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DNA Oman – What does that mean?

In biology and genetic engineering, DNA is defined as a biomolecule which carries all the genetic information. This genetic code is unique and can only be assigned to one individual. The genetic information defines the individual itself and stands for its uniqueness. The DNA of an individual never changes – it will always build the base to who a person is biologically.

Applying the symbol of DNA to Oman it is beyond question that the country has its own culture, history and landscape which cannot be found anywhere in the world in the exact same way. This uniqueness will remain unchanged – it defines the Omani identity.

The goal of our vision DNA Oman is to develop the country considering its “DNA” and keeping its unique identity. Oman has gone through big changes in the last decades and has a lot of potentials for future development. Using and developing these is not a contradiction to the goal of keeping the identity of the country – if the principles of DNA Oman are followed: developing, networking, activating.

**developing**

Development can be defined as “economic and social transformation that is based on complex cultural and environmental factors and their interactions”. We define the process of developing as the work with existing potentials of the country and the setting of goals concerning different key topics. We are aware of the fact that unique solutions have to be found to be applied to Oman and that concepts for regional planning cannot just be copied from Europa or other regions.

**networking**

The vision DNA Oman focuses on the existing network of cities and regions in Oman and tries to give a spatial reference to its ideas and solutions. It has to be considered that different cities and regions have different potentials which can complement each other in order to increase the competitive advantage and the quality of living in Oman. Bearing in mind the network of cities and regions the flexibility concerning spatial application and time horizon of realization of solutions and ideas plays a major role.

**activating**

It is essential that planning and development isn’t applied from outside but realized by local and regional institutions. These institutions should be activated to apply solutions and ideas to the matching location but remain independent concerning detailed planning. The vision DNA Oman shouldn’t be understood as a detailed planning concept but as a development strategy which can be adapted according to the economic, social and technological situation.
DNA Oman – What does that mean?

The six key topics
While the biological DNA consists of Adenine, Guanine, Cytosine and Thymine, the vision “DNA Oman” centres on six major topics: Mobility, energy, education, economy, tourism and building style. Developing a vision for the next decades these points are the most important key topics determining the future of Oman.

Development of logo and design
The red & green logo represents our vision DNA OMAN by showing a DNA-strand. It refers to our goal of identifying the DNA of Oman and develop projects which use this DNA of the country. The topic overview with the six hexagons was adapted from the chemical structure of DNA - Deoxyribonucleic acid as seen on the images. It shows not only the six key topics of the vision but also symbolizes the connection and dependency of these six topics. DNA OMAN can only be implemented if all key topic goals are realized hand in hand.

Figure 1: The development of the DNA logo and the topic overview
The field of education is very young in the Sultanate of Oman compared to other countries and the education system is still in the build-up phase. Nevertheless there have been a lot of achievements in the last forty years and the country has a lot of potentials. Whereas there were only three schools in 1970 which were only for boys, now there are more than one thousand schools both for boys and girls.¹

The reforms of the past decades were mainly concerning the improvement of basic and post-basic education. The higher education is a field which still needs to be focused on, as right now there is only one public university in the whole Sultanate. Also the sector of vocational education is not yet very well developed. In order to diversify education and economy and to increase the share of Omanis in the private sector, it is essential to establish more vocational schools.

As mentioned, with Oman being still in a build-up phase it is easier to direct and guide the development through the educational sector. The high birthrate and the expected growth of population will also be a challenge in the future that has to be dealt with. An essential issue is also the already high unemployment rate which will even increase if no measures are taken.

About one third of the Omani population is now younger than 14 years. This percentage underlines the importance of developments in the field of education. With a current unemployment rate of approximately 15%, which has to be expected to be growing in the next decades, it is crucial to focus mainly on vocational and higher education and to improve the connections between educational institutions and labor market.²

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1. Situational analysis, page 44
2. Situational analysis, page 35
developing
The field of education can definitely be seen as a big strength and future potential of Oman. There is general education for boys and girls, which is provided for free and even includes the transport to and from school. Keeping in mind the very high birthrate in the last years, investing in education is the only answer to the high unemployment rate which has to be expected. The vision DNA Oman sees the main potential of education in the improvement of vocational schools, higher education and better coordination and cooperation between educational institutions and the labor market. Specialized study fields which are related to industry, services or science can ease the burden on the public sector which now has to absorb most of the university graduates.

networking
While the spatial allocation of elementary and secondary schools among the country is relatively good, the higher education institutions are concentrated in a few spots. It is one goal of the vision DNA Oman to establish more institutions for vocational and higher education in all regions of Oman, which are specialized on a certain sector. Thereby the regional potentials can be used and a balanced regional development can be forced.

activating
Universities and higher education institutions are attractive locational factors for a region. Besides improving the educational situation, universities force further development of the region they are situated in and work as an attractor for investors and companies. With the planning and realization of public educational institutions the government has a powerful instrument to support development and force innovation according to the goals of DNA Oman.

goals
- Better cooperation between educational institutions and labor market
- Diversification of study fields in higher education
- Increase of the practical experience while studying
- Improved possibilities in the private sector for highly qualified people
- Establishment of higher educational institutions in all regions
- Establishment of vocational schools in all regions

main projects
- Economy & knowledge clusters (higher education, vocational education)
Figure 2: Projects concerning the topic education
Economy | Situational analysis

The economy of Oman is dominated by petroleum activities with a share of about 40% of the GDP (2009). Comparing the importance of the economic sectors, the industry is the most important with 51% of the GDP, services the second most important with 48% and agriculture with only 2% the least important. Especially the meaning of industry differs a lot from the structure of European countries.

Oil and gas are also the most important factors concerning the state’s income (about 77% of public revenues in 2010). This is why there is no personal income tax in Oman.¹

Like in other Gulf states, the number of expatriate workers in Oman is very high, especially in the private sector, where only 15% of the employees are Omanis. Therefore an initiative for Omanization was started, which should support the replacement of expatriate workers by Omani citizens. Up to now the initiative is only successful in the public sector. This is linked with the attitude of most Omanis that work in the public sector is more attractive, both concerning salary and status.

In 1995 the Omani government introduced a development program for Oman’s economy called „Vision 2020“. Its main goals are the diversification of economy and the reduction of the importance of oil, the Omanization especially in the private sector, the strengthening of the private sector as main income source and the development of a leading and highly competitive private sector. The Supreme High Committee of the Five Year Development Plans is working on realizing these goals step by step through five year plans and by following realistic aims. It has to be acknowledged that a lot of the goals couldn’t be reached so far.²

Because of its economic stability the Sultanate is generally attractive to foreign investors, although the relatively high level of bureaucracy restrains a lot of investors.

¹ Situational analysis, page 93f.
² Situational analysis, page 95f.
Economy | DNA

developing
The government supported industrial estates in Oman build the base to the industrial production of the country and are already well developed concerning hard locational factors. In the context of DNA Oman the industrial estates should be further developed towards economy and knowledge clusters which besides industry include services, technology and science parks and institutions of higher education. This combination will lead to innovation, support R&D and increase the importance of knowledge-based economies in Oman as well as the competitive advantage of the country.

networking
Connected as a network the economy and knowledge clusters in different locations can specialize in distinct sectors, which helps the country to diversify its economy and reduce its dependence on oil. The establishment of clusters in different regions and cities moreover helps to achieve balanced regional development and reduce spatial disparities. In this context it is especially important to focus on the endogenous potentials of each region and design the e&k clusters according to the opportunities in natural resources, location and human resources.

activating
The investment in knowledge, technology and education clearly has long-term effects and helps Oman to establish a stable, competitive economy, which secures good employment and career opportunities for the country’s inhabitants. Nevertheless regional planning using its instruments can only support the building of clusters and activate the cooperation between industry, education and science, the innovation has to come from the stakeholders themselves. Also the government is asked to invest and support research and development in order to raise the economic competitiveness of Oman in the global market.

goals
• Stronger cooperation between labor market and educational sector
• Improving the image of the private sector and making it more attractive
• Support research & development to increase competitiveness of Oman
• Diversification of economy
• Overcome unemployment with high-qualification jobs
• Balanced regional development and reduction of spatial disparities

main projects
• Economy & knowledge clusters
Figure 3: Projects concerning the topic economy
Economy & Education | Projects

Economy & knowledge clusters

Idea
The economy & knowledge clusters are a key project of the vision DNA Oman and can be seen as centers where industry, research and education come together and benefit from each other. The clusters consist of industrial estates, higher education institutions (e.g. university branches) and technology parks and should secure development and innovation in the Omani economy. In different locations the clusters are specialized in distinct sectors, which helps the country to diversify its economy and reduce the dependence on oil.

The spatial closeness and sectoral specialization in each cluster brings advantages to all institutions concerning knowledge, mobility, logistics, supply and energy. Also social infrastructure, for example child care facilities, could be shared.

The clusters are furthermore an opportunity to define what the modern Oman stands for: highly qualified people, modern technologies, environmental awareness and the will of innovation and improvement. The clusters can also differ from the traditional architecture and obtain the function as landmarks.

The establishment of economy & knowledge clusters forces two parallel processes in the Omani economy: Diversification on a national level and specialization in the clusters themselves. The diversification of economy is necessary if the country wants to significantly reduce its dependency on oil during the next decades and change towards a strong, resilient economic sector. At the same time, the specialization inside the clusters allows synergies, supports innovation and can reach to knowledge spillover effects. In addition to that, specialization makes it easier to create a unique image and identity to each cluster which brings advantages in marketing and branding.

Figure 4: Cluster concept
Reference
The cluster idea was discussed in literature and science mainly since the 1990s. A famous scientist in this context was Michael Porter, who introduced and popularized the term business cluster in his publication The Competitive Advantage of Nations. Cluster development has since then become a focus for the economy programs of many states. Porter states that clusters affect the competition in three ways: by increasing the productivity of the companies in the cluster, by driving innovation in the field and by stimulating new businesses in the field.
In summary a business cluster is a geographical location where enough resources and competences give a key position in a given economic branch of activity, and produce a sustainable competitive advantage over other places or even a world supremacy in that field (e.g. Silicon Valley).  

Implementation
Of course the instruments of spatial and regional planning have only limited possibilities to realize the establishment of economy & knowledge clusters as companies and educational institutions cannot be forced to settle in the clusters. Nevertheless there are a lot of possibilities how to support the development of the e&k clusters:

Economy structure: If complementary branches of business are located in the same cluster they can achieve synergies and benefit from the spatial closeness. Although it might seem counterproductive at first it is essential that not just any company can settle in the clusters. Only companies who offer similar or complementary products or services have the same requirements for infrastructure and qualification of labor force, can exchange knowledge, establish cooperation and commodity chains.

Cooperation with educational institution: The placing of educational institutions such as universities, vocational schools or technical colleges is a powerful instrument for the government to force the building of e&k clusters. The institutional cooperation and contextual reconciliation of economy and education in the clusters bring improvements on the quality of education and better educated labor force for the companies. Moreover companies and universities can work on research projects together which leads to innovation.

Infrastructure: A location can be made attractive for companies by offering high-level technical and social infrastructure. Companies of the same sector may have similar requirements for technical infrastructure. The social infrastructure, for example common recreation rooms, can also support the communication between people of different companies. Due to spatial closeness also technologically innovative solutions concerning infrastructure can be applied (e.g. district cooling).

Advice and consulting: Especially small and young companies cannot afford their own consulting departments. In a cluster, these facilities can be offered to make the location more attractive and help companies with problems concerning law, government aid or patents.

Marketing: A certain image or trademark supports marketing outside the cluster but also increases identification of the companies inside the cluster.

1  Cf. http://www.business.ulster.ac.uk/intlbusiness/courses/bmg900m1/GrantDiamond.pdf
Communication: Information exchange, communication and cooperation is essential for the success of the cluster strategy. These processes can be forced by certain events, where people from different companies come together, or just by offering spaces in the area (for example common rooms) where people can meet each other and exchange ideas in their every day work life.

Use of endogenous potentials: Especially when choosing the economy structure of a cluster it is fundamental to focus on the endogenous potentials of the region. Only if regional strengths are incorporated in the idea the clusters can be long-lasting successful.

Embedding in regional and inter-regional networks: Nevertheless the cooperation inside the cluster is very important, it is essential that the cluster is integrated in regional, inter-regional and international networks. The cluster should never be seen as an isolated, closed formation.

Time frame
Medium- to long-term
The establishment of economy & knowledge clusters is a very important key project in the vision DNA Oman. For this reason, the initiation and realization should be started as soon as possible. Nevertheless development in economy and education always has to be seen as a long-term process and cannot be reached in a few years. One essential step is to invest right away (short-term action) in employment of highly qualified teachers (not necessarily from Oman), who guarantee excellence in higher education. Simultaneously the process of designing and building clusters should be started. Of course not all clusters can be realized at the same time following one standardized plan. It is essential that the idea of the cluster is adapted to each location specifically and realized in the right scale and based in the endogenous potentials of the region.

Advantages
- diversification of economy
- specialization in different sectors (reduce dependency on oil)
- knowledge-based industries bring jobs for highly educated and qualified people
- support of innovations and R&D
- connection between higher education and labor market, connection between producers of knowledge (universities) and users of knowledge (industry)
- improve the image of the private sector
- concentration of industry and services offers possibility for attractive solutions concerning energy (e.g. district cooling), mobility and other infrastructure
- possible symbol for “modern Oman”: opportunity for innovative architectural design
- increase of competitive advantage through innovation
- reduction of spatial disparities through poly-centric, balanced regional development
- creating of unique products, branding
Sectors
Each economy & knowledge cluster should concentrate on a specific sector in order to avoid competition among the different clusters and to guarantee diversity in the economy. If complementary branches of the same sector are located in one cluster they can benefit from each other and share their knowledge without being in a competitive situation.

In the vision DNA Oman it is not determined, which sector should be applied where. The country itself should be flexible in the realization and implementation of the clusters. The following future-orientated branches could play an important role in the economy & knowledge clusters:

Health:
Education: medicine, pharmaceutics, medical engineering
Industry: Pharmaceutical industry, medical technology (x-ray, cardiology, prostheses, intensive care, etc.)
Science: research concerning medicine, laboratories, pharmaceutic research

Energy technologies (renewable energies):
Education: energy management, environmental management, energy technology, renewable energy systems, etc.
Industry: Production of solar cells, production of wind turbines, energy-related industry, electric car production
Science: research concerning energy systems and technology

Arts & culture:
Education: Design (especially industrial design, product design), architecture, media, graphic design, also combination with IT (e.g. web design)
Industry: any kind of mass production, e.g. combination with processing of oil → plastics, etc.; electric car production
Science:

Trade & Logistics:
Education: Logistics, transport management, ...
Industry: Harbor → can be combined with almost everything
Natural sciences: Biology, physics, chemistry, environmental sciences, geology, ecology, biotechnology, ...
Water technology: desalination plants, etc.
Food & food production, food science, agriculture,...
Telecommunications, IT, communication technology ...

Locations
Muscat (Rusayl industrial estate, 2nd cluster)
Sohar (industrial estate)
Sur (industrial estate)
Nizwa (industrial estate)
Buraimi (industrial estate)
Salalah (Raysut industrial estate, 2nd cluster)
Khasab
Duqm
Ibri
Tourism | Situational analysis

At the moment the Sultanate of Oman already presents a wide range of touristic offers. Oman owns a high number of different landscapes which all hold their unique identity. As are other things, tourism in Oman is in the building phase and thanks to the many different landscapes as the seaside, the desert, the mountain range or the many wadis it is possible to establish many different forms of tourism. It is essential to get out more of the regional potentials. The idea is to build on natural and sustainable tourism. It’s very important to put more effort in the marketing process of these offers and at the same time improve the connection between the tourism facilities.

A lot of potentials can be seen for example in the adventure tourism in the mountain ranges and deserts, the cultural tourism especially in connection with Muttrah, Nizwa and the mudbrick villages and Falaj irrigation systems in the mountain areas, the beach and sports (e.g. diving) tourism along the coast and in Musandam. The situational analysis in this context shows touristic potentials in all region of the Sultanate.

As the Ministry of tourism is now the only official planning institution concerning tourism, a more decentralized way of organization and coordination has to be found.

Figures 5-7: Touristic impressions of Oman
Tourism | DNA

developing
To develop existing tourist areas in inner Oman is an important point in the whole development of the country. Tourism is an efficient way of bringing work and money to the regions. The developing strategy for tourism includes the goal of finding a balance of the well-being in the country especially between the coast area and the inner country. The Sultanate of Oman already provides a wide range of tourism offers, so the main strategy of DNA Oman is not to find new ways of tourism but to develop these offers further and find ways of increasing the sustainability.

networking
Especially in the planning of future tourism, networking plays an essential role because many smaller regions have a hard time of establishing themselves in the touristic market. It is necessary to work in cooperation within the country of Oman and build up a joint strategy which can compete in an international context. To improve the marketing strategy of the country the implementation of a united brand is the main Goal of DNA Oman Tourism. Networking under one brand is not only important for the touristic marketing but also for further education and training in the sector of tourism. By exchanging knowledge it is easy to work on a steady improvement of touristic offers, marketing and education.

activating
For the implementation of the measures of DNA Oman tourism it is essential to build up a new system of participation in the country. The goal is to involve as many parties as possible in the planning process. To organize the participation process Regional Forums should be installed which are self-governed and coordinate with the higher institutions. Finding solutions and own ways of dealing with specific topics will raise acceptance of the measures. As in Oman there are different fundamentals in the landscape and in the offers of tourism as in Europe, it is important to find own ways of defining sustainability in tourism. The more people are involved in the progress of tourism planning the better.

goals
- Diversification of touristic offers
- Sustainable and environmental friendly forms of tourism
- Tourism based on the cultural heritage and potentials of Oman
- Building up a network of touristic offers including technical infrastructure, touristic schools, activities,..
- Building up a knowledge network about competitive and sustainable tourism (trainings, schools,...)
- Improving cooperation between tourism facilities

main projects
- Regional forums
- Certification network
Figure 8: Projects concerning the topic tourism
Regional forums

To build up a system of sustainable tourism the basic step is to implement regional forums in each part of the country. The main idea is to involve as many people as possible into the process of planning. As already mentioned before, these forums should be self-governed and be responsible for the coordination between the residents of the region, the touristic managers and the higher institutions. One of these higher institutions could be a “National Forum” with a representative of each “Regional Forum”. The essential meaning of these forums is that people in Oman can develop their own ideas and not only use current planning methods of other countries.

The Regional Forum itself should be installed permanently as a regional office where some constantly employed regional managers coordinate and provide information. This means not only information about tourism in general but also about possibilities of touristic education or further training, about job opportunities in the sector of tourism, funding opportunities, ...

In the build-up phase it is not necessary to award this institution special competences, because the main aim at the beginning is to raise people’s awareness for participation and draw their interest to the topic. Everybody can get information and add ideas at the regional forum.

In a second step, public discussions and workshops at regular intervals should be installed where local stakeholders develop ideas for sustainable tourism. The regional managers take part only as moderators and mediators. It is desirable that qualified and innovative results can be developed from the region and easily put into action.

The regional forums cannot only be used for the development of sustainable tourism but also for other issues like energy awareness in general or other projects concerning the future of Oman.

As the field of tourism is often conflict-filled because different stakeholders (for example investors, environmentalists or the ministry of tourism) have different ideas about what sustainable and successful tourism is, the regional forums should help to solve conflicts already on a regional level. The forums have the function of discussion platforms, where the stakeholders can bring in their ideas and concerns.
Certification network

This measure means generating and establishing a label in Oman, which ensures quality and sustainability in tourism. The certification can be awarded in different categories, for example for touristic attractions like nature parks or vocational schools for tourism,...

The idea of a Certification Network for Oman comes from the Sustainable Tourism Certification Network of the Americas: “The Sustainable Tourism Certification Network of the Americas brings together certification programs, public and private entities that promote certification and other environmental, tourism-related and academic organizations, all aiming to share information, reach out to other relevant programs, identify training needs and define a progressive market strategy.”

The main concept of the Certification Network for sustainable tourism is built on the system of the regional forums, which includes establishing a forum and an assembly of representatives of each region, which decides about the certifications. In the regional forums the local projects and their level of sustainability can be discussed. There can be different levels for the certification award so there can always be a chance of improving the level and the efforts of the project managers won’t stop.

For example a company, which invests in a tourism project for the region, could reach one level of the certificate if it is running only on renewable energy. The specific requirements for each level should be developed in the Regional Forums. The main goal is to develop and improve sustainable tourism through knowledge

exchange. The mission of the Certification Network is to promote sustainable tourism in the regions through strengthening tourism initiatives based on mutual respect and recognition, joint efforts, harmonizing systems, sharing information and experience.

Network objectives include:
- establishing common work tools by and for member programs
- creating and executing a joint marketing strategy
- defining strategies to promote the application of best practices and certification processes to tourism operations, especially those which are small- and medium-sized

The time frame for the implementation of the certification network is short termed, Forums can be installed easily and the process of developing sustainable concepts for Tourism could start within the next 5 years. A linkage to the existing “Oman Green Awards” could be set. “Oman Green Award” is a platform, which honors different campaigns, businesses or other institutions for outstanding environmental projects or achievements. There exist nine award categories at the moment, for example the “Green Campaign of the Year”, “Green Education Award” or the “Green Research Award”. These awards could be adapted for the best practice examples of the year.
Building structure | Situational analysis

Whereas the traditional Omani settlements were orientated at the topography and landscape, the last 30 to 40 years had made a big influence on the structures and architecture of the Omani cities. The increase of overall wealth and growing population is creating an increasing pressure on new, more comfortable housing which is causing abandoning of the old part of towns, their partial destruction and expanding of the new settled areas. A new type of the residential home is emerging which doesn’t really fulfill the traditional oasis settlements building principles. The new detached, individual standing house, surrounded by tall walls, built in open space right next to a street, enabling fast transport everywhere in the area is the new model of modern housing in Oman. The consequence of this building style is the high amount of energy needed for climatic conditioning, complicated and mostly limited water resources and in some areas cutting down date palm trees which are essential for clime regulation in oasis settlements.\(^1\)

At the moment the building structure is therefore very widely spread, especially on the countryside the distances between houses and settlements and to the nearest public buildings are enormous. It is generally not possible to reach public buildings like hospitals or schools by foot. In the context of sustainability it has to be a goal to increase the density of building structure and improve the accessibility of public facilities.

Beside the structure on the countryside it is also important to consider the bigger cities of Oman. Currently the urban feeling in the cities is very low because of the homogenous building styles, which is no deficiency but through the rapid growth and development it will be necessary to launch more urban segments. The main issue both on countryside and in the cities is however the increase of density.

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1 Situational analysis, page 61
Building structure | DNA

developing
As Oman is a country where fast development takes place it is important and necessary to guide these development in an organized way. Oman has to find its identity in building culture and develop concepts for city and regional planning. The traditional housing units should not be abandoned but there has to be found a way of increasing the density of the settlements in order to improve energy efficiency and reduce infrastructure costs.

networking
The concept for planning in Oman should be coordinated all over the country and adapted for the particular requirements. The planning system in Oman should be better coordinated within the country. Every region has its own landscape and building requirements, so regional masterplans for the system of building plots could be a method of finding efficient solutions for each region.

activating
Activating in the context of building structure and style means the implementation of a planning concept which includes the participation of the Omani population. As already mentioned, every region has its own needs and people who actually live in these regions will know how to use the land in the best way. It is important to involve more people in the planning process especially when bigger projects are concerned.

goals
- Higher density in the urban areas
- Compact building style in the rural areas
- Energy efficient building style (district cooling, solar energy)
- Step by step Urbanization in the big cities starting in the Industrial Estates

main projects
- Urbanization (urban areas)
- Row housing (rural areas)
Figure 11: Projects concerning the topic building structure
Building structure | Projects

Urbanization - urban areas
As Oman is developing and growing so fast, in the future the cities will get bigger and more dense. At the moment there is not a lot of urbanity in the cities, but in some years cities like Muscat, Salalah or Sohar should become more urban to stay attractive for people. The design of public spaces gains importance and it should be possible to add some aspects of modern architecture in the cities. This step by step urbanization could start at the existing industrial estates, where modern architecture is already used. In the process of transforming the industrial estates into modern economy and knowledge clusters the building structure around these areas could be modernized too. The goal of the Vision DNA Oman is not to build one skyscraper after another but to find a marriage between tradition and modernity in the building structure of the cities. Through the higher density it will become possible to use better and more efficient cooling systems like for example “district cooling” which will reduce the waste of energy.

Row houses - rural areas
The own house plays a rather important role in the Omani society because it is a place where family comes together. But without doubt single family homes are the building type with the highest land and energy consumption. In rural areas it is therefore a goal to make the building structure more compact without giving up the residential unit of the house.

One option to achieve this goal is to build row houses. An example for existing row houses in Oman would be “The wave”, a recently built area in Muscat. By joining the houses together on two sides, the building sites can be used more efficiently, less space is needed and the costs for water supply, sewer and road access are reduced. Furthermore using the right construction technology, the energy consumption can be reduced as the buildings are not standing on their own and aren’t exposed to the sun that much. Nevertheless the houses and gardens or yards can be arranged individually. Also building row houses doesn’t necessarily interfere with the Omani building style if the two building concepts are combined.
Mobility | Situational analysis

The rapid development in the last decades brought a lot of building activity also concerning transport infrastructure. Whereas in 2003 there were only 12,000km of asphalted roads, in 2009 there were more than twice as many, almost 26,000km. Although this can be seen as an essential infrastructure improvement, it entails the focus of transportation on the individual car.

In Oman transportation is mainly oil based and it is necessary to build up a more sustainable way of living. One reason for the use of the private car is certainly the high temperature in summer which will be bearable through the air conditioning system. The challenge is to implement a system of sustainable and at the same time comfortable public transportation system. Oman is already doing a lot of research in these sectors like for example there is by now an existing project about an Oman-build electric car.

Another important issue is traffic safety. The statistics show an extremely high number of traffic accidents in Oman. Whereas the total number of accidents is decreasing since 2003, the number of seriously injured or dead people is increasing.¹

Concerning public transportation the situational analysis showed a lack of offers in the whole country. Besides some busses there are hardly any possibilities to use public transport instead of individual cars. According to a survey the population regards public transport as less safe, comfortable, convenient and flexible than individual transport.²

¹ Situational analysis, page 83
² Situational analysis, page 84
Mobility | DNA

developing
In Oman, transport is mainly processed by individual car, so it will be a challenge to implement a system of public transportation. Goal of the vision DNA Oman is to try and implement a system which is a marriage between individual cars and public transportation. Different regions, densities and settlement structures require different mobility solutions. For the rural areas, the vision’s goal is to provide sustainable individual mobility without negative environmental impacts. In the capital area a basic approach to public transport already exists, but the attractiveness, comfort and efficiency are not compatible with the requirements of the modern Muscat. So the main idea is, to find a high tech solution for public transport which surpasses all expectations.

networking
The vision aims for the complete provision of sustainable transportation infrastructure in the country. Local, regional and interregional transportation should be consolidated and coordinated. Beside the matched organisation another important point is the spatial closeness between the interchange stations. Because of the high temperature it is important to find a way of linking all systems of transportation.

activating
Providing the transportation infrastructure alone won’t bring change of mobility habits of the Omani people. In a parallel process it is essential to also change people’s attitude towards public transportation. The vision DNA Oman has the goal of raising awareness for the negative environmental impact of oil based transportation and showing the advantages and comforts of public transport.

goals
- Establishment of an efficient public transport system in the Muscat area
- Reduction of the traffic volume in the capital area
- Establishing a network of public transport connections between the main cities of Oman
- Introducing environmentally friendly means of transportation
- Reducing dependency on oil in transportation

main projects
- MOMO | Muscat Optimized Mobility Organization
- EMO | Electric Mobility Oman
- iEMO | individual Electric Mobility Oman
Figure 16: Projects concerning the topic mobility
Mobility | Projects

MOMO | Muscat Optimized Mobility Organization

Idea
As the capital area is the most dense urbanization in the country, it has the highest potential for efficient public transport solutions. Some basic approaches to public transport (e.g. buses) already exist, but these are neither very reliable or comfortable nor do they have a really good image among the population. All these problems should be solved by establishing the MOMO, the “Muscat Optimized Mobility Organization”.

Before designing the MOMO concept certain requirements for a public transport system in Muscat were defined:

- The transportation should run on renewable energy
- The transportation should be able to transport a lot of people at once
- The transportation should be air-conditioned
- The transportation should be economic
- The transportation should be accessible within a few minutes from (almost) every point of the city
- The transportation should be attractive to use under all weather conditions
- The transportation should have a symbolic function

Keeping all these points in mind, the concept for public transportation in Muscat was developed: MOMO is a two-staged transportation system, which combines the speed and efficiency of a high tech maglev train with the comfort and flexibility of a taxi. This cooperation combines the strengths and compensates the weaknesses of both means of transport: A high speed maglev can transport a large number of persons at a time over a big distance, but is expensive to build and operate, needs a lot of space and is not flexible concerning routing. Taxis on the other hand are rather cheap to buy and run, are extremely flexible where to move in the city but can only transport a small number of passengers, cause a lot of traffic and therefore need a lot of time to overcome larger distances. As a conclusion MOMO makes it possible to overcome big distances fast with the maglev train but allows passengers to reach their exact destination by taxi.

Nevertheless MOMO can be seen as one mean of transport which can be used with only one ticket. An essential part of the MOMO concept are also the stations, where it is possible to change between taxi and maglev without being exposed to the climate. Hot temperatures especially during summer make even short stops in the sun uncomfortable. This problem can be avoided by perfect connection of train and taxi in cooled stations. A challenge concerning the MOMO is the organization of the taxis. Due to the high acceptance of the Omani population of modern cell phones a “MOMO App” (or something similar) could be programmed which allows passengers to indicate their location in order to get picked up by a taxi.
Implementation

Maglev: One or two main maglev routes connect the city along its east-west-axis, orientated at the Sultan Qaboos Highway. The most important and most dense areas should be rather close to the maglev stations as figuratively shown in the picture below. Important points connected by these routes are for example the university, the airport, the Rusayl Industrial Estate, the business areas of Ruwi and Medinat Qaboos, the touristic areas of Qurum and Muttrah.

The maglev train itself should be more than just a way of public transportation but a symbol for Muscat. It is an intentional decision not to just copy the concept of a metro or bus system from another city but to develop a combined transportation method which is especially suitable for the settlement structure of the Muscat area. The design of the maglev train should be comfortable and modern and underline the advantage of public transport over driving a car by being able to just lean back and read a book or write an e-mail while arriving at one’s destination.

The energy which is necessary to run the maglev train should be produced in a sustainable way by solar or wind energy (see energy concept). Other advantages of a maglev lie in low maintenance cost, the high level of operational reliability, the little noise and zero air pollution.
**Taxis:** Based on the maglev stations the taxis circulate around the stations in a small radius of a few hundred meters so that every passenger can reach his or her desired destination. It is important to point out that the MOMO taxis are not usual taxis but part of the public transportation system. This means that the taxis are not private and also people who don’t know each other can share a taxi if they go in the same direction. Besides reducing traffic through the city the aim of MOMO is to minimize the emissions produced by traffic. Therefore all MOMO taxis are electric cars which run on renewably produced energy.

**Stations:** The stations form the link between maglev train and taxis and play an important role in the MOMO concept. Due to the hot weather, changing between different means of transport can be exhausting and impractical for the passengers. It is therefore essential that the passengers of MOMO can change from maglev to taxi (or the other way round) without leaving the cooled stations. Built in a modern way the stations include a waiting area for the taxis to offer the best and most comfortable connections between the different transportation methods.

**Organization:** Besides the establishment and connection of the two means of transport, the organization of the MOMO is important to make the concept work. A so far unresolved challenge is the call for a taxi that brings the passenger to the

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**Figure 20-21:** Ideas for the stations and electric taxis

**Figure 22-23:** The Triangeln station in Malmö as example for modern station design
closest metro station. There could be a so called “MOMO App” for smartphones which allows passengers to indicate their location so that they get picked up by a taxi within a few minutes. The disadvantage of this method is that it requires a smartphone with internet connection. An alternative could be to order a taxi by phone which requires more time and employees. Moreover a large number of taxis is needed to provide fast transportation even during peak time. This number of taxis might not be in use during the less frequented hours which reduces the efficiency of the transportation system. These logistic challenges have to be faced in detailed planning.

**Time frame**

**Short- to medium-term:** As the MOMO is a leading project in the vision DNA Oman the implementation should start as soon as possible. An efficient public transport system for the Muscat area is long overdue and there shouldn’t be wasted any more time to start with the detailed planning.

**EMO | Electric Mobility Oman**

Beside the key project for the Muscat area, the vision DNA Oman also includes mobility projects for the countryside. One of these projects is the EMO - Electric Mobility Oman. The EMO project is an inter-regional bus system for the Sultanate which will connect the bigger cities in Oman. At the moment some kind of bus systems already exist. The idea is to use a classic transportation concept and combine it with sustainable, non-oil-based and environmentally friendly systems.

Public transport with buses is the cheapest and most efficient system for sparsely populated areas because the road infrastructure is already existing and it’s not necessary to invest in building up an expensive rail system right away. Existing buses should be replaced step by step by modern and low emission vehicles. This measure can be implemented short-termed and it’s also possible to adapt the concept of the bus stations simultaneously for improved comfort.

![Figure 24-25: The Dutch Superbus](image)

These measures can of course only be put into practice if the DNA Oman vision for energy is implemented as the highly technological buses will be in need of much non-oil-based energy. As a reference the concept of the “Superbus” can be mentioned. The “Superbus” is a 15 meters long vehicle for 23 passengers with a
maximum speed of 250 km/h which was developed in the Netherlands and tested in Dubai.

Another important reason for the implementation of a well connected public transportation system is that the reduction of individual traffic can help decrease the number of accidents in Oman.

**iEMO | Individual Electric Mobility Oman**

The iEMO is a project for individual electric mobility in Oman with the same goals as the EMO, which means sustainability and ecologically friendly aspects are very important. In rural areas where it is hard to implement public transportation and every Omani is depending on his/her own car, the iEMO can be an ecologic alternative. The time frame for the iEMO is longer than the timeframe for the EMO because it will take some time to build up a connected system of recharging stations. As in case of the EMO it is also necessary to implement the energy vision of DNA Oman to provide the iEMOs with energy supplies.

![Oman-built electric car](image)

**Figure 26: Oman-built electric car**

Oman has already done a lot of research on electronic cars and these prototypes could be developed further to become the future iEMO vehicle. These are the basic informations which were released in 2010 about the Oman-built electronic car:
- Range: 2,250 miles
- Time between required maintenance: 21 years
- 0-60 time: four seconds
- 800 horsepower engine

To promote the change to and use of iEMO cars some measures by the government should be taken:
- Sales appeal by offering financial support
- Reduced energy rates for the use of iEMOs
- Introduction of taxes for oil-based vehicles
- Awareness raising through marketing campaigns (e.g. unappealing stickers for non-ecologic cars)
Energy | Situational analysis

In Oman Energy is primarily oil-based at the moment. In the last thirteen years the production of natural gas was increased more than fourfold, but just like crude oil natural gas is a non-renewable energy source. If Oman wants to become independent from these limited resources, it has to increase its efforts concerning the introduction of renewable energy. In the last years there has already been made some research in alternative and renewable energy but this sector is still very young nowadays. The country has a lot of potential nevertheless in sustainable production and use of energy. The enormous expanse of desert landscape offers a range of opportunities of investing in solar power plants and the coastal areas hold many potentials in using the wind power. Beside the production of energy another issue is the awareness of sustainable energy use which in fact exists but should be more promoted and spread around the country.
developing

On the topic of energy DNA Oman states, that there has to be a change on how Oman gains his energy and also in the way energy is used. Plainly this means, that Oman has to set a stronger focus on renewable energy, because first the oil sector and in the further future also the gas sector won’t be available in Oman. There is also a big potential to decrease the volume of wasted energy, for example by expanding existing and introducing new district cooling systems, instead of using the comparable energy wasting common air conditionings.

networking

Developing renewable energy of course means that the energy system has to be well considered, and that there has to be a well coordinated network of different types of energy production. For example solar energy is produced during the peak load (while the sun is shining) and thermal energy could be responsible for the medium load. Wind energy and solar energy is most effective in the summer time, which coincide with peak periods of electricity demand in Oman. But the higher the share of renewable energy is, the more difficult it gets to produce energy only at the times, when it is needed and therefore it will be impossible not to think about energy storage systems as well. As the different regions have distinct potentials concerning the production of energy, cooperation and coordination is essential to allow the provision of renewable energy in the whole country.

activating

Because changing the production of energy is a long term process, which has to be done step by step and of course because it should be a sustainable change, which is supported by the population, it is important to activate the people of Oman and raise their interest for the topic of renewable energy. Besides supporting the change by financial aids for people to install solar panels at their own plot of land, the vision DNA Oman should also increase the awareness concerning the economical use of energy.

goals

• Diversification of the energy supply
• Increase the share of renewable energy and primary energy
• Prepare the energy system for the needed capacity
• Produce the necessary energy storage systems for the new energy sectors
• Introduce off-grid systems in areas that cannot be developed economically in another way (e.g. desert camps)
• Saving energy by sustainable cooling systems (district cooling)

main projects

• CSP (concentrated solar power) plants
• PP PV - pilot projects photovoltaic
• Wind parks
• District cooling
• Geothermic research
• Green campaign
Figure 27: Projects concerning the topic energy
Energy | Projects

CSP plants | Concentrated solar power

Concentrated solar power is a very effective way of producing energy, but at the moment it is very expensive to build and the implementation time is much longer than photovoltaic or wind energy. Concentrated solar power is only suitable for large scaled projects and not for small plants. In contrast to photovoltaic and wind energy CSP is still under development and there are a lot of different types of plants, in the future the costs for CSP will decrease. In the pictures you can see some examples for the different types of CSP: The first two pictures show the “PS10 Solar Power Plant” in the southwest of Spain, which is world’s first commercial concentrating solar power tower, while the third picture shows a classical Parabolaic through power plant.

Very important for Oman is the fact, that the produced heat can be used for Desalination, which helps a lot with the water supply. The basic idea is to raise the temperature of sea water causing it evaporate, this condensed water can be used as fresh water.

Advantages:
• Environmentally friendly
• Heat storage possible
• Decreasing costs for CSP in the future
• Suitable for desert regions
• Produced heat can be used for desalination

Disadvantages:
• Expensive to establish
• Not suitable for small plants
• Technology (storage and heat transfer media) still under development
• Implementation of CSP takes longer than PV

Location:
Because of the space consumption of CSP it can’t be used in settled areas and also not in uneven terrain. Because the intensity of the sun is the most important factor it should be located in the south of the desert.

Time frame:
CSP plays a major role in our concept, because it uses the sun in its most effective way. Because this will be a key technology for Oman the implementation of CSP will be a long process. It is useful to make large-scaled projects, but in order to consider the different types of concentrated solar power it is better to make experiences with the different types of CSP instead of just forcing the cheapest or most efficient method(s). Therefore it is necessary to take enough time for reflecting the first facilities and to explore possible improvements on the different systems. And
because of the long time frame it is especially important to start with the first CSP projects as soon as possible.

**PP PV | Pilot projects photovoltaic**

The best proven technology is photovoltaic, which is very easy to apply and can be used even by single households themselves. This technology is also suitable for off-grid systems, which play a major role for the areas that are very isolated and therefore not suitable for on-grid connections. Examples for these operational areas are desert camps and small villages which are laid far away from other settlements. In contrast to concentrated solar power the implementation for photovoltaic is extremely short.

**Advantages:**
- Environmentally friendly
- Very flexible in size
- Decreasing costs for PV in the future
- Suitable as off-grid as well
- Simple to apply
- Proven technology
- Low maintenance
- Long life time

**Disadvantages:**
- Expensive to establish
- Only works while the sun is shining
- Directly produced electricity is expensive to store

**Location:**
The location for PV projects could be anywhere, because it even works with hazy conditions, off-grid systems can be used in areas with very little settlement (e.g. desert camps, bus stop in the desert) for local use.

**Time frame:**
The first projects that should be realized are the photovoltaic sector and the wind...
energy, because both types of energy winning can be implemented fast. In order to improve the situation for those who are not connected to electricity yet, it is suggested to force the off-grid systems first and then to introduce it to public buildings and also try to convince the private households from using photovoltaic themselves. The first two points concerning photovoltaic can be realized within a few years; the third point of course means awareness rising and therefore is a process, that has to run for a long time in order to change the mentality of all generations.

**Wind parks**

Wind energy is better adapted for large amounts of energy, but in contrast to photovoltaic it’s not possible to implement it close to a settlement, because of the visual impact and because of the possible noise emission (according to the direction of the wind). Like photovoltaic wind energy is a well proven technology with a short implementation time. To produce energy for the Muscat area it is suggested to build an offshore wind park located at the northern coast of Oman, because it is important that energy is produced where it is needed in order to keep the conduction losses small.

![Offshore and onshore wind parks](image)

**Figure 33-35: Offshore and onshore wind parks**

**Advantages:**
- Environmentally friendly
- Short implementation time
- Proven technology
- Low noise pollution and visual impact if established offshore

**Disadvantages:**
- Visual impact on the landscape
- Noise emission is possible
- Directly produced electricity is expensive to store

**Location:**
Wind energy could easily be produced in the Dhofar Region in the area around Thumrait, because it shouldn’t be located near to settlements because of the noise impact and the southern part of Oman has got more wind, than the north. To supply the Muscat area it is necessary to establish an offshore wind park at the coast ahead of Muscat.
Time frame:
Beside the first projects in the photovoltaic sector some projects of the wind sector should be realized very soon as well: First a wind park in the Dhofar Region in the area around Thumrait should be realized, which can be implemented in just a few years.

Further projects concerning wind energy will be offshore wind parks at the northern coast of Oman to supply the Muscat area. Because offshore wind parks are more expensive and more complicated to convert, it is important that this project is well-considered and therefore it is necessary to give the project enough time to be developed in detail.

**District cooling**

Because of the climate in Oman and because of the wealth of Omani people there are many air conditioning systems. Those systems need a lot of electricity, around 70% of total building energy, and therefore it is necessary to reduce the consumption of energy, wherever it is possible. One way of reducing it without giving up a cool climate is “District Cooling”. It works similar to the principles of district heating, which is more common in European countries. There is a central plant, which chills water that is pumped through a pipe network to the buildings of the customers. In each building, which is connected to the pipe network, there is a water circuit that circulates the cold water and produces an air conditioned environment. In the central plant the warm water will be re-chilled again. Compared to common air conditioning District Cooling can save up to 55% of energy. Beside this positive effect for the environment it also helps to reduce the energy and maintenance costs for the buildings.

District cooling is especially suitable for large-scaled, high density population developments in cities, there are already lot of projects for District Cooling in the Gulf-region, for example the Metro in Dubai, or the Knowledge Oasis (KOM) in Oman.

Because the Omani people have a tradition in building their own houses we think the first projects concerning district cooling should be public buildings, District cooling would be very suitable for Economy and Knowledge Centers, but also for MOMO (Muscat Optimized Mobility Organization).

**Geothermic research**

At the moment there are not too many geothermal power plants and it is quite expensive to use it, nevertheless geothermal power supply could play an important role for Oman in the further future, because in contrast to solar energy and especially to photovoltaic, which cannot store the produced energy effective geothermal energy can be used constantly for the medium load, while the solar energy produces most energy while the peak load (over the day time). For the hydrothermal power generation water temperatures have to be at least 100°C, to drive a turbine directly it has to be over 150°C, to reach these temperatures there are expensive deep drillings with some kilometers depth necessary, but with some methods (for example Organic Rankine Cycle, Kalina Cycle) it’s possible to produce energy even with temperatures of less than 100°C. Because the efficiency then is not very high and there are other processes in development it is important to watch the development of geothermal power supply and explore this field of energy winning.
Location:
The highest soil temperatures (90 to 174°C) are located in the northern part of Oman in the mountains, especially around Nizwa between Ibri, Fahud and Ibra.

Time frame:
In the future, especially when there is no Natural Gas left geothermal power could play an important role in Oman for the medium load, but as it is not necessary for the peak loads, which can be covered by solar and wind energy, in the first step it is enough to focus on the research concerning geothermal power.

Green campaign

Beside the development of sustainable energy systems in Oman it is also very important to raise the awareness for the importance of reducing the energy consumption in general. In Oman there already exist some campaigns for raising the public awareness for sustainability. There is also an own category at the „Green Oman Awards“ for the „green campaign of the year“. The challenge is to spread these campaigns all over the country and involve more people.

Participation process

One method of spreading the information about awareness could be realized in the context of the regional forums (see also key topic Tourism). For the public a participation offer, for example a “World Cafe”, could take place, where people are invited to join the process of developing a sustainable country. The idea is to talk about “my personal energy vision” and discuss the possibilities of implementation. It is not about finding the one solution. The process of talking about own wishes and visions helps raising the personal awareness for sustainability and the use of energy.

Web 2.0

Sharing the campaigns for energy awareness can be enforced by modern technical ways of communication. The concept builds on a platform which connects all people and constructs a network of ideas. With the aid of technical devices like mobile phones, tablet PCs or interactive info-screens it is very easy to spread information. The main idea is that people can not only view the information but also take part in the process of building up awareness. Through applications everyone can add ideas and comment on the different topics and share them with others on the internet. This will help raising the personal awareness and bring new ideas and concepts to the people. It might also increase the feeling of solidarity between the citizens.
Regional potentials

As the potentials and opportunities of the regions and Governorates of the Sultanate of Oman differ quite a lot, the following short regional descriptions try to give an idea about the special conditions that should be kept in mind for each region when looking at the vision DNA Oman.

**Dhofar Governorate**

The Dhofar Governorate differs a lot from the rest of Oman as the climate is less hot in summer during Khareef, the monsoon rain, which occurs in this part of the country. Because of the heavy rainfalls there is generally more vegetation, which makes the landscape greener and more fertile and suitable for agriculture. Especially during summer the coastal region is attractive for tourists from Oman (and other gulf states), because temperatures are lower than in the rest of the country. The majority of the inhabitants of the Dhofar Governorate is living in Salalah and smaller villages along the coast. Salalah is the second biggest city of Oman and the most important center of the Southern part of the country. It has now around 200,000 inhabitants of which 60% are employed by the government. This percentage shows clearly, that there is still a lot of potential for growth in the private sector, concerning both industry and services.

The interior of the region is mainly covered by sand and stone desert and is sparsely populated. Due to high average temperatures the potential for solar energy fields in this area is very high.

Besides its geographical and economical potentials, the Dhofar Governorate and especially the city of Salalah show a strong independence from the rest of the Sultanate and a lot of courage to change. This makes the area ideally suited for the realization of modern pilot projects for example concerning energy, mobility or building structure.

**Al Wusta Region**

The Al Wusta region is characterized by its enormous deserted areas and the very small amount of people living in this part of Oman. From the few villages in this region, Duqm has the highest development potential because of its strategic location at the Arabian sea. At this time the Sultanate is building a big port in Duqm which should be followed by a significant population increase and urban growth in the city in the next 15 years. Right now it is still uncertain whether Duqm will grow as planned or not. In the vision DNA Oman the city of Duqm is of strategic significance, as with the transformation from a small fishermen’s village to one of the biggest cities in the country there are lots of opportunities which could be taken. For example concerning building structure, energy efficiency, economy and education the city has a lot of options for realizing innovative ideas and solutions.

The interior of the region is almost entirely covered by sand and stone desert and reaches very high temperatures throughout the year. The high number of sunshine hours makes the region suitable for solar energy production, the areas close to the Saudi Arabian border also show potential for geothermal energy production. The touristic potential of the region lies in the adventure and desert tourism.
Musandam Governorate
There are two main factors which determine the special position of the Musandam Governorate: Its geographical position, which separates the Governorate from the rest of the Sultanate, and its small number of inhabitants (appr. 30,000 in 2010). Nevertheless these factors seem to limit the development potentials of the Musandam Governorate it plays an important role in the vision DNA Oman. Following the principles of the vision, the decentralized development of all regions is essential for the network of innovative cities. Especially the fields of tourism and energy production through offshore wind turbines but also the building of an economy and knowledge cluster, although in a smaller scale than in other cities, are the most promising opportunities in the northern exclave of Oman.
Like in other regions, the establishment of cooperation and achievement of synergies with the United Arab Emirates will play an important role in the future of the Musandam Governorate. It is already an important touristic destination for people living in and around Dubai who come to Oman to enjoy the beaches and beautiful landscape of the region. The distance of less than 140 kilometers between Dubai and Khasab offers a lot of possibilities in the fields of tourism and economy. Another relatively strong potential of the Musandam Governorate is the agricultural field of fishery, which could possibly be combined with the touristic significance of the region.

Muscat Governorate
The capital area of Oman is an urban area of unique size and density in the country, therefore special solutions concerning mobility, building structure and energy efficiency are needed. The focus of the vision DNA Oman in the Muscat Governorate lies on the realization of an efficient public transportation system (MOMO) and the establishment of economy & knowledge clusters which support innovation and offer possibilities in vocational and higher education. Besides that the connection and cooperation of Muscat with the other Omani cities is an essential goal of the vision.
With about one third of the whole population of the Sultanate living in the capital area, the Muscat Governorate plays a very important role in the vision DNA Oman. With a lot of young people, for example the students of Sultan Qaboos University, the region has a high potential for modern solutions concerning all key topics. As the capital of the Sultanate, Muscat is also the linking element between Oman and the rest of the world. Exemplary pilot projects realized in Muscat can serve both as models for other cities in Oman and as statement concerning the position of Oman in the global world.

Regions of North Western Oman
(Ad Dhahirah, Al Batinah North, Al Batinah South, Al Buraimi)
The regions of Al Buraimi, Al Batinah North and South and Ad Dhahirah can benefit from the spatial closeness to the United Arab Emirates, which can be an advantage both concerning economy and tourism. This part of Oman owns a strategically important location in the economically strong triangle of the cities Dubai, Abu Dhabi and Muscat.
Especially the city of Sohar has already a relatively strong industrial sector and has a lot of potential for further development also in connection with innovative technologies and products. Following the vision DNA Oman also the other main cities, Al Buraimi and Ibri, should be strengthened in the economic and educational sector. As for all regions in Northern Oman the inter-regional transport connections between the cities are of high importance.

The Al Batinah regions have great significance in the agricultural sector, as this is the most fertile area of Oman and the most suitable for growing fruits and vegetables. This potential could possibly be developed further towards an e&k cluster specialized in food production.

**Regions of North Eastern Oman**
(Ad Dakhiliyah, Ash Sharqiyah North, Ash Sharqiyah South)

The converge of the mountains, the desert and the coastal area makes the North Eastern part of the Sultanate especially attractive for touristic activities. The area around Nizwa also has a lot of cultural sights to offer whereas the area around Sur is industrially affected. According to the vision DNA Oman both cities should continue using their strengths and at the same time start building a future based in high quality education and innovative economy.

A special feature of the region are the Falaj irrigation systems which origins date back to the 6th century BC. The Falaj provides irrigation facilities for cultivation of fruits such as dates, limes and mangos. The region is moreover famous for its inherent natural beauty and the variety of landscapes.
Implementation

For the vision DNA Oman a homepage and a report were developed. The homepage is currently available under www.ifip.tuwien.ac.at/p3oman/dna.

The written report mainly contains the same topics and texts as the homepage and was created to enable reading about the vision DNA OMAN in a neatly arranged way. Another point is that the homepage requires internet connection and a report can be read without any technical devices. Through the report the vision DNA OMAN can reach a larger number of people and can be distributed also to people, who are not familiar with the internet.

Beside the report a website was created which mainly includes the texts from the report but also involves an interactive map which is the heart of the homepage. Nowadays it is indispensable to be present on the internet with a project to spread information widely and efficiently. A proper email address (oman.dna@gmail.com) was installed, so it is easy to contact the team for more information.

The idea of the homepage is that it is very easy to share all around the world through the internet and also can be modified and improved very easily. It is possible to spread the information about the vision DNA OMAN through info-screens on well-frequented places or by publishing applications for mobile devices like mobile phones or tablet computers. A further adaptation to the homepage of the vision could be an interactive forum where people can add their comments, opinions and critics about the vision and the projects.
Team

Eva Maria Halwachs  
0725786

Johannes Hatzl  
0726934

Patrik Hladschik  
0527724

Eva Purkarthofer  
0726496

Please contact the team under oman.dna@gmail.com!
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Figure 32: Example of PV implementation  
Source: http://www.belectric.com/typo3temp/pics/a1a95d2d8f.jpg

Figure 33: Offshore wind park in Denmark  
Source: http://images.travelpod.com/tripwow/photos/ta-00f3-b6e8-73de/wind-turbine-from-norwin-roskilde-denmark+1152_12987188451-tpfil02aw-22663.jpg

Figure 34: Onshore wind park  
Source: http://xahlee.org/Whirlwheel_dir/livermore/116m.jpg

Figure 35: Offshore wind park  
Source: http://lifeglobe.net/media/entry/1286/95_3.jpg

Figure 36: Dhofar Governorate  
Source: Authors

Figure 37: Al Wusta region  
Source: Authors

Figure 38: Musandam Governorate  
Source: Authors

Figure 39: Muscat Governorate  
Source: Authors

Figure 40: North Western regions  
Source: Authors

Figure 41: North Eastern regions  
Source: Authors

Figure 42: QR Code of DNA Oman  
Source: Authors (via goqr.me/de)

Figure 43: Interactive Info-screen  
Source: http://relevant.at/system/galleries/upload/2/4/3/175779/2759064154723920_BLD_Online.jpg

Figure 44: Interactive Info-screen  

Figure 45: QR-Codes  
Source: http://www.qrmore.com/media/4722/qr-code-branding_500x489.jpg
Figure 46: Tablet PC

Figure 47: Eva Maria Halwachs
Source: Authors

Figure 48: Johannes Hatzl
Source: Authors

Figure 49: Patrik Hladschik
Source: Authors

Figure 50: Eva Purkarthofer
Source: Authors