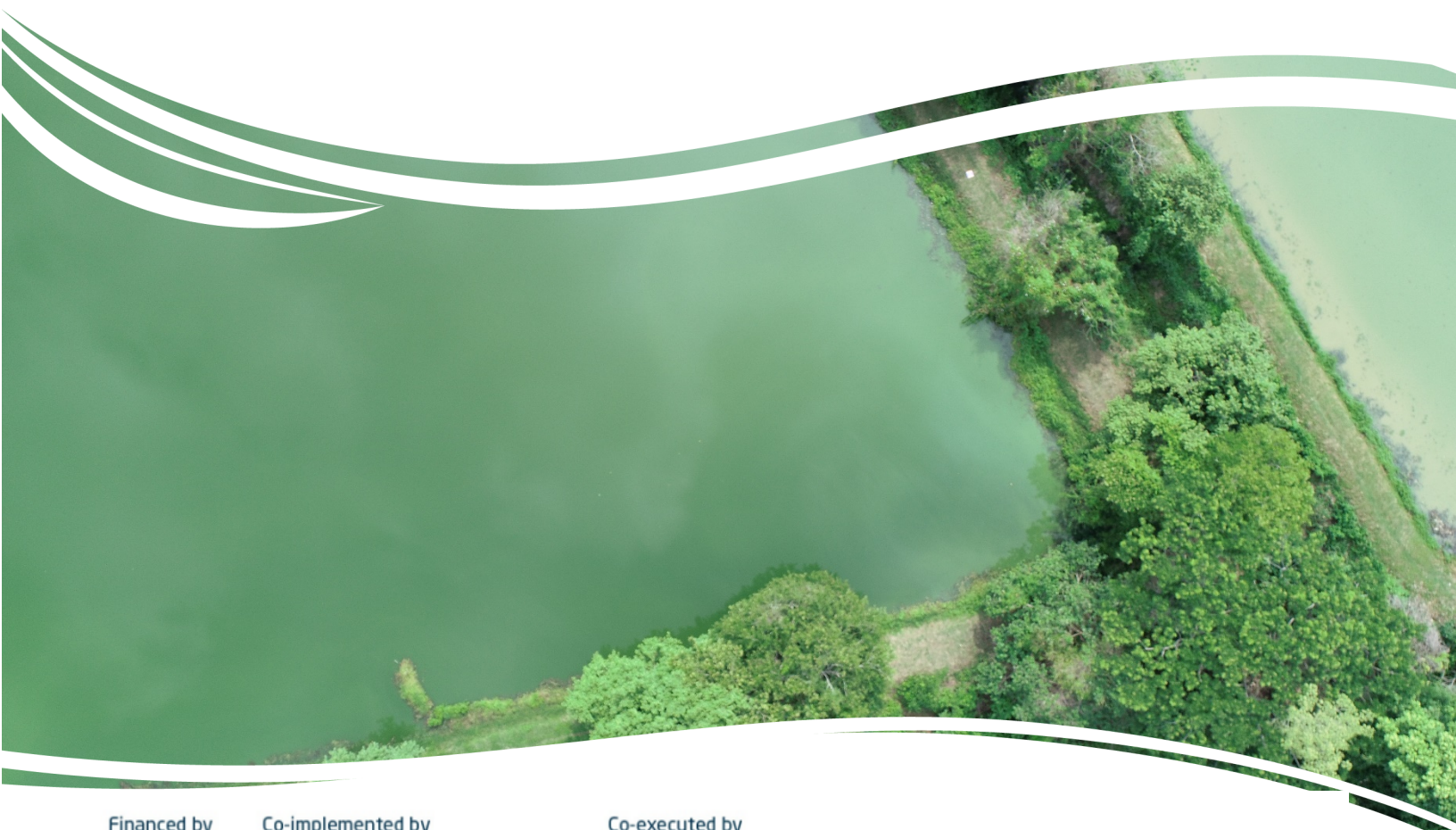




Good Practices

Planning and design for the construction of a water reuse system in San Antero, Colombia.

Historia de éxito



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Best practices in planning and design of treated water reuse systems

A treated water reuse system in San Antero, Colombia.

Success story in Colombia.

Project Description

The GEF CReW+ project "An integrated Approach to Water and Wastewater Management using Innovative Solutions and Promoting Financing Mechanisms in the Wider Caribbean Region" is a partnership project funded by the Global Environment Facility (GEF) and co-implemented by the Inter-American Development Bank (IDB) and the United Nations Environment Programme (UNEP) in 18 countries of the Wider Caribbean Region (WCR). This innovative project builds on the successful previous phase called "The Caribbean Regional Fund for Wastewater Management (CReW)" (2011-2017). CReW+ is being executed by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the Organization of American States (OAS) and the Cartagena Convention Secretariat (UNEP-CAR/RCU) on behalf of the IDB and UNEP respectively.



Figure 1: San Antero church, Col. / Foto: © GIZ/ Diana García

Project activities focus on four main components:

Component 1: Rethinking Wastewater Policy: Institutional and policy reforms for Integrated Water and Wastewater Management (IWWM).

Component 2: Financial sustainability: Sustainable and tailored refinancing options for urban, peri-urban and rural IWWM.

Component 3: Design and management of wastewater facilities: Creation of innovative small-scale, local, rural, peri-urban, and rural solutions.

Component 4: Experience sharing: Knowledge management and advocacy on the importance of IWWM to achieve the Sustainable Development Goals (SDGs).

In the case of Colombia, the project worked on technical support for the tariff reform of the sanitation and drinking water sector through the government entity CRA (Comisión de Regulación de Agua Potable y Saneamiento Básico, Portable Water and Basic Sanitation Regulation Commission), to include reuse in the tariffing that is being reformulated, thus covering axes 1 and 2 of the project. For the third axis, the project supports the country in the implementation of a pilot project for the reuse of treated wastewater in the municipality of San Antero, Córdoba.

The pilot project seeks to optimize the existing infrastructure of the San Antero municipal domestic wastewater treatment system. The system is composed of three oxidation ponds, which have operational problems and maintenance failures that prevent achieving the necessary quality to perform a discharge according to resolution 631 of 2015. Through pre-feasibility studies, the points that require greater attention to achieve the operability of the system were identified. Subsequently, a consulting firm was hired to design in detail the optimization of the lagoons and the reuse system. A part of the flow treated in the lagoons will have an additional treatment to meet the requirements imposed in resolution 1256 of 2021 that regulates the reuse in the country. The treated water will be used for irrigation of a forage pasture crop and a forestry crop established on land adjacent to the treatment system, which is intended to be managed through an association of small-scale farmers for a community benefit from the sale of these pastures.

The Experience

In Colombia, despite having a large number of regulatory standards for integrated water management, important aspects such as the reuse of treated wastewater have not yet been included in practice. Due to this lack of inclusion, the country has little experience in this field. Initiatives related to this issue have been developed empirically, seeking to meet the urgent need for the resource, but without considering sanitation and public health issues or the national and local standards that regulate safe reuse since 2014. The informality of the few national examples is reflected in the absence of formal data from the entities in charge of controlling water resources in the country. This situation is being countered thanks to the efforts of the national government, which, in its National Circular Economy Strategy, has prioritised the flow of water among the six material flows of great importance for the country. In addition, efforts have been concentrated on the regulation of reuse, through the updating of resolution 1207 of 2014, seeking greater ease for both generators of the resource and potential users to have reuse agreements through a more flexible standard with fewer requirements: resolution 1256 of 2021.



Figure 2: Bank of the Río Sinú Col. / Foto: © GIZ/ Diana García

On the other hand, the population of the municipality is generally unaware of the wastewater treatment processes generated in their communities. They only pay attention to them when the effects of poor operation of the treatment system generate adverse impacts, such as the permanent presence of bad odours or the visible deterioration of the water resources where the treated water is discharged. These conditions generate a rejection of these waters, which are deliberately associated with the appearance of diseases, damage to crops, contamination or damage to soils, among others. However, the national policy seeks a safe reuse of treated water with the necessary quality conditions that allow its use and do not generate negative impacts on people or resources, such as water or soil associated with reuse. It is therefore important to provide greater knowledge, ownership, and training to enable reuse and to become a widespread and safe practice in the country.



Figure 3: Creek El Lobo, San Antero, Col. / Foto: © GIZ/ Diana García

This allows these practices to be replicated throughout the country and the benefits to be understood by the general population, considering that the safe reuse of treated water reduces the pressure on water resources, increases the availability of water for other uses and avoids the discharge of nutrients and high organic loads that deteriorate its quality. An example of this is the case of San Antero, where the stream receiving the discharge does not have the capacity for purification as it has a lower flow than that received by the municipal discharge. Another advantage of reuse is the availability of water 365 days a year, which is crucial in certain areas of the Colombian Caribbean, where periods of drought can be longer than four months, making it impossible to grow certain food crops with high water demand, forcing the sale of livestock as there is no pasture for their sustenance and generating economic losses in families that depend on their crops or livestock for their daily sustenance.

Another important challenge is the operation and maintenance of the treatment systems, as it is common that the systems are built but the operating companies do not have the financial resources and/or sufficient technical staff for their maintenance, understanding that on many occasions there is more pressure to maintain and correctly operate the aqueduct systems than the sewage systems. The common thinking is that there is a greater benefit for the population with the supply of drinking water than with the correct management and disposal of wastewater. In addition, the operation of sewage systems is generally more expensive. On the contrary, in systems that do not require electrical power or chemical inputs such as Nature Based Solutions (NBS) e.g., oxidation ponds, the systems function autonomously and do not require operation and/or maintenance, which often leads to the abandonment of the treatment systems and an increase in operational problems that lead to cost overruns when they are restarted.

In the case of San Antero, the company operating the water and sewerage system has not had the best performance to guarantee the provision of services, leaving the population without drinking water for prolonged periods and not carrying out the necessary maintenance activities in the wastewater treatment system, so the perception of the general population is negative when it comes to rating the service. The challenge for the implementation of the optimised treatment system lies in achieving a greater commitment and coordination of all stakeholders to guarantee the operation and maintenance of the measure and its sustainability over time. To achieve this, the GIZ has provided support and coordination between the municipality and the operating company to ensure clarity on the costs of operation and maintenance, activities, and personnel to be assumed by the parties before and after the rehabilitation. These commitments have been formalised through an agreement between the parties where there is not only a commitment to carry out the activities, but also awareness for the importance of working together to achieve the sustainability of the project while reaching common benefits through its implementation and sustainability over time.



Figure 4: San Antero, Col. / Foto: © GIZ/ Diana García

Planing and design activities of the GIZ

- Pre-feasibility phase: Through a consultancy it was possible to document the current state of the treatment system, which showed advanced deterioration mainly due to lack of maintenance of the lagoons over a prolonged period. At present there is an excessive accumulation of sludge, tree growth around the lagoons and infrastructure in an advanced state of deterioration. The consultancy established the needs and alternatives required for the rehabilitation of the treatment system. Preliminary work with potential beneficiaries took place to establish alternatives for the reuse of treated water.
- Due to the fact that in November 2021 the standard regulating the use of wastewater (1256/21) was updated, which modified the initial reuse standard (1207/14) on which the pre-feasibility was based, it was necessary to update the reuse options to adapt them to the current standard. This resulted in the feasibility of water reuse for irrigation of cut pasture, benefiting both small-scale livestock farmers who receive their pasture as a subsidy in times of drought and the municipality, which must purchase the pasture from third parties.
- Detailed design phase: Subsequently, detailed engineering of the alternative identified in the prefeasibility was carried out. It includes the design devices that improve flows and retention times and thus water treatment but thereby maintain the existing infrastructure. In addition to the plans, details, calculation memories, budgets and the documents required by the environmental authority were generated for the application for the forestry exploitation permits. This should authorise the removal of the trees.
- Environmental baseline: The baseline study was carried out through a complete environmental characterisation of the area of influence of the treatment plant discharge. Once the implementation is completed, the characterisation can be carried out again and the impact of the rehabilitation project of the treatment system and the reuse system can be evaluated, especially on the water sources associated with the discharge, which finally flow into the Caribbean Sea. This project was carried out in cooperation with INVEMAR (Instituto de Investigaciones Marinas y Costeras José Benito Vives Andrés) and financed by the German Federal Ministry for Economic Cooperation and Development (BMZ).

Complementary activities of the GIZ

On the other hand, the aim was to increase the population's knowledge of reuse, making clear the difference between the safe use of treated water and the use of contaminated water for crop irrigation. This was achieved through the participation of associations of small-scale farmers, livestock farmers, fishermen and mangrove farmers in the workshop "Integrated crop management with irrigation by reuse of domestic wastewater, focusing on forest and agricultural species", in which technical knowledge was strengthened regarding efficient water management in crop irrigation, irrigation techniques, types of crops, soil care, benefits of reuse, the importance of this new vision for environmental sustainability, among other topics. This approach not only allowed to impart technical knowledge for the better development of their daily work, but also improved the acceptance and interest of the community in the project. This workshop was financed by the German Federal Ministry for Economic Cooperation and Development (BMZ) and developed and implemented together with the GIZ global programme [Sanitation for Millions](#).



Figure 5: Workshop on cultivating crops with reusable wastewater, San Antero, Col. / Foto: © GIZ/ Diana García

GIZ has accompanied the municipal administration in the search for alternatives for the operation of the wastewater treatment system and the treated water reuse system, as a precautionary measure due to the failure of the operating company to guarantee the proper functioning of the system. Therefore, finding operational alternatives is especially important in the project. For the operation of the irrigation system, we have worked together with the leaders of the small-scale farmers' associations, to whom the municipality could provide financial support in the initial phase of establishing the crop and using the resources currently available for the purchase of cut grass during the dry season, which represents 45,000 US-Dollars per year. Therefore, this money could be invested in the operation of the irrigation system, which would represent a continuous income once the crop has been established. In this way the operation of the irrigation system would be guaranteed directly by the municipality without having to depend on the service provider.

Expected impact

Thanks to the activities that were developed in a participatory manner for the planning and design of a treated water reuse system, it has been possible to collect important information such as duration and costs of environmental permits, additional treatment requirements, necessary technical staff, among others. Those have been shared with stakeholders (Ministry of Environment and Ministry of Housing and Municipality of San Antero). It is expected that after the implementation of the pilot project, even more data could be generated. That would allow for a concrete analysis of the application of the reuse standard in specific projects and the economic possibilities of obtaining benefits that would make reuse more attractive for both public utilities and individuals. In addition, at the working tables with the ministries, it has been discussed that once the pilot project is implemented, it will be possible to analyse with real data, the requirements, costs, time, and benefits of a reuse project, with which the regulations can be reviewed. In comparison with resolution 1207 of 2014, they are no longer so restrictive. But it still presents some challenges in terms of implementation, which prevent the application of reuse in the country from spreading throughout the territory due to the fact that the social, environmental, and economic benefits of using treated water safely in production processes are visible and tangible.

For the specific case of San Antero, and the implementation of the construction, there will be multiple benefits, starting with the adequate treatment of the municipality's wastewater, which will both allow compliance with dumping regulations and the elimination of bad odours and reduce the contamination of water sources, especially in the bay of Cispatá. Thereby, it will improve the living conditions of fishermen and promote tourism in the area. In relation to reuse, there will be a year-round production of cut pasture, which will benefit small-scale livestock farmers as they will be able to sustain their livestock throughout the year and not have losses from their sale in summer when there is not enough pasture to feed them. In addition, the community can manage the reuse and production of cut grass, so that small-scale farmers perceive it as an additional source of income, an improvement in production and a greater commitment from the operating company to guarantee the quality of water needed for irrigation. These are some of the benefits that could be generated after the implementation of the project, demonstrating that reuse can not only improve the environment but also generate direct and indirect benefits to the population and their living conditions as discussed below:



Figure 6: Benefits of reusing treated wastewater in San Antero, Col. / Source: © GIZ/ Diana García

Results and Learning

What should be avoided?

- Find and identify available land and land tenure before pursuing land implementation opportunities:** During the pre-feasibility of the project, work was done with the community to identify possible areas for reuse implementation. Initially, there was a lack of interest from the landowners near the treatment system, a distrust of using treated water and a resistance to change their practices and carry out additional activities such as the rotation of plots for grazing, which implied preventing the passage of livestock to the irrigated area for a period of time, among other activities. When this situation was found, it was decided to use areas adjacent to the treatment system that belong to the municipality. These lands have the necessary title to process permits and facilitate the intervention. Subsequently, other ways could be sought to link the owners of nearby land in the project in later stages.



Figure 7: Existing infrastructure and wastewater treatment system, San Antero, Col. / Foto: © GIZ/
Diana García

- Initial identification of the current state of the infrastructure to be intervened to include rehabilitation/upgrade costs in the implementation budgets:** Changing all existing elements of the treatment system was discarded after a cost/benefit analysis during the design phase, prioritising alternatives that allowed an improvement in water characteristics (quality) and correct operation, as well as facilitating subsequent maintenance. The additional costs associated with changing elements of the system should be taken over by the operator, who will gradually be able to make these investments. However, considering the characteristics of the operating company, it is not possible to guarantee that these investments will be made over time. Ideally, the change of all elements should be included in the project, whenever feasible, avoiding leaving activities that could hinder the normal operation of the treatment system to third parties.

The construction will not be carried out by the GIZ because the IDB and the GEF CReW+ project did not have sufficient funds for the implementation. However, it is important that the resources needed for construction are calculated from the beginning of the project with assumptions of price increases for materials, longer execution times, additional activities, and unforeseen events. As mentioned above, part of the cost overruns of the intervention is due to the lack of maintenance of the treatment system, which is the responsibility of the operating company, and which generates not only an increase in project costs but also a longer time for the execution of construction activities. Therefore, it is important to investigate the initial conditions of the treatment systems, as in the present case, in which sludge clogging is so evident that it could have been considered at an early stage to be included in the cost calculation.

- Institutional strengthening actions should not be overlooked in order to guarantee the sustainability of the project once this institution has to assume the operation and maintenance of the intervened infrastructure:** It was initially thought that both the operation of the wastewater treatment plant and the reuse system should be assumed by the municipality's operating company. However, it was identified that the contractual obligations regarding operation and maintenance were not being fulfilled by the operating company and that there were administrative and legal problems between the municipality and the operating company due to this non-compliance. It was necessary to reconsider this point, so it was considered that the operation of the reuse system should remain in the hands of the municipal administration, since the operating company is not legally obliged to assume this extra operation and there is an additional risk of increasing the responsibility for operation with a corresponding increase in costs for a company that is not fulfilling the initial commitments in the operation of the treatment system. Ideally, an operating company would find a reuse project attractive and incorporate it into its operation and maintenance activities, so that the management of treatment and reuse is in the hands of the same entity, thus avoiding potential conflicts of interest that could jeopardise the sustainability of the system as a whole.

What should be promoted?

- The collaborative participation of interested institutions facilitates compliance with administrative procedures and increases stakeholder commitment:** Having the support of the local administration is fundamental for the correct development of the project. This support allows streamlining administrative procedures that are necessary for the proposed optimization, and their commitment allows defining their roles and responsibilities from the beginning, which, thanks to their willingness, allows them to maintain this responsibility throughout the project. In the case of San Antero, they will be responsible for the environmental permits and the obligations associated with them and for the operation of the reuse system, so involving them in each of the stages is key to ensure that both the costs to be assumed by them and the benefits are understood and socialized to the responsible persons and that the necessary resources are projected and guaranteed even before implementation.

Similarly, involving central government entities and seeking their support for the processing of key activities for the development of the project gives it greater importance at the local level, thus reducing the time required for certain administrative steps. In addition to accompanying both the municipality and the operating company to socialize the progress and expected results to achieve the sustainability of the intervention, as explained above, it is key to have a vision of the degree of commitment of each entity, the importance of the intervention for them and their vision for the future.

- **Seek alternatives that maximize the benefits of the project, and that are in line with the regulations:** For reuse projects it is important to analyse the possible applications. Initially, it was thought that it would be used for crops for direct human consumption, or for irrigation of green areas. But regulations changed as the project progressed, limiting reuse to this type of crops, so the alternatives for reuse had to be rethought. Finally, it was decided to have a pasture crop for livestock and a complementary forest crop in the area.
- **Participatory work that allows the integration of the visions of different stakeholders strengthens the project and its results:** Involving the community from the initial stages makes it possible to identify potentialities for reuse application, to know their position on the issue and to generate synergies to support the process at each stage. In addition, it is possible to work on strengthening their capacities and finding options to make the results even more visible to them as direct beneficiaries. By doing so, they become involved first hand, seeking alternatives for participation that could even be addressed in terms of gender, as in the case of San Antero, where a potential has been identified for the reuse project to be headed by women leaders of small-scale farmers' associations.
- **Complement technical activities with scientific processes that support the benefits achieved by a project and its results can be understood in all spheres:** Supporting parallel research topics allows enriching the results of the project with a broader vision of the changes that can be generated in the territory. These results should be socialized in large scenarios to increase their dissemination. Since being a pilot project, it seeks to be replicated in more scenarios thanks to the social, environmental, and economic benefits identified and thus have a greater impact. In the case of San Antero, through INVEMAR a project was developed to evaluate the environmental quality of water bodies and mangrove receiving domestic wastewater discharges in the municipality of San Antero, department of Cordoba. This research was carried out before the intervention, thus providing a baseline for subsequent evaluation after the implementation of the optimized treatment system and the reuse system. This will make it possible to identify changes in environmental quality associated with the project. The project carried out by INVEMAR was financed by the German Federal Ministry for Economic Cooperation and Development (BMZ) and supported by the GIZ global program *Sanitation for Millions*.



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Figure 7: Document Evaluation of the environmental quality of water bodies and mangrove forests receiving domestic wastewater discharges, INVEMAR, San Antero, Col. / Source: INVEMAR, 2022.



Figure 9: Local ecosystems that would benefit from reuse. San Antero, Col. / Foto: © GIZ/ Diana García

Potential challenges for implementing the policy: sustainability, financing, policy changes

The project has had a participatory approach in which each stage of the process has been influenced by the results obtained, the risks identified and the ideas to be developed in subsequent stages, involving the Ministry of Environment and Sustainable Development, the Ministry of Housing, the Drinking Water and Basic Sanitation Regulatory Commission, the San Antero Municipal Mayor's Office, leaders of community organizations and the beneficiary population.



Figure 8: Participants of the workshop on integrated crop management, San Antero, Col. / Foto: © GIZ/ Diana García

Through the development of the project and its final results, it is intended that these entities involved identify strengths and weaknesses of the current reuse standard to achieve a greater application of reuse alternatives in the country, assess the costs involved in the administrative procedures versus the social, environmental and economic benefits, identify alternatives to facilitate the application, especially in small groups of reuse users, among other opportunities to extend the experiences to other municipalities.

The project has also supported the Portable Water and Basic Sanitation Regulation Commission in identifying the potential of reuse in the tariff, since the commission is in the process of updating its tariff, which has allowed identifying alternatives not only for the commission in the structuring of its tariff, but also for the sewerage service providers to identify potential for the application of reuse within their business scheme. Doing so provides users with a safe water alternative, makes it more economical and includes greater benefits in the case of crops.

Finally, according to the IDB, it is expected that the implementation of the construction will be carried out by an NGO, so that the benefits described here are materialized and can be scaled and replicated throughout the country, ensuring that the safe reuse of treated water is taken as an opportunity for all stakeholders in the sector. Made possible by the multiple economic, social, and environmental benefits associated with it, which are tangible and measurable in the experience of San Antero.

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