***Switch On* Episode 1: Modern Cooking Fuels Transcript**

0:00:05.680
Scott Tinker: Nearly three billion people today still burn wood, straw, charcoal, or dung for cooking or heating. The smoke from these fires fills their homes and their lungs, breathed in mostly by mothers and their children, and leading to disease and premature death across the developing world. Many governments, international agencies, and local businesses are trying to address this problem. Some have tried more efficient stoves for burning wood, but the smoke persists. Most now agree that the solution is to change cooking fuels.

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ST: There are nearly 3 billion people today who still live with little or no energy. And what I want to know is how they'll finally get it. So this is sort of what it was, and that's the future. I'm Scott Tinker and I study energy. Come with me around the world to meet people and communities as they *Switch On*.

0:01:22.560
ST: To get a first-hand understanding, I went to Nepal, to meet a team studying the transition away from wood and biomass fuels. The challenges and solutions they're seeing here are the same in developing countries around the world. The leader of this project is environmental health scientist, Dr. Amod Pokhrel.

0:01:43.920
Amod Pokhrel: So here what we're trying to do is create a smoke-free village. Our definition of smoke-free village is that eighty percent of the time all the households use clean energy. That's our target.

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ST: You say clean cook stove, what's what do you mean clean?

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AP: Our definition of clean cook stove is gas and electricity and the by gas or LPG or electric cook stove.

0:02:06.000
ST: Because it doesn't have the smoke

0:02:07.840
AP: Yeah, it doesn't emit smoke

0:02:08.319
ST: And you're able to do this with just a few houses or do you have to

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AP: It takes a village to sow this effect. That's where there's 773 households. We're measuring the stove uses every day like every five minutes we're collecting data on that and air pollution level like four times throughout this study and blood pressure also four times so it's a longitudinal yeah so we want to show the longitudinal change.

0:02:42.640
ST: Power lines along main roads supply electricity from Nepal's dams to small businesses. This workshop makes and sells furniture and sells its scrap wood too. Sanukanchi, a mother of five from a nearby village was here to buy some. So why don't they get this wood from the forest?

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AP: So, the government opens community forest for people to collect with only one time in a year and yeah because there was a big problem of deforestation and then after that you have to purchase it from the market which is expensive.

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ST: This is probably plenty, huh? Curious to see how much this weighs. 21and 0.3 kilos so this is uh 45 pounds or 21 kilograms. How long will that last for cooking?

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AP: So it goes for two weeks.

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ST: So we need 25 of those every year and we just spent two hundred, so five thousand per year just for the wood and the fuel. How much money do you have each year just to spend?

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AP: She says she doesn’t know the exact, but according to her, she spends a lot of money.

0:04:11.599

ST: Probably maybe half of...

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AP: Yeah, half of her income.

0:04:14.879
ST: Just on fuel for the fire, yeah. That's a tremendous amount.

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ST: So people have been cooking over wood and solid fuels for many hundreds of years.

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AP: Thousands of years and it's good because you know this allows people to boil water and then give warm food yeah which is also helpful for sure and something healthy but the smoke is the main issue here and so you can see there's no vent and ventilation in the window opening right for the smoke to go out.

0:05:46.720
ST: Amod showed me the indoor air pollution measurements for this house without the fire burning and with it.

0:05:53.919
AP: Yeah so the evidence would be around 30 microgram per cubic meter.

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ST: So two or three times a day we're going to 900, yeah.

0:06:02.639
AP: Yeah so they're fire

0:06:06.000
ST: 15 to 20 times every day. You can hear the kids, you can hear their lungs you can hear when they cough. And you've been cooking in your home all your life?

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AP: Yes, she has always used a wood stove, she has not used any other modern fuel.

0:06:37.199

ST: I mean you can see the smoke completely darken rafters. Yeah, that's really remarkable with the exposure.

0:06:47.039
AP: Yeah they're exposed to this smoke you know.

0:06:49.599
ST: It's constant.

0:07:00.160
AP: She’s a health volunteer.

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ST: Oh okay, she goes around to the villages?

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AP: Yeah, so all households.

0:07:07.039
ST: Now she's going to do what?

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AP: She checks the respiratory symptoms in the children.

0:07:11.680
ST: Yeah, how often?

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AP: Every three months, so this is a part of our current ongoing activities. Biomass users are usually, we have found, have high blood pressure compared with biogas users. And smoke increases the risk of hypertension. Hypertension is one of the main problems among adults.

0:07:36.720
ST: Interesting.

0:07:39.199
AP: And the respiratory illnesses are one of the chief causes of death in Nepal. So it's a big problem here.

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ST: What is it? 140 over 97. That's quite high and she's a young person. That's a high pressure. In nearby Bhaktapur, Amod took me to Siddhi Memorial Hospital to see the health effects of breathing smoke.

0:08:42.560
Siddhi Memorial Doctor: The child is having a fever and a difficulty breathing and complaining of a cough and she visited me once on Thursday and now she's complaining of fast breathing.

0:09:20.839
ST: How many do you see like this every day, who have the respiratory? How many kids?

0:09:28.160
Doctor: Usually it's more than 60 percent of the cases who come here, it's upper respiratory infection.

0:09:48.200
ST: The electricity's not working.

0:09:57.040
AP: This is a very common problem in Nepal, and our study here, which was conducted here in the same hospital, we also found a very strong association between pneumonia and users using biomass fuel.

0:10:08.959
ST: We couldn't breathe after two hours this morning.

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AP: Yeah yeah, imagine the breathing you know right for a long time.

0:10:17.360
ST: Sadly children die frequently here of pneumonia and related diseases and they're not alone. Nearly 3 billion people still burn wood or other biomass as their primary energy source and 3 million of them, mostly mothers and their children, die each year from breathing the smoke. Three million. Clearly one of the most important challenges in the world today is moving from biomass to something else. One alternative that's gaining popularity, especially in rural areas is

biogas. It's methane, just like natural gas, but it's made right here on the farm. So we're going to get biomass and look at biogas.

0:11:02.959
AP: So we will use dung, yeah this is cow dung.

0:11:08.320
ST: What's she gonna do?

0:11:10.000
AP: So she'll put this dung in the bucket.

0:11:11.600
ST: Yeah I guess I probably ought to help. All right, oh nice that's nice. Oh yeah, biogas. Nice, that's just a fresh one.

0:11:28.079
AP: Yes I want to use the water, do you want to wash your hands?

0:11:35.360
ST: Oh yeah yeah, I'll wash my hands, sure.

0:11:36.640
AP: It solved two purposes

0:11:39.240
ST: There you go, efficiency in every step, this might take a while because I really picked it up. So you gotta mix it first.

0:11:53.279
AP: It has to be thoroughly mixed.

0:11:55.200
ST: I'm glad I already washed my hands.

0:11:57.760
AP: It has to be thoroughly mixed and then,

0:12:01.040
ST: Is it good? Now your turn. Okay okay now I take this here? All right, oh yeah that's nice, that's not very deep.

0:12:18.800
AP: The toilet is also connected.

0:12:21.360
ST: Nobody's there, luckily, just opened the door on them so Amod, you know we've got a concrete canister and a bunch of stuff in it and then there's gas up in the kitchen. What's the process?

0:12:34.560
AP: So this is an inlet, you put a mix of dung and then water you stir it and it goes inside the digester, it's a big digester. It's a large digester inside, it's covered, and then methanogenic bacteria then works on the manure okay, sorry, and then it generates biogas and then people get by gas through that pipe that yellow pipe, and it goes to that house.

0:12:58.880
ST: Are there, do you have to put in enhancers to create the process of digestion or is it just natural?

0:13:04.079
AP: It's natural, just happening. So yeah, when it is newly constructed, so that you have to leave dung for about one month, so gradually it builds bacteria very naturally, very natural everything. So she’s using biogas for the last 16 years. It’s free, you have one cow, they drink the milk and use the dung

0:13:48.399
ST: Drink the milk, they use the dung and you cook again, it's a perfect circle. Oh it's very good, very good just how I like it, perfect.

0:14:04.000
AP: So what happens is, during the winter time because biogas depends on temperature and during winter time, the gas yield is low so usually what people were doing they were used to cook on mudstone, so we are encouraging them to use induction or LPG during winter time so that they can get clean air throughout the year.

0:14:26.079
ST: What have you seen and the differences between?

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AP: A lot, we usually see 500, 600 microgram per cubic meter. In this kitchen we see 2017.

0:14:41.199
ST: Which is just acceptable completely. Wow this is quite an operation.

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AP: So it is the new biogas system.

0:15:09.279
ST: So where do you put in the dung and the water and?

0:15:14.160
AP: So it will be there.

0:15:16.160
ST: That's a big room.
AP: It's a big room, yeah.

0:15:17.920
ST: There's a concrete dome over the big chamber.

0:15:20.240
AP: Yeah.
ST: And how much biogas will this make?

0:15:24.560
AP: So it provides you gas, enough for eight hours, to cook food for six family members.

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ST: Wow! How much does it cost to build the system like this?

0:15:34.959
AP: So it costs 70,000 - 100,000

0:15:38.839
ST: So 700 - 1,000 dollars.

0:15:44.530
AP: And the government provides a subsidy of 300 dollars.

0:15:50.730
ST: So, wonderful system. Where can it be put around the world?

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AP: Yeah, it can go a lot of places. For example, if it works in Nepal, there are lots of opportunities to upscale this to South Asia and Africa, South America. If it’s possible in Nepal, it’s possible everywhere.

0:16:11.040
ST: Nepal's more urban areas have opted for a different gas solution. In a suburb of the capital city, Kathmandu, this plant bottles liquefied petroleum gas or LPG. We are surrounded by canisters.

0:16:25.120,0:16:29.440
AP: Yes, so these are LPG, propane, and butane mixed gas which is mainly people used for cooking.

0:16:30.480
ST: How much is moving through here every day?

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AP: These plants have about 255 distributors in Kathmandu valley, because the people once they saw this gas coming in, this is clean people decided to switch, mainly in the valley. Now these gases are all over the country wherever there are good networks.

0:16:50.480
ST: So this operation is really growing then.

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AP: It's growing, it's growing at the rate of like LPG consumption is growing at the rate of 13 percent every year.

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ST: Now do the people have to buy their original canister?

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AP: Yeah, it's a one-time buy.

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ST: And that lasts probably quite a while.

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AP: It depends on the family size, for family size of like four it goes uh up to one month, if they don't have any secondary stove. If they have a secondary stove, then it goes for two months.

0:17:18.959
ST: Oh this is uh it's quite the operation here.

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AP: Yeah, so there are uh 24 filling stations and for one gas to fill, one gas, it takes one minute. So minute per tank.

0:17:39.520
ST: So, we talked about it being better fuel, wood and biomass. What are some of the challenges?

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AP: Oh, there are many challenges, for example 100% comes from India. Nepal is dependent on India. And there have been some hiccups like there was a blockade in 2015 immediately after the earthquake and there was a supply cut for about five, six months because Nepal has a different, you know, very difficult geography.

0:18:06.480
ST: And of course then there's a cost to the government in subsidies.

0:18:09.919
AP: Yes, it's about 300 rupees, like three dollars.

0:18:12.480
ST: Okay, yeah.

AP: Per cylinder.

0:18:15.919
ST: Helps the user.

0:18:17.840,0:18:21.360
AP: Yes, but again it's costly for the government. And price is increasing also, that's another challenge because it depends on international market price also.

0:18:25.120
ST: Nothing's perfect.
AP: Nothing's perfect.

0:18:29.600
ST: You ready to take us? So it's interesting where all the different people live and things. I mean, these look like pretty modern buildings over here. In lieu of pipelines, this is Nepal's LPG distribution system. Gas comes from refineries in India, on ever smaller modes of transportation, to reach the people who use it.

0:18:53.360
AP: We'll put this cylinder on a bicycle

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ST: On a bicycle?

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AP: Yeah we're going to put these on a bicycle.

0:19:02.240
ST: Oh good.

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AP: Yeah, so one bike can carry two canisters.

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ST: I'll hold the bike, you can load them up. Oh yeah that's 70 pounds. Perfect. Are we good?

0:19:18.640

AP: Yeah.

0:19:22.080
ST: This is me.

0:19:24.400
AP: Let's go straight, okay and then turn left and I'll see you there, okay.

0:19:29.200
ST: Okay, I'll try to go straight. This might not go very straight, but we're gonna give it a good run. Wow where do my heels go? All right we're out of here!

0:19:45.280
AP: So how's the ride?

0:19:48.559
ST: We made it. These are heavy.

0:19:50.480
AP: Okay, let me try.

0:20:02.799
ST: They’re very heavy. Here we go, watch your head.

0:20:19.679
ST: Perfect and no emissions, no smoke.

0:20:24.320
AP: No smoke, very clean.

0:20:26.960
ST: You enjoy the cooking with the gas?

0:20:36.840
AP: It’s easy.

0:20:38.720

ST: It’s easy. Both LPG and biogas are much healthier than wood but there's one alternative that makes no indoor air pollution at all. It's beautiful, and there are lots of different ways to cook I can see already.

0:20:52.559
AP: This is, they're making a meal.

0:20:54.720
ST: On the electric. When we walked in, I saw there was a wood, wood stove.

0:21:07.410
Nepal Woman: This is an old traditional stove.

0:21:10.080
AP: Yeah so fire is a god so they worship uh stove, worship fire first and then use other stoves for cooking.

0:21:20.320
ST: For cooking, yeah. So there was a time when you were only cooking with the wood?

0:21:24.799
Nepal Woman: Yes, we did not have any other stove before. We used to cook food on a traditional wood stove. We had built a mud stove with chimney here. The stove there was built with the house.

0:21:45.440
ST: You've never cooked over wood so you'll never know that? Your generation is gas and electricity, right? What's your favorite dish? What's the favorite thing you cook?

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Nepal Woman: I mainly cook rice and lentils, and sometimes meat.

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ST: That sounds good. Are you doing the same kind of testing and health measurements that we're doing in other places?

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AP: Yeah, so we're measuring blood pressure on all main cooks, net health monitoring right so she will measure her blood pressure and we can see the difference.

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ST: Do a comparison. Let's go!

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Nepal Health Monitor: One hundred twelve by eighty.

0:22:44.159
ST: One twelve over eighty. That's great.

0:22:47.200
Health Monitor: Seventy three.

0:22:50.400
ST: Seventy three, that's great.

0:22:51.280
AP: So you can see uh she has a blood pressure level of 112 by 80. And yesterday you saw on Sanukanchi she had 148 by 86 or something. The only difference is that she cooks on a clean cook stove LPG by gas or is exposed to less smoke than her. She has only one stove and she has only one stove.

0:23:14.480
ST: I mean, phenomenal amount of data. This is, you've been doing for this is, it is.

0:23:20.240
AP: Yeah, so we are measuring you know blood press level on uh 773 main cook.

0:23:24.799
ST: 773 homes, yeah.

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AP: And we also measure the personal level of exposure. One is kitchen area monitoring and another is personal and how much she's exposed to. So this is more evidence-based.

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ST: You got a long time ahead of you, many good years.

0:24:02.200
AP: They're using this monitor, an air pollution monitor; it's a light scattering based instrument, technically.

0:24:08.200
ST: So this is what they put in the kitchens?

0:24:09.200
AP: Yes, yes. You can see the data is from the kitchen where they use LPG. Thirteen microgram per cubic meter. So it's very low.

0:24:29.600
ST: Okay, so we're looking at the time period of what here? Nepal Woman: 24 hours.

0:24:37.520
AP:There's a huge difference in the air pollution level between houses that use wood stove vs gas. Kitchens that use biogas stoves are also very clean in terms of pollution and also in terms of health.

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ST: You know there's a cost piece to this.

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AP: Yes, we're also seeing that you know as you saw in the case of Sanukanchi she pays about 400 to 500 rupees per month but what we're seeing is that uh households that use electric cook stove uh it costs about three hundred rupees. And the bigger picture we're trying to show is that governments would intervene and provide some subsidy or incentive for electric cook stove. This also generates revenue, local revenue. You can create a market for an induction stove.

0:25:25.360
ST: Are these markets springing up places? Are you seeing change in that?

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AP: Oh yes, now you know many people, I mean they are an entrepreneur, selling, it's all women, women entrepreneurs.

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ST: Perfect. That's awesome.

0:25:38.159
AP: Yeah, so Scott, this is the store that I was referring to. So she's one of the entrepreneurs. There's also female community health volunteers.

0:25:46.720
ST: Nice to meet you. Yeah, let's take a look.

0:25:48.559
AP: Okay.

0:25:54.960
ST: 80 then 60 to 280. So that up 2000 watts

0:26:06.159
AP: So you want to cook rice, then you press this rice button, so you're going to boil water, then you press the water button. If you want to fry anything then you can just press this and then you'll get that.

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ST: That's beautiful. So how many of these have you sold in your store?

0:26:24.320
AP: Yeah so overall 60 induction stoves have been sold but she has sold 10.

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ST: And how and how much time did that take?

0:26:33.679
AP: Yeah, within a month.

0:26:36.320
ST: Wow! That's amazing. Are you seeing that bigger trend in the valley as well?

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AP: Yeah, other you know people are buying it yeah from other markets, also other other stores also.

0:26:46.159
ST: How much would this cost?

0:26:54.799
AP: 5000 500 Nepali rupees.

0:26:58.240
ST: So that's about 55 dollars, that's a lot. But you're still selling that many. You know what? Sold! I'll take it. I'll take it today. That's beautiful. Thank you so much. This is gonna be great.

0:27:29.200,0:27:38.750
ST: We have something to give you. Electric cooking. Have you seen that before? Should we open it? It's for your pot to sit. Okay, now we plug it to electricity, which Amod will help you get to your house. And it costs less money.

0:28:12.919
Sanukanchi: I don’t know how to read, but my daughter does. She’ll read about it and teach me how to use it. And there’ll be no smoke. I heard it’s good for our health.

0:28:41.360
AP: She’s asking if you would like to have tea.

0:28:43.360
ST: Absolutely, let's have tea! Amod and I went back to the city to wrap up my visit to Nepal. Like many developing countries, Nepal is a traditional society with a culture stretching back centuries. Still, change is coming. LPG use is growing rapidly in the cities and their surrounding areas, as it's doing throughout developing Asia and Africa, where there are refineries to produce the gas and road systems to transport it. In Nepal's more rural areas, where LPG delivery is difficult, there are already half a million biogas systems supported by a government subsidy program. Similar systems could work across the developing world where there's livestock to fuel them and temperate climates to keep them from freezing or drying out. Here and around the world electric-cooker stoves are becoming more popular, where people have access to grid electricity. But there are a few challenges to their broader adoption. When we think of converting to electric induction cooking, is there resistance to this change?

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AP: Yeah, still you know when we ask why you're still using it then people say that's it for the test they're like food prepared or the fire for the test. Another thing is that most households have livestock inside their house, so they think that you know the smoke would help you know keep the mosquitoes and flies away.

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ST: That transition is going to require more reliable electricity, particularly in the rural areas. Does everybody have electricity in their home?

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AP: Yeah not in all areas, because voltage fluctuates and electricity is not reliable and still not reliable in some parts of rural areas.

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ST: What makes you the most proud of the work that you've done?

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AP: Only 50 households now have only a mud stove, no other secondary stove. We also did a study on who adopted this modern stove. And what we found is that you know if the woman is the head of the family, if she's the main decision maker, we found you know, those households adopting cleaner fuel more than other households where the male is the head of the household. That's what we found, so women, education, and head of the household status, you know these are important determinants. Once we'll have you know all these households using clean fuel, that will be a very proud moment for me.

0:31:13.679
ST: In Nepal, and everywhere in the world, energy is tied into culture. Education, women's rights, so many issues. As cleaner cooking fuels come to developing countries, they'll bring better health, more convenience, and more time to pursue other things. In some ways they will modernize traditional cultures. Most of those changes will be welcomed.