑞士，苏黎世

Zurich, Switzerland

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A project financed by the Swiss Agency for Development and Cooperation (SDC) and the Chinese Ministry of Housing and Urban-Rural Development (MoHURD) and implemented by intep and Skat.

本项目由瑞士发展与合作署（简称 SDC，瑞士联邦外交部下属机构）与中华人民共和国住房和城乡建设部共同支持和资助，由 intep 和 Skat 联合团队共同实施

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01

2000-Watt-District Certificate in Switzerland

2000-Watt Society

The Vision

The 2000-watt society is an environmental vision, first introduced in 1998 by the Swiss Federal Institute of Technology in Zürich (ETH Zurich), which pictures the average first-world citizen reducing/increasing their overall average primary energy usage rate to no more than 2'000 watts (i.e., 2 kWh per capita per hour or 48 kWh per day) by the year 2050, without lowering their standard of living. The concept addresses not only personal or household energy use, but the total for the whole society, including embodied energy, divided by the population.

Two thousand watts is approximately the current world average rate of total primary energy use. This compares to averages of around 6'000 watts in western Europe, 9'000 watts in the United States, 3'000 watts in China, less than 1'000 watts in India and in Africa and only 300 watts in Bangladesh in 2021. Switzerland itself, currently

using an average of around 4'000 watts, was last a 2000-watt society in the 1960s.

The vision was developed in response to concerns about climate change, energy security, and the future availability of energy supplies. It is supported by the Swiss Federal Office of Energy, the Association of Swiss Architects and Engineers, and other bodies.

The Guiding Concept

The guiding concept for the 2000-watt-society from 2021 is primarily intended to provide cities and municipalities, but also other sectors and actors, with a uniform orientation aid for taking national and international energy and climate targets into account.

The aim is to methodically standardize the quantitative approach to these various energy and climate policy objectives.

At the same time, an awareness of their congruence and convergence is to be achieved to generate strength in implementation and maximum impact via the common target definition.

The guiding concept has three main objectives:

瑞士 2000 瓦社区认证

2000 瓦社会

愿景

2000 瓦社会是瑞士苏黎世联邦理工学院（ETH Zurich）于 1998 年首次提出的环境愿景，它描绘了普通公民在不降低生活水平的前提下，到 2050 年将其总体平均一次能源消耗量减少/增加到不超过 2000 瓦（即每人每小时 2 千瓦时或每天 48 千瓦时）。

这个概念不仅涉及到个人或家庭的能源使用，而且涉及到整个社会的能源消耗总量，包括隐含能源，并以人均一次能源消耗量进行评估。

目前全球人均一次能源消耗量约为 2000 瓦。相比之下，2021 年，西欧的平均数约为 6000 瓦，美国为 9000 瓦，中国为 3000 瓦，印度和非洲不到 1000 瓦，孟加拉国只有 300 瓦。瑞士在 20 世纪 60 年代曾是一个 2000 瓦的社会，目前平均一次能源消耗量约为 4000 瓦。

愿景的制定是为了回应对气候变化、能源安全和未来能源供应的关注。它得到了瑞士联邦能源办公室、瑞士建筑师和工程师协会（SIA）以及其他机构的支持。

指导性方案

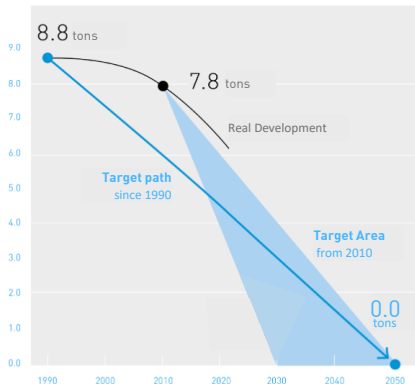
从 2021 年开始 2000 瓦社会的指导方案主要是为城市和市政当局，以及其他部门和管理者提供一个统一的指导意见，同时考虑到国家和国际的能源和气候目标。

其目的是有条不紊地将这些不同的能源和气候政策目标的量化方法进行标准化。

与此同时，要认识到它们的一致性和统一性，以便通过共同的目标定义在实践中发挥作用，并产生最大的影响。

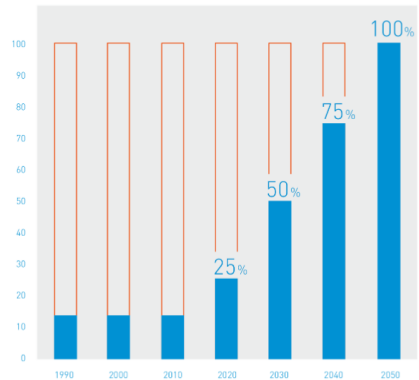
这个指导性方案有三个主要目标:

1. Reduction of the primary energy from today around 4'000 Watt per capita (black line) down to 3'000 Watt by 2030 and 2'000 Watt per capita by 2050. This can only be reached by increasing the energy efficiency. Switzerland is pretty much in line with the forecasted target path.



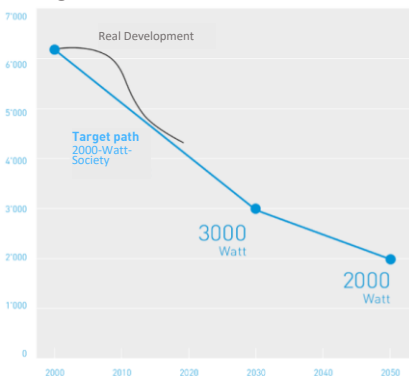
cop. 2000watt.ch

3. Increase of the amount of renewable energy in the Swiss energy supply mix. Energy from waste is counted as renewable energy.



cop. 2000watt.ch

2. Reduction of energy related GHG Emissions from today around 6.5 t per capita (black line) down to Zero latest in 2050. The longer we wait the steeper the target path gets.



cop. 2000watt.ch

Additionally, two more requirements are included in the guiding concept:

- A step-by-step reduction on consumption related GHG-Emissions. This includes mainly scope 3 products as for example building materials and products.
- Monitoring of the GHG Emissions, the primary energy, and the amount of renewable energy to supervise the success.

-
1. 将今天的一次能源消耗从人均 4000 瓦（黑色实线）减少到 2030 年的 3000 瓦，2050 年的 2000 瓦。这只能通过提高能源效率来实现。瑞士的实际情况与预测的目标路径基本一致。(见前页图示)
 2. 与能源有关的温室气体排放从现在的人均 6.5 吨左右（黑色实线）下降到 2050 年的近乎为零。我们采取行动的时间节点越晚，目标路径就越陡峻。(见前页图示)
 3. 增加瑞士能源供应结构中可再生能源的数量。这里，废弃物处理过程中获得的能源也被视为可再生能源。(见前页图示)

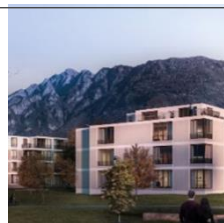
此外，指导性方案中还设置了两项附加要求：

- 逐步减少与消费有关的温室气体排放。这主要包括第 3 领域的产品，例如建筑材料和产品。
- 监测温室气体排放、一次能源和可再生能源的数量，以使其成功。

“我们采取行动的时间节点越晚，目标路径就越陡峻”

On the right: This district “Kleinbruggen” is just at the edge of the eastern part of the Alps.
右侧图例是阿尔卑斯山东部山脚下的一个社区。

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2000-Watt Building

Background

The 2000-Watt Society considers the total primary energy use and total greenhouse gas emissions from all consumption sectors in Switzerland. Based on these overall and per capita goals the Swiss Engineer and Architect association (SIA) has developed a standard called SIA Energy Efficiency Path (SIA Instruction Sheet 2040). Its aim is to create the best possible preconditions for achieving targets for the building sector; the course should be set in such a way that the structural development proceeds in big steps in the right direction. As the most important sector in Switzerland in terms of energy consumption, the building sector takes on a pioneering role here, showing that it is already possible to embark on the path towards the 2000-Watt Society today.

Target values

The target values were determined for the building categories Residential, Administration, School, Specialised Store, Food Store and Restaurant, proceeding from the assumption that the proportional share of total energy use represented by energy use in the building sector remains constant during the period from 2010 to 2050. For this purpose, the current status was determined for each building category and reduced to the target status in the year 2050 using the reduction factors from the targets of the 2000-Watt Society.

The target values are related to the energy reference surface; the consumption values in the 2000-Watt Society are related to a per capita reference. It's converted by means of standard surface per person.

In SIA Instruction Sheet 2040 it is assumed that the surface requirement per person remains constant during the period of validity of this technical specification. This simplification should be reviewed periodically. If the energy reference surface per person continues to increase in the

future, the target values will need to be tightened accordingly.

The target values correspond to the average acceptable demand for primary energy use or the greenhouse gas emissions in buildings in 2050, including location-dependent daily mobility from the inhabitants. It shows that individual building categories cannot fully achieve the reduction targets. However, for the building categories considered in the SIA Instruction Sheet 2040 (which comprises around 80 % of the total energy reference surface in Switzerland), the overall implementation is possible.

Project values

The project values are always calculated using the data normally available at the relevant stage of the project. During the preliminary study and preliminary project phases there exists a calculation aid that can be used to arrive at an initial estimate of non-renewable primary energy use and greenhouse gas emissions for construction, operation, and mobility. For later planning stages different energy simulation software are available and must be used.

Assessment

If buildings including one or several building categories have a lower project value than the target value for the indicators primary energy use and greenhouse gas emissions, they can be called 2000-Watt Buildings.

2000 瓦建筑

背景

2000 瓦社会考虑了瑞士所有消费领域的一次能源使用总量和温室气体排放总量。基于这些总体目标和人均目标，瑞士工程师和建筑师协会（SIA）制定了一个名为 SIA 能源效率路径的标准（SIA2040 指导手册）。其目的是为实现建筑领域的目标，创造尽可能好的先决条件；以这样的方式来设置目标，使建筑领域发展朝着正确的方向大步前进。作为瑞士最重要的能源消耗领域，建筑领域在这里发挥了先锋作用，表明今天已有可能踏上通往 2000 瓦社会的道路。

目标值

确定住宅、办公、学校、专卖店、食品店和餐馆等建筑类别的目标值时，假定建筑领域的能源使用比例在 2010 年至 2050 年间保持不变。为此，我们可以确定每个建筑类别的现状，并利用 2000 瓦社会目标的减少系数将其减少到 2050 年的目标状态。

目标值与能源参考基准有关；2000 瓦社会的消耗值与人均基准值有关。它是通过每人的基准值来转换的。在 SIA 2040 指导手册中，假定在本技术规范的有效期内，每人的需求量保持不变。

这种简化应定期审查。如果每人的能源基准值在未来继续增加，目标值将需要相应收紧。目标值对应于 2050 年建筑中一次能源使用的平均可接受需求或温室气体排放，包括居民与居住地有关的日常通勤。它表明，个别建筑类别不能完全实现减排目标。然而，对于 SIA2040 指导手册中考虑的建筑类别来说（占据瑞士建筑总能耗面积的 80%左右），整体目标是可行且可达的。

项目值

项目值使用项目相关阶段通常可用的数据来计算。在初步研究和项目初步设计阶段，有一种计算辅助工具，可以用来初步计算项目建造、运营和交通的不可再生一次能源使用和温室气体排放情况。在后续的规划阶段中，则必须使用各种不同的能源模拟软件。

评估

如果包括一个或几个建筑类别的建筑（群）的项目值低于一次能源使用和温室气体排放指标的目标值，就可以称为 2000 瓦建筑。

2000-Watt-District

Introduction

The 2000-Watt-District certificate builds on the SIA Energy Path of Efficiency (2000-Watt Buildings) and distinguishes settlement areas that can demonstrate sustainable use of re-sources for the construction of buildings, their operation and the mobility caused by their operation. The label is awarded by the Federal Office of Energy and can also only be used in operation. Regular performance reviews serve as quality assurance and support the process.

The main prerequisites for obtaining the certificate are that the owner has the power to act on behalf of the site and that the total floor area or property area is at least 10'000 m2.

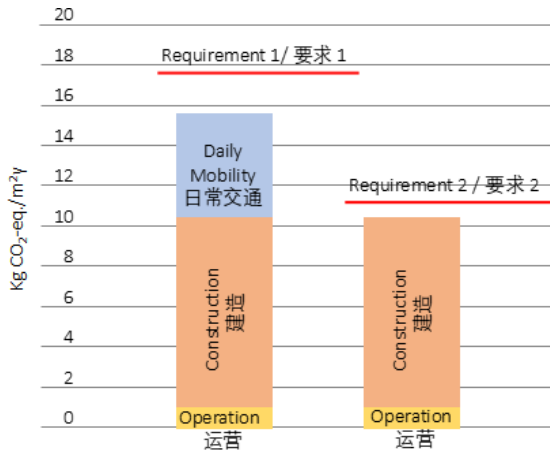
Until now, the 2000-Watt-District certificate was supported by the Swiss Federal Office of Energy. Due to a building label harmonization, the label will no longer be maintained from 2024. However, the concept will be retained and can also be applied to districts in the future.

Requirements

Quantitative Verification

The site target values and additional requirements for primary energy use and green-house gas emissions from the three areas of building construction, building operation and mobility are determined individually for each district according to the location and the building and mix of use using a standardised instrument ("Calculation Aid II"). Quantitative proof that the target values are met is provided in the operating phase with the effective, measured operating values and the surveyed mobility values.

This means, the goals are set, not the path which is very attractive for architects and planners as it gives great freedom.



Example of the results for greenhouse gas emissions

温室气体排放的结果示例

“定期的性能审查作为质量保证来支持这一评价过程”

On the right: A wooden multi storey building located in the “Freilager” Site in Zurich-West. One of the goals was to reduce the embodied carbon and energy from the building materials.

右图是位于苏黎世西部“Freilager”建筑用地内的多层木制建筑。该项目的目标之一是降低建筑材料的隐含能耗及其碳排放。

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2000 瓦社区

介绍

2000 瓦社区认证建立在 SIA 能源效率路径

（2000 瓦建筑）的基础上，并认证了那些能够证明其可持续利用资源于项目建设、运营和由运营建筑而引起的交通的居住区。该认证由瑞士联邦能源办公室授予，可以仅用于运营阶段。这里，定期的性能审查作为质量保证来支持这一评价过程。

获得该证书的主要前提条件是，业主有权代表该建筑用地行事，并且总建筑面积或地产面积至少为 10'000 平方米。

到目前为止，2000 瓦社区认证由瑞士联邦能源办公室管理。出于统一整合瑞士各个建筑认证体系，从 2024 年起该认证将停止颁发。然而，相关的思路和方法将被保留，并在未来将被应用于其他社区层面的认证中。

要求

定量验证

建筑在建造、运营和交通三个方面的一次能源使用和温室气体排放的现场目标值和额外要求，是根据每个建筑的位置和建筑类型以及功能的组合，使用标准化的工具（“计算辅助工具 II”）单独确定的。在运营阶段，需要用有效的、测量的运营值和调查的交通数据来提供满足目标值的定量证明。

这意味着定义目标而非路径，这对建筑师和规划师来说非常有吸引力，因为它给予了他们极大的设计自由。

Qualitative Assessment

For the qualitative assessment, there is a simplified catalogue of criteria with 6 thematic fields and a total of about 100 criteria. The six thematic fields are:

- Management
- Communication, Cooperation, and Participation
- Use of Site and Urban Development
- Supply and Disposal
- Buildings
- Mobility

In the qualitative assessment, at least 50% of the achievable number of points must be fulfilled per thematic field.

The catalogue of criteria is structured in such a way that the individual requirements of the site and the achievements and objectives of the responsible body can be considered and documented flexibly and as comprehensively as possible. The criteria catalogue ensures the comparison of different sites and individual measures. It is thus also to be understood as a collection of "best practice" solutions for sustainable site development.

Qualitative Criteria

The six thematic fields have the following focus/content:

- Management: The landowners must be organized very well, the district needs guiding principles, a monitoring needs to be put in place etc.
- Communication, Cooperation and Participation: It is important that during planning there is a good communication with the municipality, the neighbours, and the future users. After the district is build and in operation the communication will focus on the triangle between owner, facility manager and users as well as between the users.
- Use of site and urban development: The focus here is on a good mix of uses, a high-quality outdoor space with enough green and good shading, enough services as a café, a store, childcare etc. as well as a project competition which considers energy and climate issues.
- Supply and Disposal: This subject area focusses on the quality and regionality of the energy as well as water supply and waste disposal

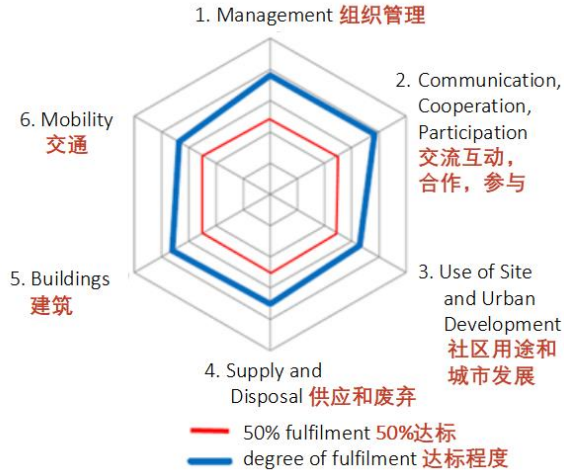


“As the most important sector in Switzerland in terms of energy consumption, the building sector takes on a pioneering role”
“作为瑞士最重要的能源消耗部门，建筑部门承担着先锋的角色”

On the right: District de l'Etang in the western part of Switzerland, close to the Airport of Geneva. It's one of the largest certified 2000-Watt districts with a very mixed use

左图是位于瑞士西部的伊藤社区，靠近热内瓦机场。它是 2000 瓦社区认证的面积最大的社区之一，同时也是一个功能混合程度很高的社区。

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Results of the qualitative assessment shown in a spider diagram

定性评估结果举例见蜘蛛网图

定性评估

对于定性评估，有一个简化的指标目录，它包括 6 个主题领域，共约 100 个指标。这六个主题领域分别是：

- 管理
- 沟通、合作和参与
- 社区定位和城市发展
- 供应和废弃
- 建筑物
- 交通

在定性评估中，每个主题领域必须至少取得该领域总分的 50%。

指标目录的结构可以尽可能灵活而全面地考虑和记录现场的单个要求以及负责机构要实现的成果和目标。同时，该指标目录也确保了对不同地点和单个措施的比较。因此，

它也可以被理解为可持续建筑用地开发的“最佳实践”解决方案的集合。

定性指标

这六个主题领域的重点/内容如下：

- 管理：土地所有者必须被很好地组织起来，该社区需要指导性原则，并建立一个监测机制等。
- 沟通、合作和参与：重要的是，在规划期间，要与市政部门、周边社区和未来的用户进行良好的沟通。在社区建成并投入使用后，沟通将集中在业主、设施经理和用户之间以及用户与用户之间。。
- 社区定位和城市发展：重点在于用户的多样化，高质量的户外空间，足够的景观和良好的遮阳，充足的服务设施，如咖啡馆，商店，托儿所等，以及在能源和气候保护方面提高项目竞争力。
- 供应和废弃：这个主题领域重点是能源的质量和区域性，供水以及废弃物处理。

-
- Buildings: The 2000-Watt-District certificate is considering all common labels and standards for buildings in Switzerland. The wider the sustainability range and the better the achievement, the more points. Furthermore, also the Life Cycle Costs and the per-person density is assessed. This means, the less living area per person is consumed, the higher the rating. This is a clear link to the 2000-Watt Society and a so called “sufficiency” criteria.
 - Mobility: The focus here is on all different measures which can’t be assessed quantitative, but which have a clear positive effect on the reduction of the motorized private transport. Topics are for example: number of parking lots for cars and bikes, bike sharing services, quality of connection to public transport, etc.

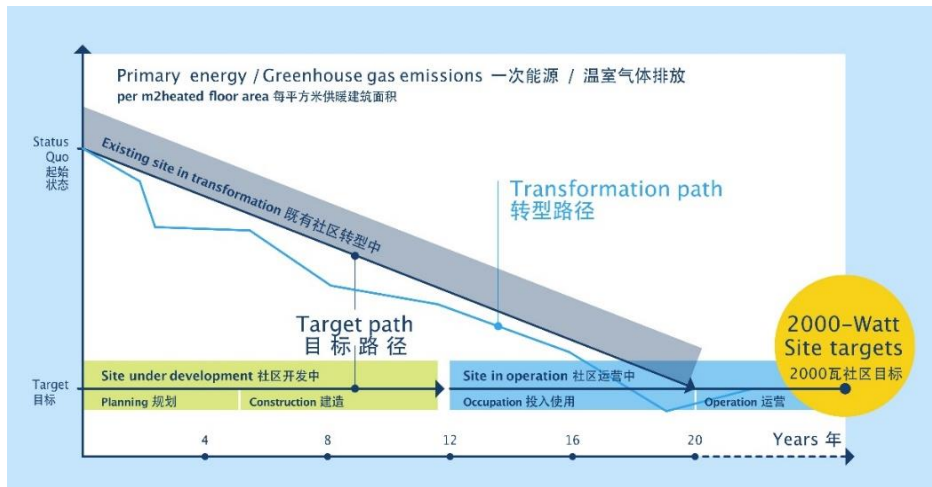
For each subject area, a degree of fulfilment of in minimum 50% must be achieved. This means here as well, the goal is set, not the path to follow.

Three Specifications

The 2000-Watt-District certification scheme offers three different specifications:

- For new developments (green), the goal is to be below the quantitative requirements during the whole planning process. Basis are the model-based project values.
- After the district is in operation (blue), again the goal is to stay below the quantitative requirements. Basis are the measured energy consumptions as well as the mobility behaviour which is assessed through a survey. The embodied carbon and energy are not assessed again.
- For existing Neighbourhoods (grey), the starting point is in most cases clearly above the goals of the 2000-Watt-District as the energy supply is mostly still based on fossil fuel. When the landowners can present a binding strategy showing that with certain measures (e.g., retrofitting, change of energy supply or replacement constructions) the goals can be achieved within 20 years, the neighbourhood will be awarded a certificate already today.

With these three specifications almost all new developments, districts in operation as well as existing neighbourhoods with a transformation strategy can be certified



Specification of the 2000-Watt-District (© 2000watt.ch) / 2000 瓦社区的认证类型 (cop. 2000watt.ch)

- 建筑物: 2000 瓦社区认证考虑了瑞士建筑领域所有的认证体系和通用标准。可持续发展的范围越广，成就就越高，得分就越多。此外，还对生命周期成本和人员密度进行评估。这意味着，人均居住面积越少，评分就越高。这与 2000 瓦社会和所谓的“充足”标准有明显关联。
- 交通: 这里的重点是所有不能被量化评估的措施，这些措施对减少私人机动车的使用有明显的积极作用。例如：汽车和自行车的停车场数量，自行车共享服务，与公共交通的联接质量等。

对于每个领域，必须达到至少 50% 的完成度。这意味着在这里定义的是目标，而不是路径。

三种认证类型

2000 瓦社区认证包含三种不同的认证类型：

- 对于新开发项目（图中绿色），目标是在整个规划过程中要低于量方面的要求。这里的依据是基于模型计算的项目基准值。
- 在社区投入运营后（图中蓝色），目标同样是要保持在定量要求以下。基依据是测量的能耗以及通过调查而评估得出的交通行为及其能耗。这里，隐含碳排放和能源无需再次评估。
- 对于既有的居民区（图中灰色），在大多数情况下，其能源消耗量明显高于 2000 瓦社区的约束值，因为能源供应大多仍基于化石燃料。如果土地所有者能够提出一个有约束力的战略，表明通过某些措施（例如，改造、改变能源供应或更换建筑结构）可以在 20 年内实现目标，那么该社区当前即可以被授予证书。

有了这三种认证类型，几乎所有的新开发项目、运营中的社区以及有转型战略的既有街区都可以得到认证。

Certification Process

By agreeing to the certification process, the owner must run through several certifications in different cycles:

- For a certification in Development, it's cycle of two years with a yearly evaluation in between.
- For a certification in Transformation or in Operation it's a cycle of four years with a yearly evaluation in between
- There is a need to work with an accredited consultant. There are about 30 of these consultants in Switzerland by the time.

The advantage of this process certification is that the landowners are forced to keep on going and will so be sensitized regularly and very deeply.

The 2000-Watt-District certificate is one of the only certificates which make the transition from model data to real data and the past has shown, that the performance gap over the whole district is very small. This can be quite different on a single building perspective.

Overall, the certification process is very clear and simple which is one of the reasons that the 2000-Watt-District label is so successful.

Benefits

General

The greatest opportunity of a 2000-Watt-District lies in understanding and designing a sustainable district/neighbourhood. In this way, districts achieve much greater effects than several independent individual buildings. The 2000-Watt-District requirements are demanding, but at the same time they ensure that there is a well-coordinated process. Both planning and construction as well as operation are considered.

The certificate is valid for 2 years (in development) or 4 years (in operation). The sites are thus evaluated on an ongoing basis. The aim of this long-term monitoring is to ensure that the sites continue to develop or improve instead of only fulfilling the required criteria once. In this way, they can optimally exploit existing but also new potentials, e.g., innovative technologies and communication. The 2000-Watt-District consultants supports the owners, architects and planner in doing so.



“The 2000-Watt-District certificate is one of the only certificates which make the transition from model data to real data”

On the left: logo of the 2000-Watt certificate
左图为 2000 瓦社区认证标志。© Swiss Federal Office of Energy (SFOE) | Web: bit.ly/303mmwG

认证过程

就认证过程达成一致后，业主必须在不同的时间周期内通过如下认证：

- 对于开发认证，认证周期为两年，要进行年度评估。
- 对于转型或运营阶段的认证，认证周期为四年，要进行年度评估。
- 这里必须与有专门资质的审计顾问进行合作。目前，在瑞士大约有 30 名这样的顾问。

这个过程认证的好处是，项目所有者被强制定期开展认证，因此项目将定期且非常深入地受到影响。

2000 瓦社区认证是唯一从模型数据向真实数据过渡的证书之一，过去的经验表明，整个社区的能耗表现落差非常小。这和单体建筑很不同。

总的来说，认证过程非常清晰和简单，这也是 2000 瓦社区认证体系如此成功的原因之一。

优点

概述

2000 瓦社区的最大机会在于理解和设计一个可持续的社区/街区。通过这种方式，社区得到的收益要比几个独立的建筑大得多。2000 瓦社区的要求很多，但同时也确保了一个良好的协调过程，且规划和建造以及运营都被考虑在内。

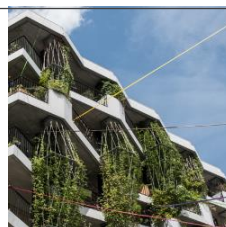
该证书的有效期为 2 年（适用于开发中项目）或 4 年（适用于运营中项目）。因此，项目需进行持续的评估。这种长期监测的目的是确保这些建筑所在地的持续发展或改进，而不是只在一个节点满足所需的标准。通过这种方式，可以最佳地利用现有的但同时也是新的优化潜力，例如，创新技术和通信技术。2000 瓦社区审计顾问将支持业主、建筑师和规划师落实相关操作。

“2000 瓦社区证书是唯一从模型数据向真实数据过渡的证书”

On the right: Measures against overheating especially in summer are green facades, roofs and a green outside space.

右图展示了用于防止夏天建筑过热的措施，诸如外墙和屋顶绿化以及绿色的户外空间。

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For Municipalities

In local municipalities, a 2000-Watt-District certificate makes sustainable urban development visible. The sites are often lighthouse projects. With the catalogue of criteria for 2000-Watt-Districts, the municipalities receive a tool to specifically demand the energy and climate goals of the 2000-Watt Society in site developments.

Specific benefits are:

- The certificate guarantees that energy consumption and greenhouse gas emissions meet the target values and are climate friendly.
- 2000-Watt-Districts create attractive living spaces with optimal conditions for non-motorised traffic and low-emission vehicles. This also makes settlements attractive that are located somewhat outside of centres.
- The districts promote the use of public transport as well as walking and cycling. In this way, urban traffic flows are managed in a resource-friendly way.
- Municipalities with a 2000-Watt-District promote internal development. Attractive, lively, and mixed residential areas are created in the urban area.
- The dialogue between authorities and site owners is firmly anchored in the development process. The same applies to the definition of clear, transparent goals for all parties involved.
- 2000-Watt-Districts are suitable for derelict sites, old industrial sites, or existing neighbourhoods in need of renewal.
- The 2000-Watt-District also serves as a comprehensive specification in special use and design plans of municipalities. The certificate sets clear target values and gives the development teams a great deal of freedom in implementation. This means that each site can exploit its specific strengths and the municipality does not have to act as an enforcement authority.

A 2000-Watt-District makes a significant contribution to the Swiss Energy Strategy 2050 and to the climate goals of the Paris Agreement 2015,



This aerial photograph shows a project called "Kalkbreite" located in the center of Zurich. 航拍图显示了位于苏黎世中心的一个名为 "Kalkbreite" 的项目。

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Web: bit.ly/3yCwIU0



2000 Watt Areal "Sihlbogen" with a special mobility focus.
2000 瓦社区"Sihlbogen", 交通是一个核心主题。
© Swiss Federal Office of Energy (SFOE)
Web: bit.ly/3PkgwYL

对于市政部门而言

对地方市政部门而言，2000 瓦社区认证是对城市可持续发展的可视化。这些社区往往是示范项目。通过 2000 瓦社区的指标目录，市政部门有了一个工具，并利用它在 2000 瓦社区的开发过程中对能源需求和气候目标进行清晰定义。

具体的优点如下：

- 该证书保证了能源消耗和温室气体排放符合目标值，并且是利气候保护的。
- 2000 瓦社区创造了有吸引力的生活空间，为非机动车交通和低排放车辆提供最佳条件。这也提高了位于市中心之外的居住区的吸引力。
- 这些地区提倡使用公共交通工具、步行和骑行。这样，城市交通就会以一种有利资源的方式得到管理。
- 拥有 2000 瓦社区的城市可借此促进其内部发展。在城市内部创建了有吸引力的、有活力的、混合的住宅区。
- 在 2000 瓦社区项目开发过程中，政府部门和地产所有者之间的沟通均经过确认。这也适用于所有项目参与方制定清新、透明的目标。
- 2000 瓦社区同样适用于废弃的建筑用地、旧工业用地或需要更新的既有街区。
- 2000 瓦社区还可作为市政当局用于特殊用途和设计计划的综合规范。该认证设定了明确的目标值，并给予开发团队很大的规划自由。这意味着每块用地都可以利用其特定的优势，而市政部门则不必深入参与技术性的决策。

2000 瓦社区对瑞士 2050 年能源战略和 2015 年《巴黎协定》的气候目标的实现做出了重大贡献，特别是通过额外的“零排放”奖项（准备就绪但尚未实施）。

For Architects and Planners

With 2000-Watt-Districts, urban development, architecture, environmental design, energy, infrastructure, and mobility can all be actively integrated. and implemented from a sustainable point of view. Far-sighted and integrated planning is essential. Innovative solutions will also be awarded in the 2000-Watt-District.

Specific benefits are:

- The concerns of all necessary experts are considered at an early stage and considered in order to achieve the objectives. Coordination and joint processing of the planning tasks are a central element in the process.
- All stakeholders can have a positive influence in the planning phase, which results in broadly supported and accepted solutions.
- The quality assurance of energy and climate compatibility can be made based on the certificate from the test planning, in the preliminary studies, and in the project planning and operation stage.
- Planning each building in accordance with comprehensive building certification and standards is a prerequisite for the certificate. The low energy consumption and green-house gas emissions can be continuously monitored, and planning deficiencies can be corrected directly and cost-effectively.
- Thanks to their long-term quality, 2000-Watt-Districts are suitable as part of a valuable portfolio strategy.

For Investors

2000-Watt-Districts are a sustainable offer for a growing target group. More and more people want to actively contribute to sustainability and pursue a corresponding lifestyle.

Specific benefits are:

- Certification as a 2000-Watt-District increases the attractiveness for the intended target group and improves rentability.
 - The investors contribute to sustainability and the certification proves the credibility of the commitment.
 - With the certificate, the high sustainability quality can be credibly communicated (high reputation).
 - High standards of building quality ensure a long service life for the site.
 - The costs for certification are comparatively low (compared to other sustainability labels).
 - Re-certifications and monitoring create the basis for a qualitative, continuous further development and optimisation of the site.
 - Monitoring identifies cost drivers and potentials in the areas of operation, energy, mobility, waste, water, and user satisfaction. In this way, costs can be reduced, and the community strengthened.
 - Due to the high level of identification with the area, there is generally a lower fluctuation of tenants and thereby reduces the costs.
-

对建筑师和规划师而言

在 2000 瓦社区内部，城市发展、建筑、环境设计、能源、基础设施和交通规划都可以被整合在一起，并从可持续的角度进行实施，因为有远见且综合性的规划是至关重要的。创新的解决方案也将在 2000 瓦社区中得到实施。

具体优点如下：

- 为实现项目目标，在项目早期阶段所有专家所关心的问题都要被得到考虑。规划任务的协调和联合处理是这个过程中的核心要素。
- 所有的利益相关者都可以在规划阶段产生积极的影响，从而产生能得到广泛支持和可接受的解决方案。
- 在初步研究和项目规划及运行阶段中，可以根据试验规划的证书进行能源和气候兼容性的质量保证。
- 按照综合建筑认证体系和标准来规划每个建筑，是获得认证的前提条件。建筑能耗与温室气体排放需要得到持续监测，规划阶段的不足可借此得到直接有效地纠正。
- 由于其质量可以得到长期保证，2000 瓦社区适合作为有价值的战略组合的一部分。

对投资者而言

2000 瓦社区是为一个不断增长的目标群体提供的可持续发展服务。越来越多的人希望为可持续发展做出积极贡献，并追求相应的生活方式。

具体优点如下：

- 2000 瓦社区认证增加了对预期目标群体的吸引力，并提高了租赁的可能性。
 - 投资者为可持续发展做出了贡献，而认证则证明了承诺的可信度。
 - 证书可视为公认的可持续发展质量证明。
 - 高标准的建筑质量保证了社区的长期使用寿命。
 - 认证成本相对较低（与其他可持续性认证相比）。
 - 重新认证和监测为社区的质量、持续的发展和优化奠定了基础。
 - 监测确定了运营、能源、交通、废弃物、水和用户满意度等领域的成本驱动因素和优化潜力。通过这种方式，可以减少成本，并加强社区建设。
 - 由于对该地区的高度认同，一般来说，租户的流动性较小，从而降低了成本。
-

02

Concept Zero-Emission-District (ZED) Certificate for China

Background

Based on the successful Swiss Certificate 2000-Watt District (see Brochure Part 1) a development for China is possible. This paper offers suggestions on how this could be implemented.

Quantitative Proof

System Boundary

For the quantitative proof following aspects should be considered as they all have a significant impact on global warming and can be influenced by the architects/planners:

- Embodied carbon Emission from materials (Construction)

- Carbon Emissions from energy demand (Operation)
- Carbon Emissions from daily mobility (Mobility)

To able to come up with this proof, it is necessary to calculate the project values in different planning stages and to have target values for the different uses (resp. building categories, see chapter “Target values”).

The idea is to base the quantitative proof on the ZEB Standard but to use the target values over the whole district. This allows for certain buildings to not fulfil the quantitative requirements and others clearly undercut the target values of the ZEB-Standard.

对建立中国零碳社区（ZED）认证体系的建议

背景

基于 2000 瓦社区认证（见手册第一部分）在瑞士的成功实施，可见类似 2000 瓦社区认证体系在中国发展是有潜在可行性的。下文就如何实现这一目标也提出了建议。

定量证明

系统边界

由于以下几个方面不仅对全球变暖有重大影响，并且还受到建筑师/规划师的影响，所以要对其进行定量分析：

- 材料中的隐含碳排放（建造阶段）
- 能源需求产生的碳排放（运营阶段）
- 日常交通的碳排放（交通）

为了能够得出相应结果，有必要在不同的规划阶段计算项目相关数据，并为不同的用途（即建筑类别，见“目标值”一章）设定目标值。

这个想法是基于零碳建筑标准的定量证明，但是面向整个社区层面使用的目标值的。这允许某些建筑不满足定量要求，而其他建筑则需明显低于零碳建筑标准的目标值。

Project Values

Operation

The energy for following uses could be considered:

- Space heating
- Space cooling
- Hot water
- Electric auxiliary energy used for heat generation
- Ventilation
- Lighting
- Appliances (incl. process units and general building services)
- Use of renewable Energy onsite

Today there are sufficient technologies available to achieve a zero-emission operation of the building resp. a district.

If a building produces more energy, then it consumes (e.g., PV-Panels), the surplus energy could be considered as negative.

Construction

All materials needed for a new or retrofit building must be considered:

- Type of materials
- Amount of materials

Difficult to consider are the transports from a regional warehouse to the construction site. The background datasets must include the whole life cycle of the materials/components with a certain lifespan, including the upstream processes (from cradle) to the manufacturing process and the disposal at the end of life (to grave). The functional unit will be per kg or m3 of material and year.

In a first approach (maybe for 15 years) carbon trading could be an approach to achieve zero carbon emission for construction. This needs to be defined clearly.

Mobility

Only location-dependent everyday mobility is considered. Following information is necessary to assess mobility:

- Type of means of transportation resp. car (e.g., bus, train, electric car, etc.)
- Distance travelled (only one way)
- Average number of persons travelling in the car

After people have moved in the new building the impact from transportation can be assessed by a survey.

In Switzerland the model to calculate the impact from mobility in the planning stage is based on a regular national survey including the mobility behaviour of the Swiss inhabitants. This will most probably not be available in China. Therefore, a new model needs to be developed.

If it is not possible to come up with a China-specific model to calculate in a simple way the impact from mobility in the different planning stages, then we would recommend to only assess mobility on a qualitative basis.



“Today there are sufficient technologies available to achieve a zero-emission operation of the building resp. a district.”
目前已经有足够多的技术可以实现建筑物和社区的
零排放运行。

“在人们搬入新建筑后，可以通过调查来评估交通的影响”

On the right: Location-dependent mobility is an important factor of a 2000-Watt site.

右图：区域性的交通方式是 2000 瓦社区的一个重要组成部分。

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项目值

运营

需考虑以下方面的能源需求：

- 供暖
- 制冷
- 生活热水
- 电辅热
- 通风
- 照明
- 电器设备
(包括工艺装置和一般建筑服务)
- 用地现场可再生能源的使用

现在已经有足够多的技术可以实现建筑和社区的零排放运营。

如果一栋建筑生产的能源多于它所消耗的能源（通过光伏发电板），那么能源消耗可以被视为负值。

建造

必须考虑新建或改造建筑所需的所有材料：

- 材料的类型
- 材料的数量

难以考虑的是从仓库到施工现场运输过程中的数据。数据必须包括具有一定使用年限的材料/部件的整个生命周期，包括上游过程（从生产）到制造过程以及使用结束时的处置（到废弃）。计算单位将是每公斤或每立方米的材料和年份。

在第一种方法中（可能是 15 年），碳交易是可能实现建筑零碳排放的一种方法。但这需要明确定义。

交通

只考虑与地点有关的日常交通方式。以下信息对于评价交通的影响十分必要：

- 交通工具和汽车的类型（例如，公共汽车、火车、电动汽车等）
- 出行距离（只有单程）
- 乘坐汽车出行的平均人数

在人们搬入新建筑后，可以通过调查来评估交通的影响。

在瑞士，在规划阶段计算交通影响的模型是基于一项定期的全国调查，包括所有瑞士居民的交通行为。这在中国很可能是不可行的。因此，需要开发一个新的模型。

如果不能提出一个适应中国情况的模型，以简单的方式计算不同规划阶段交通的影响，那么我们建议只在定性的基础上评价交通的影响。



Special for this site in Zurich is the train which passes through the neighbourhood and stops next to it.

苏黎世这个 2000 瓦社区的特殊之处在于，有火车经过并停靠在附近。

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bit.ly/3PkgwYL

Database

Based on the above-described necessary information for Construction, Operation and Mobility, these must be linked to the related impacts listed in one or several databases. These databases must contain the different impacts of following sectors and if possibly calculated consistently:

- List of different energy systems (e.g., energy from wood fired heater, from gas heater, etc.). Functional unit: per kWh end and/or net energy
- List of different electricity consumer mixes (e.g., regional, products, etc.). Functional unit: per kWh end energy
- List of all building materials (e.g., concrete, timber, reinforcement steel, window glass, etc.). Functional unit: per kg or m3 material
- List of all different means of transportation (e.g., train, bus, car). Functional unit: per person-km
- Some research is needed to find out, what databases are available. If necessary new and consistent data must be collected. We recommend adding these data in ecoinvent (www.ecoinvent.com) as this is an international database with high and consistent quality.

It is recommended to commission a specialist for a comparison of the different impact data in the KBOB-list with data from China to see where and how big the differences are. If they are not too big, it might be possible to use the Swiss data if no other China-specific data are available.

数据库

基于以上所描述的用于项目建造、运营和交通的必要信息，这些信息必须与一个或几个数据库中列出的影响相关联。这些数据库必须包含以下方面的不同影响，并在可能的情况下统一计算：

- 不同能源系统的清单（例如，来自燃木加热器的能源，来自燃气加热器的能源等）。计算单位：每千瓦时终端能耗和/或净能耗
- 不同的电力消费组合（如地区、产品等）的清单。计算单位：每千瓦时终端能耗
- 所有建筑材料的清单（如混凝土、点火器、钢筋、窗户玻璃等）。计算单位：每公斤或每立方米材料
- 所有不同的交通方式（如火车、公共汽车、汽车）的清单。计算单位：每人-公里
- 所以需要进行一些研究，以了解有哪些数据库可用。如果有必要，必须收集新的和连续的数据。我们建议将这些数据添加到ecoinvent (www.ecoinvent.com) 中，因为这是一个具有高质量和连续性的国际数据库。

建议委托一个专家对 KBOB 列表中的不同影响数据与来自中国的数据进行比较，以了解差异在哪里，有多大。如果差异不大，同时没有其他针对中国的数据，就有可能使用瑞士的数据。 KBOB = 建筑领域生命周期计算数据库



On the right: The 2000-Watt district “Sihlbogen” is vastly powered by a PV rooftop system.

右图为 2000 瓦社区“Sihlbogen”，由大量屋顶光伏进行供电。

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Target Value Definition

Introduction

The main indicator to be considered are the greenhouse gas emissions measured/calculated in kg CO₂-eq. per m² heated floor area. Another indicator, covering the resource consumption, could be total primary energy in kWh per m² heated floor area. This needs to be checked in case related data are available and if this is wanted.

The target value is defined as the sum of the guiding values from Construction, Operation and Mobility. Another requirement in Switzerland is the so-called “additional requirement” which covers only the sum of Construction and Operation (excl. Mobility). It needs to be clarified, if only the additional requirement or also the target values are of interest in China. The experiences in Switzerland have shown that it is hard to achieve the target values with rural properties whereas the additional requirements are harder to achieve with urban properties which usually have good connection to public transport.

Derivation of the target and guiding values

The target values in Switzerland were developed for the building categories Residential, Administration, School, specialised Store, food Store and Restaurant, proceeding from the assumption that the proportional share of total energy use represented by energy use in the building sector remains constant during the period from 2010 to 2050. For this purpose, the current status needs to be determined for each building category in China and reduced to the target status in the year 2050 using the reduction factors calculated for China. (Top-down approach).

The building categories to be represented in China must be defined. In minimum they should cover the most important ones: Residential (Dwellings) and Administration (Office). Maybe there will be a differentiation between single family houses, multi- family houses, high rise buildings, etc. We recommend starting with the most common residential buildings and then define further categories.

The guiding values in Switzerland were derived by searching for the today best available technologies for Construction, Operation and Mobility and then calculating the related impact factors which are hard but feasible to achieve (Bottom-up approach). The sum of the guiding values from Construction, and Operation must reach the target value and from Construction, Operation and Mobility the additional requirements (Top-down approach).

Operation

The guiding values for operational energy related to the carbon emissions must be Zero as there are enough technologies available to achieve this. For the indicator total primary energy, which is an indicator representing the insulation quality of the building, a guiding value must be defined for China.

Construction

The guiding values for construction related to the carbon emissions must be dynamic as today it is not possible to achieve Zero Carbon Emission. Based on a hard but feasible value for today a reduction path for the next years must be defined. In 2050 it should be possible to build without any carbon emissions (e.g., raw timber constructions, renewable materials, etc.) For the indicator total primary energy, a corresponding dynamic (based on the reduction path) guiding value must be defined for China.

The guiding values would then be tightened every couple of years (e.g., every 5 years)

Mobility

The same approach as for construction must be taken to define the guiding values for mobility.

目标值的定义

简介

主要考虑的指标是温室气体排放，以每平方米采暖面积的公斤二氧化碳当量来衡量/计算。另一个涵盖资源消耗的指标可以是每平方米采暖面积的一次能源总量，单位为千瓦时。这需要检查是否有相关数据以及是否需要考虑这个指标。

目标值被定义为建造、运营和交通的指导值之和。瑞士的另一个要求是所谓的“附加要求”，它只包括建造和运营阶段（不包括交通）的总和。在中国是否只有附加要求，抑或目标值也是有意义的需要被进一步澄清。瑞士的经验表明，农村房屋很难达到目标值，而城市房屋则很难达到附加要求，因为城市房屋通常与公共交通有紧密的联系。

目标值和指导值的推导

瑞士的目标值是为住宅、办公、学校、专卖店、食品店和餐厅等建筑类别制定的，其前提是 2010 年至 2050 年期间建筑部门的能源使用占总能源使用的比例保持不变。为此，需要确定中国每个建筑类别的现状，并使用为中国计算的减少系数将其减少到 2050 年的目标状态。（自上而下的方法）。

必须确定中国的建筑类别，至少应包括最重要的类别，住宅和行政办公（办公室）。也许会有单户住宅、多户住宅、高层建筑等方面的区别。我们建议从最常见的住宅建筑开始，然后再进一步定义其他类别。

瑞士的指导值是通过寻找当今建造、运营和交通的最佳技术，然后计算相关的影响因素，这些影响因素很难实现，但却是可行的（自下而上的方法）。建造和运营的指导值之和必须达到目标值，而建造、运营和交通的指导值必须达到额外的要求（自上而下的方法）。

运营

与碳排放相关的运营能耗的指导值必须为零，因为有足够的技术来实现这一目标。对于总的一次能源指标，也就是代表建筑保温质量的指标，必须为中国定义一个指导值。

施工

与碳排放有关的建筑指导值必须是动态的，因为今天还不可能完全实现零碳排放。基于今天的艰难但可行的指导值，必须确定未来几年的减排方式。到 2050 年，应该有可能实现没有任何碳排放的建筑（如原木建筑、可再生材料等）。对于总的一次能源指标，必须为中国定义一个相应的动态（基于减排方式）指导值。

然后每隔几年（如每 5 年）收紧指导值。

交通

必须采取与施工相同的方法来确定交通的指导值。



“It is recommended to base the qualitative criteria on the Indian 2000-Watt-Smart City concept.”

On the left: The “Hunziker Site” located in Zurich was planned and built by a cooperative called “more than living”..

UMAR 的 NEST 的东南面带有新部件

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Qualitative Assessment

It is recommended to base the qualitative criteria on the Indian 2000-Watt-Smart City concept. This concept is assessing the following themes:

- Smart Governance
- Smart Centrality
- Smart Mobility
- Smart Energy & Environment
- Smart Buildings
- Smart Food Production & Tech Centres

The content of each of the themes possibly need to be adapted as well as the max. points per theme.

Other Important Issues

Following open questions must be answered:

- Should there be target values and additional requirements only for new or also for retrofit constructions? Probably depending on whether a simple model to calculate the impact from mobility during the planning stage can be develop.
- Definition of a District is needed. What are the minimum requirements they must fulfil to be authorized for certification? E.g., minimum floor area, number of buildings, number of uses, etc.

Research Fields

In following working fields further work must be done and could be realized through Swiss-Sino cooperation:

- Definition of the target values resp. the additional requirement for the most important building categories (uses) in China based on the reduction path of China (collaboration China/Switzerland)
- Development of a simple model to calculate the impact from Mobility in different planning stages (China together with Switzerland)
- Comparison of the today available LCA Data with the Swiss Data in the KBOB-List (Swiss expert)
- Research on existing China LCA Databases for construction materials, heating systems, electricity mixes (regional?) and mobility with the related quality guidelines (China)
- Collection of LCA data from most important building materials and means of transports (China)
- Research on existing LCAs of buildings in China and what's the potential regarding low emission constructions (China)
- Comparison of the today available LCA Data with the Swiss Data in the KBOB-List (Swiss expert)

“我建议将定性指标建立在印度 2000 瓦智慧城市的概念上。”

On the right: The first car free district “Burgunder” in Bern. As identity spot a large old house has been refurbished and is now used a communal space.

右图是位于伯尔尼的第一个无机动车区域。作为地标建筑，一栋巨大的老旧建筑已经被翻新，现在被用作公共空间。

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定性评估

2000 瓦社区认证体系曾在印度以“印度 2000 瓦智慧城市”体系进行尝试。建议将中国可能的定性指标建立在印度 2000 瓦智慧城市的方案上。这个方案需要评估以下主题：

- 智慧管理
- 智慧中心化
- 智慧交通
- 智慧能源与环境
- 智慧建筑
- 智慧食品生产和技术中心

每个主题的内容可能都需要调整，每个主题的最高分也需要调整。

其他重要问题

以下是必须回答的开放式问题：

- 仅仅只对新建建筑，还是也包括改造后的建筑提出目标值和附加要求？可能取决于是否可以开发一个简单的模型来计算规划阶段的交通影响。
- 需要对一个社区进行定义。他们必须满足哪些最低要求才能被授权认证？例如，最小的建筑面积、建筑物的数量、使用人员数量等。

研究领域

针对以下领域，必须做进一步的研究工作。研究工作可以以中瑞合作方式进行：

- 根据中国的减排方式，定义中国最重要的建筑类别（用途）的目标值和附加要求
 - 开发一个简单的模型来计算不同规划阶段交通的影响
 - 将中国现有的碳排放因子数据与 KBOB 列表中的瑞士数据进行比较
 - 研究中国现有的建筑材料、供热系统、电力组合（区域？）和交通领域的碳排放因子数据库以及相关的质量准则
 - 收集最重要的建筑材料和运输工具的碳排放因子数据
 - 研究中国现有建筑领域的碳排放因子数据库，以及低排放建造的潜力
 - 将现有的 LCA 数据与 KBOB 列表中的瑞士数据进行比较
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